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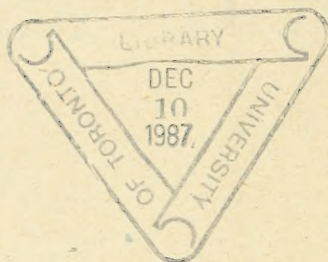
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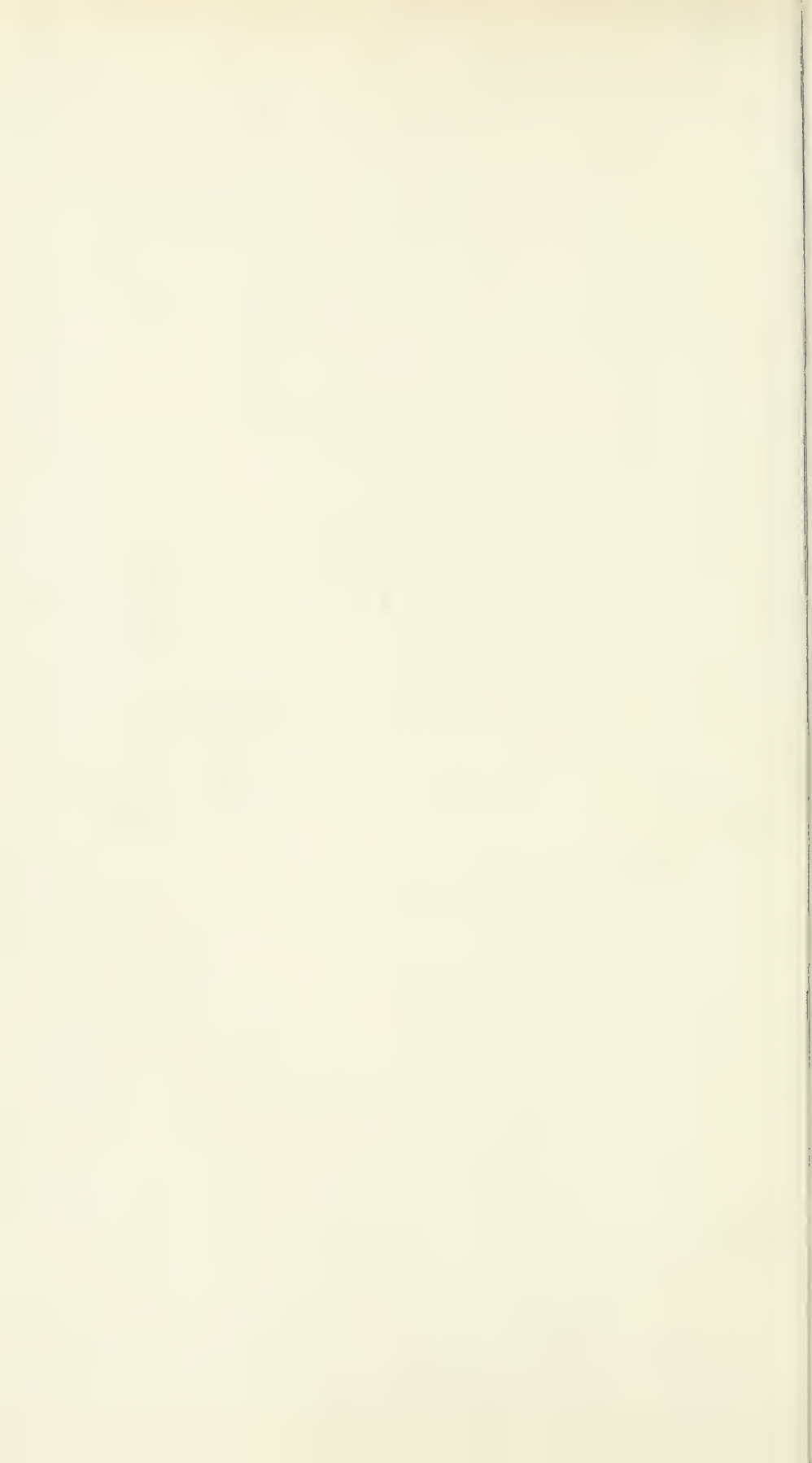
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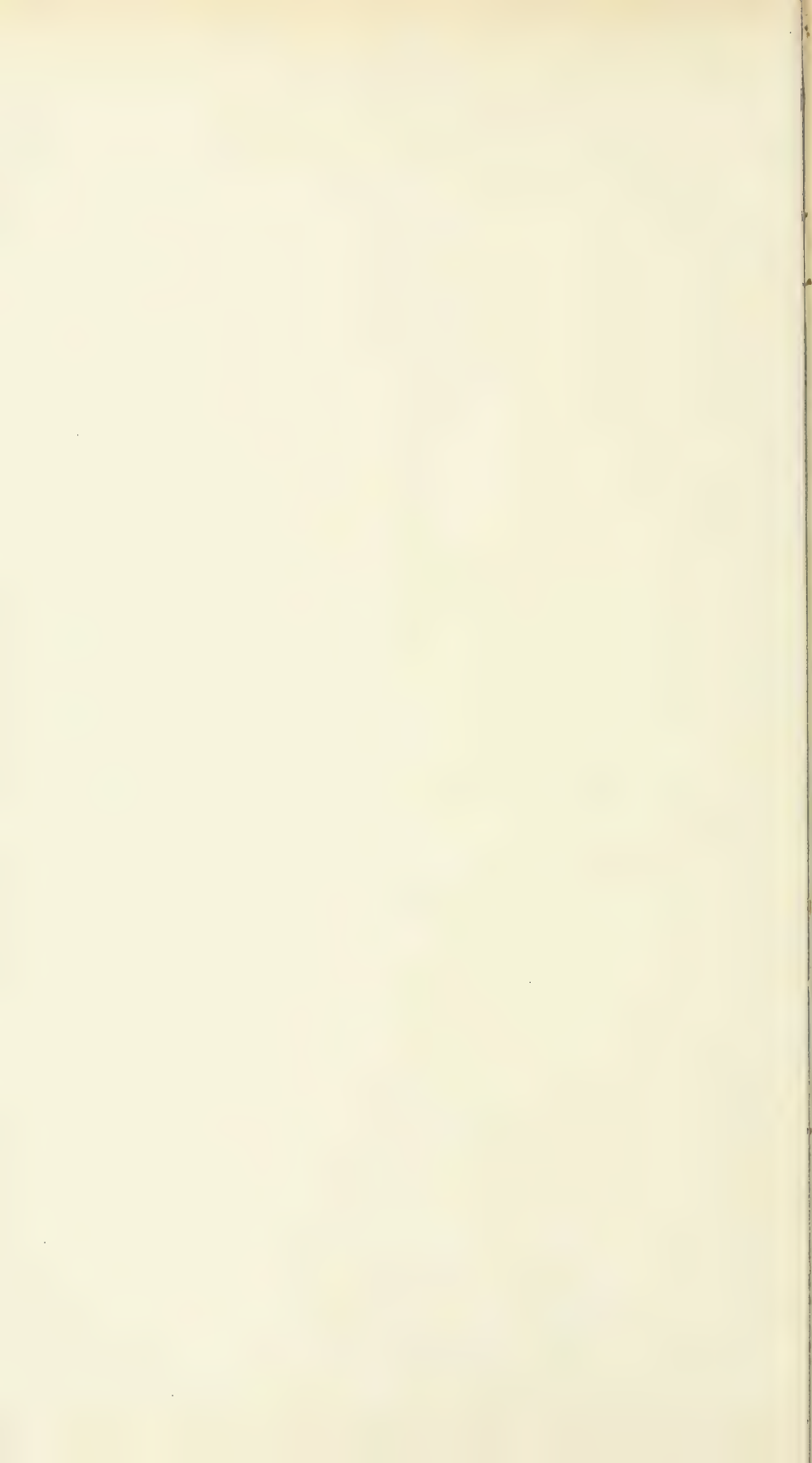
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THE FRENCH ELECTRICAL INDUSTRY.

OUR French neighbours, like ourselves, have resolved to liberate themselves as far as possible from the undermining influence which German electrical firms exercised, either directly or indirectly, in the French market down to the outbreak of the war. French electrical firms have suffered in the past from a comparative scarcity of labour, and the situation in this respect may become accentuated after the conclusion of peace. The manufacture of electrical apparatus is chiefly carried on in the vicinity of Paris, where formerly labour was fairly abundant, whereas the construction of machinery was carried out generally in the provinces, where a shortage of labour was experienced, and where the time required for the execution of orders was longer than if workers had been available in greater numbers. Apparently the establishment in the provinces of most works for the production of heavy machinery was originally prompted by the desire to secure cheaper sites, lower taxation, and lower wages than in the Capital, but it is a question whether the commercial results have justified that course. On the other hand, and apart from the mechanical engineering works in operation in the neighbourhood of Berlin, it has to be borne in mind that two of the largest electrical groups in Germany are concentrated in the Capital, and they have certainly found great financial prosperity in that district, despite the prevailing rates of wages, taxation, and the great distance which separates them from the centres of production of raw materials.

A little light concerning French hopes and intentions for the future is shed by the annual report of the Compagnie Française pour l'Exploitation des Procédés Thomson-Houston. Without concealing the fact that formidable economic and social problems will arise after the war, the report expresses confidence that victory will bring about a rapid expansion of the national industries, and particularly of the electrical branches. But in the commercial struggle, as in the case of the war, it will be necessary to fight with equally efficient methods. To definitely evict German industry from the French market and to compete with it in the markets of the world, it is considered necessary for the French works to increase their productive capacity, to improve their plant and machinery, and to adapt them in such a manner that they will be able to make up for the deficiency of labour by adopting bulk production of standard types, and to pursue a vigorous commercial policy in the opening-up of new markets. The realisation of this programme will require large financial resources. In this connection, the formation is announced of a *Chambre Syndicale des Constructeurs de heavy electrical machinery*, which will examine and solve the problems of this important department of the industry, and is in complete agreement with the *Syndicat Professionnel des Industries Electriques* which groups all the specialities of electrical manufacturing.

M. Charles Laurent, chairman of the French company, at the recent meeting stated that there was no doubt that at the conclusion of hostilities a great demand would arise in regard to the applications of electricity, and that it was necessary to make preparations at once for coping with it. The French electrical industry henceforward would have to supply articles that competitors across the Rhine had formerly succeeded in placing on the French

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market, and must also render itself capable of competing with them in the foreign markets. It was admitted that the task would be a hard one, and that individual efforts would be inadequate unless they were energetically co-ordinated. Germany had shown what could be obtained from a solid industrial cohesion, and the French would also organise their productive resources without, at the same time, abandoning their capacity for individual initiative. In this connection, M. Laurent mentioned that the views which he had exchanged with the most important firms permitted him to state that this necessity had been unanimously recognised, and the recent constitution of the *Chambre Syndicale des Constructeurs* marked a decisive step towards an understanding which could not fail to be fertile, and which would complete the work already undertaken by the *Syndicat Professionnel des Industries Electriques*.

It is satisfactory to learn that a re-awakening of national energy and the spirit of enterprise has become manifest in France, and as the economic life of the country is resuming a natural course a progressive expansion is proceeding in regard to orders for peace purposes, quite apart from the exceptional requirements of the Army. The task confronting the French electrical industry, as previously mentioned, will be difficult to solve. But with the cessation of hostilities, there seems no reason for doubting that sufficient financial support will be forthcoming to place the French works in a position which will render them independent of enemy countries and, at the same time, contribute largely to the future prosperity of the country.

THE past week has been one of great events. All hearts and prayers are with the brave Forces who are so gallantly and heroically fighting to redeem the Liberty of Europe. God speed their efforts! While these stirring events are in progress, steps are being taken at home to deal with some of the problems that will follow when Victory has been won. The Government has, through the Board of Trade, drafted a Bill bringing munition workers under the provisions of the unemployment part of the Insurance Act, with the object of minimising some of the inevitable consequences of demobilisation and reduced war munitions activity. Mr. Asquith's Reconstruction Committee of the Cabinet, which is considering after-the-war problems of every kind, has issued an invitation to all who have any suggestions to make on the subject to submit them, so that the nation may do its utmost to face an unparalleled situation. The House of Lords has allowed the appeal in the celebrated *Continental Tyre* case, and last, but by no means least, the President of the Board of Trade has appointed a further Committee to make preparations concerning the problems of trade. Each of the foregoing subjects is worthy of considerable attention in our pages this week, but we must forego the privilege owing to the demands upon both time and space in these exceptional days. While the Forces at the Front are putting forth all their energies to win the war in the field of blood, thinking and practical minds must prepare for the days that, we trust, will not be long deferred. Some of the problems are so complex that they will call for deep inquiry and anxious thought for months to come, for we are faced, indeed, with a vastly altering national situation fraught with infinite possibilities. The Economic Conference, which arrived unanimously at such important recommendations, carried its work through with marvellous expedition, and the Nations must not be less expeditious in facing the details that necessarily follow upon the acceptance of the principles laid down in those conclusions. We trust that we shall

be justified in our hopes that matters will now move more rapidly in both the military and the economic spheres, and we hope that in these preparations for the period of Demobilisation, Reconstruction, and Trade Security there will be energetic action and, as far as possible, unity of spirit. The new Trade Committee is, to our minds, as important as any that has yet sat to consider pressing problems. It is to consider the best means of meeting the needs of British firms after the war as regards financial facilities for trade, particularly with reference to the financing of large overseas contracts, and to prepare a detailed scheme for that purpose. The Committee is composed of bankers and other financial authorities, as well as industrial and commercial men, to whom the subject of industrial finance is no new one. The evidence should be ready at hand, for the subject has been discussed almost to death for many years. We look to this Committee to go a long way to assist British industry, which unquestionably has been handicapped in the past by competition with the industrial banking systems of the Teuton.

THE announcement which we make in our "Notes" to-day, that the Council of the Institution of Electrical Engineers has appointed a Committee of seven members to

consider the present and future of the supply of electricity in this country, in the light of Mr. Williams's paper and the discussions which followed it, will be read with pleasure by all who have the interests of the industry and of the Institution at heart. The announcement is somewhat belated, as the Committee was formed on June 8th—the day before we urged the Council not to miss the opportunity of placing the Institution in its rightful position at the head of this great movement, lest others should forestall it. We trust that no time will be lost in pressing on with the matter, which is of urgent importance.

In our issue of June 23rd we drew attention to the suggestion put forward by Mr. H. S. Ellis, in his paper read before the I.M.E.A., that a committee of members of that Association should be formed "with power to co-opt members of other scientific societies" to investigate the state of electricity supply in this country; the formation of such a committee was in fact decided upon on June 21st, at a joint conference of the Council of the I.M.E.A. and representatives of the power companies, and the President made a statement on the subject on the following day. There are, therefore, two Richmonds in the field, and it will be observed that our renewed warning to the Institution with regard to the leadership of the industry was fully justified. But we are certain that there is no desire on the part of the I.M.E.A. to usurp the position, provided that the I.E.E. is disposed to take vigorous action in the interests of progress and reform. Whether the two committees will eventually combine, or hold joint sittings, or whether they will agree to divide the field of labour between them, remains to be seen; on this point we have no official information. It is obvious, however, that overlapping should be avoided. On the one hand, we have the municipalities and the power companies jointly representing the supply undertakings of the country; on the other is the Institution, which represents, or ought to represent, not sectional interests but the whole of the electrical engineering profession and industry, and is in a position to consider the subject on the broadest lines. It would seem that there is room for both parties to work harmoniously together towards the development of the supply industry on a sounder basis.

In the absence of additional information we can make no further comment on this particular sub-

ject; but we take this opportunity of appealing once more to the Council of the I.E.E. to keep its members and the public better informed as to its doings. There has been a distinct improvement in this respect of late, but as a rule the items which appear on the last page or two of the *I.E.E. Journal*, whilst of the kind we advocate, are altogether too absurdly meagre to fill this want, which, we can assure the Council, is widely and deeply felt amongst the members.

Rubber.

ADMITTEDLY the market for crude rubber has been anything but encouraging to the producing estates, but, as already hinted in these columns three weeks ago, there is not much hope of better things for another few months, or until towards the autumn, when market conditions may possibly improve, though the outlook presents many uncertainties. Much depends, of course, on the progress of the war in connection with which huge quantities of the product have been absorbed within the last twelve months or so. The United States will probably continue a heavy consumer, yet indications in that quarter have become distinctly reactionary, so that future needs are a matter of considerable uncertainty. Owing to the critical state of shipping during the war, the larger trans-Atlantic manufacturers have made probably full provision against prospective requirements. The stocks still available across the Atlantic are now doubtless being eaten into steadily, but new enterprise is, at the same time, kept within more conservative limits, and it is hardly likely that any market expansion of new buying will take place for an indefinite period. The general feeling of weakness, moreover, is against any development of the demand beyond actual needs. In the second half of June very considerable quantities of plantation rubber were disposed of, consumers who were short having replenished stocks to some extent at the comparatively low prices ruling, but there is still plenty of rubber awaiting disposal, though arrivals lately have been less numerous through shipping delays or other drawbacks.

The price of fine plantation grades has fluctuated down to about 2s. 4d. per lb., this being about the lowest figure seen since the end of the third quarter of last year. There is just a possibility that the weakness may become accentuated, despite the fact that the market seems to display rather more resistance. The set-back from the highest registered earlier this year represents not much less than 2s. a lb., which is a rather serious matter for the estates, whose profits are bound to be curtailed to an extent which must lead to renewed efforts being made for more economical working in the interest of their shareholders. It is rather peculiar that developments as regards prices during the last three months have been pretty similar to those witnessed within the same period two years ago, or just prior to the outbreak of the war, the advent of which had a paralysing effect upon the demand. The market subsequently had frequent fluctuations, but fell only slightly below 2s. for No. 1 latex, and after rallying up to about 2s. 6d. dropped again late in 1914 to the lower figure mentioned. With the turn of that year, however, a steady upward movement ensued. History may possibly repeat itself, owing to the unsettlement which must be expected to continue pending a conclusion of the war. It remains to be seen, however, whether the price will break to under 2s. a lb., as happened in 1914. The outlet for rubber is, after all, still quite good, and the present low prices tend to restrain producers in their forward sales. It is rather more difficult to place orders for distant deliveries, even at a notable premium, notwithstanding the ease with which spot purchases can be made.

THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION CONGRESS.

ON Friday afternoon last, the eighth annual congress of the Tramways & Light Railways Association was held in London, being restricted to a short meeting at the Westminster Palace Hotel, where, after some introductory remarks by the chairman, the Hon. Arthur Stanley, M.P., on the report and accounts, a paper by Mr. W. T. Robson (Southampton) on "Tramway transit and comfort: a plea for the passenger," was read and discussed, the members being subsequently conveyed in special 'buses to the London General Omnibus Co.'s Training School at Milman Street, Chelsea. Here, under the guidance of our old friend, Mr. Blain, Operating Manager of the L.G.O. Co. and the Underground Railways, the methods employed by the company in training, equipping, and feeding its staff were explained and demonstrated to the visitors, whose attention was fully occupied until such time as it became necessary to adjourn to the Trocadero Restaurant for the annual dinner, which was held during the evening.

The Hon. ARTHUR STANLEY (Chairman), in opening the meeting and welcoming the visitors, referred to the necessarily restricted programme.

In regard to the report and accounts, both revenue and expenditure were on a reduced scale during the year, but a revenue balance of £126 remained, which, added to funds in hand, left them with £430 to carry forward.

He referred in sympathetic terms to the deaths of Sir Charles Rivers Wilson, their first president, and Mr. Robert Hammond; also to the severe illness of Mr. A. L. C. Fell, from which he is now happily recovering.

One of the most serious problems which had confronted them was the loss of employees; on some systems 40 and even 60 per cent. of the staff had joined H.M. Forces, and great difficulty was experienced in filling vacancies.

Female conductors were very generally employed now with satisfactory results, and in some cases women drivers were employed on easy routes.

Satisfactory arrangements had been made with the manufacturers in regard to delivery of steel tires, but the rail question was a more difficult one.

In regard to the effect of paper shortage on tickets, the difficulty had been generally overcome by using smaller tickets.

In regard to Finance (No. 2) Act, 1915, and excess profits, the Association had applied to the Board of Referees on behalf of company tramway members for an increase of the statutory percentage from 6 to 12 per cent., which is considered fair in cases of limited tenure; in regard to the Local Government (Emergency Provisions) Act, 1916, Section 20, dealing with consent necessary for establishing new 'bus routes, &c., the Association would have preferred a general Act applying to all users of the roads, and apportioning the burden of taxation fairly amongst them.

It was hoped that as the result of joint efforts, a standard method of assessing income-tax on motor 'buses would be obtained, similar to the tramway standard.

On their behalf, he congratulated their late Vice-Chairman, Mr. James Devonshire, on his appointment to the Board of Trade Electrical Committee, and, as the Council thought that the tramway industry should be represented at the inquiry now being held by that Committee, he proposed that Mr. Stephen Sellon should be invited to give evidence on their behalf.

The report and accounts having been approved, Messrs. A. H. Beatty, Bulfin, Vincent Edwards, A. W. A. Chivers, H. M. Sayers, and G. M. Harriss were elected to fill vacancies on the Council caused by members retiring, whose period of office had expired.

The Chairman then called on Mr. W. T. Robson (Southampton) to read his paper, an abstract of which and the discussion follow.

Tramway Transit and Comfort: A Plea for the Passenger. By W. T. ROBSON.

The object of this paper is to endeavour to point out that the passenger has not always been sufficiently considered in the prosperous times of the past; and in making plans for the future it might be well to consider how his comfort may be increased, because by such means he might be induced to ride more often.

Just before the outbreak of war I rode down a steep hill on a certain tramway system in the upper saloon of a car, and the condition of the track, together with the condition of the car, turned that ride into a species of nightmare.

The sum of roughly £20,000 had been allocated to the relief of rates out of the surplus profits of this undertaking in

the last four years. A small proportion of this amount would have been much better spent in track renewals.

It is surprising that so many systems have not done more to abolish hammered joints, considering the facilities which exist in the way of welding. The impossibility of obtaining new rails at present should only serve to wake us to the necessity of increasing the life of existing track by means at our disposal.

The question of rail groove cleaning has never received the consideration due to this method of reducing noise. One hopes that in the near future vacuum cleaning will bring about the desired result.

It is, however, in the direction of rolling stock that the hopes of a passenger desiring a more comfortable ride must principally be centred; we are mounting our cars on practically the same track as we did 15 years ago, and, although we may add various devices in the hope of gaining flexibility and radial action, it must nevertheless be admitted that a really comfortable riding truck is not yet an accomplished fact.

To all intents and purposes, the hand brake is the same as on the horse cars 20 years ago; the various devices of inserted gearing have not improved things from the point of view of those travelling in the car. An interesting experiment is being made at Huddersfield at the present time, in the nature of a brake drum keyed on an extended armature shaft in the same way as the pinion, with a Ferodo-lined hand-brake operated in the usual way by means of the brake spindle. The advantages of such a brake are obvious, and in actual practice it is proving a great success. There would appear to be quite a movement in the direction of improved brakes at the present time, and similar efforts should be applied to the whole truck.

The longitudinal seating of the usual British car, and the wearisome cry of "Move up, please," or "Sit closer together, please," makes one wonder why the use of cross-seats in the lower saloon has never become more common. The advantage of being able to tell at a glance if any seat is available is very obvious. A 24-passenger cross-seat car holds 24, whereas on a longitudinal-seated car the best conductor often is unable to induce, say 22 passengers, to move up and make room for 24. There is infinitely more comfort in facing the direction in which the car is travelling and in being able to look out of the window without twisting one's neck. I would warmly recommend this type of seat to those who are considering the question of new rolling stock. The question of gauge is not an obstacle, as cross-seats have been most successfully adopted at West Hartlepool, a narrow gauge system. Before leaving the question of seating, is it not time that the uncomfortably hard wood seat was superseded by something more comfortable to sit upon?

The question of providing adequate ventilation without undue draught has long been one of the problems of tramway management, and it is quite evident that ventilators should be fixed and not subject to the whim of any passenger. The best method is to arrange the ventilator windows to open outwards on a quadrant, in the direction in which the car is travelling.

Experiments have been made with induced draught by means of a fan driven from the axle, and there would appear to be no reason why this method should not be adopted with success.

It is evident that any arrangement whereby a passenger may alight from the rear side of the front platform would both add to his comfort, and also make the conductor's duties easier. It would be interesting to hear the experience of Newcastle and other places where experiments in this direction have been made. From the passenger's point of view it is a grievance that, after taking a seat at the front of the car in order to leave room for those entering after him, he should be compelled to fight his way back to the rear in order to alight.

A uniform finish, in a car body, in teak or oak is not nearly so attractive as a contrast afforded by, say, oak and mahogany. The modern car should have rounded corners without mouldings and dust-traps; the end panels might well serve as frames for attractive photographs, displaying the charms of the district through which the cars run, confined, as far as possible, to views at the extreme ends of the routes, ceasing the exploring passenger the maximum fare to get there.

It is not easy to understand why the top saloon is often so much more uncomfortable and unattractive than the lower one. An interior finish of alternate light and dark match-board with sashless lazy-long windows and tip-up seats, allowing a clear floor for cleaning, with a row of ventilator windows to match those in the lower saloon, would give a wholesome attractive effect, and would please the ordinary passenger as well as "drawing" the man who boards a top-covered car in order to have a comfortable smoke.

A year's experience of south country tramways makes one wonder if the British principle of a double deck closed car has been too closely followed, at any rate in the south; the extraordinary popularity of a car on the Blackpool toast-rack principle, adopted at Southampton, certainly leaves no room for doubt as to the preference of the travelling public.

It is hardly reasonable to expect intending passengers to wait in wind and rain, and pavement verandahs are greatly appreciated.

The war has given us a fine opportunity of getting rid

of certain unnecessary stopping places, and it will be found that the travelling public as a whole are quite pleased to find the cars getting along quicker. Many systems suffer from too many stopping places, and the excuse for remedying the evil which now offers itself is too good to miss.

It is somewhat deplorable, especially from a passenger's point of view, that on many systems some purely local obstruction should have been allowed to govern the design of the whole of the car service for future ages. Quite a number of tramway authorities have had to reduce head-room to the smallest possible limit because of one wretched bridge or archway.

Large and awkwardly-shaped parcels are frequently a source of irritation to passengers; the best way of dealing with this evil is to charge for parcels beyond a certain size and weight, and insist on them being placed on one or other of the platforms.

The sale of books of tickets has recently met with so much success in certain towns that the subject ought not to be ignored in considering the point of view of the passenger.

A railway time-table at each end of the car is often very useful, and large illuminated route numbers are a great boon if the system is large enough to warrant them. Someone once said that tramway passengers were composed of all classes of humanity, mostly fools, but I venture to suggest that after nearly 20 years of electric traction, the travelling public are entitled to many things which on the average system they do not get, particularly in the nature of a more comfortable ride, less noise, easier exit, and less petty annoyance.

Mr. A. V. MASON, in opening the discussion, said that on his tramway routes women could drive cars if the latter were equipped with air-brakes, but not with ordinary brakes. He had experimented with ball bearings on one car, and found that while energy was saved, as compared with ordinary bearings, when running light, the reverse was the case when loaded. He agreed as to the advantages of cross seats, the "toast-rack" car having proved popular.

Mr. A. W. A. CHIVERS thought that the average tramway passenger had much done for him that he had not paid for, and he was afraid that it would not pay to incur much further expense. Tramway trucks had been considerably improved since the horse car days, and it might be noted what excellent riding was obtained on sleeper trucks; the rigid street track was no doubt responsible for hard riding experienced in towns. He had been struck by the efficiency of the drum brakes employed on buses, and in regard to the Huddersfield tramway drum brake, said he would have thought that with the high speed of the armature shaft, the coefficient of friction would be very low. For short-distance dense traffic, fare collection was much facilitated by the longitudinal seat arrangement, and it was easier for the passenger to signal to the conductor. Seats were generally good enough, but ventilation was often bad in double-deck cars, and could be improved by a high roof.

Mr. ERNEST HATTON (Newcastle) said that as a result of their experience he thought they would eventually alter all the Corporation cars to the front exit type. Newcastle was the first city to use all cross seats in its cars, but in altering the design for front exits, the seating was modified and longitudinal seats fitted near the doors, to avoid obstruction; he agreed that it was easier to collect fares with longitudinal seating. Four front exit cars were running; there was only room for one person at a time to get off and not a single accident had occurred so far, which condition, he hoped, would apply later to other reconstructed cars, and thus reduce compensation. It was not his experience that double-track cars did more damage to the track than single-track cars.

Mr. C. W. SHEPHERD (Edinburgh) considered that there was very little in the question of passengers' comfort. Regular meals were a necessity for female conductors, or they would break down in health.

Mr. F. BLAND disagreed with the author's suggestion as to great difficulty in obtaining materials such as tires, axles, and rails; if members would apply to his firm they would obtain assistance. Tokens would be better than books of tickets, as the latter were easily destroyed, but some inducement must be held out to passengers to invest in tokens.

Mr. EDWARDS (S. Lancs. Tramways) emphatically condemned modern tramway truck design, and asked why solid steel rather than forged or pressed side frames should be used. His experience with 40 or 50 cars with built-up side frames had been very satisfactory, and he thought there was scope for some body to take up the question of car design on an engineering basis. While rails and tires were obtainable, they were prohibitively expensive.

Mr. STEPHEN SELDON considered that they only wanted plenty of money and comfort would doubtless induce travelling. Opinion seemed to favour longitudinal seats. He could not quite agree that temporary repair work should be condemned when new work was so costly.

Mr. L. E. HARVEY (Ilford) said his experience with pressed steel trucks was that they were always under repair, and he regretted that most of his cars were fitted with them. Tokens were used at Ilford and much appreciated; a discount was allowed to purchasers.

Mr. HAME (York) said he used trailer cars to a limited extent; they were satisfactory and would be much more used

in the future, as also would the air brake. The drum brake, he thought, would result in many "flats" remaining on the wheels, which the tire brake ground out.

Mr. BENDICK asked why, if there was such a shortage of paper, tickets were not collected and returned to the paper makers?

Mr. F. COURTS (Paisley) thought the sale of tokens at a discount led to fraud as between the employes and passengers, and that this could not, in his experience, be avoided. He asked whether anyone had had experience of "seatless" cars; with such an arrangement an ordinary car would carry 150 standing passengers during rush hours from factories.

Mr. HARTON interposed to mention that it had been proposed at Newcastle to alter cars to the "seatless" type for conveying factory workers in bulk, but they now had longitudinal seats in some cars, and with the wide car bodies used there was space for 40 standing passengers. The seatless car, with a turnstile at each end, had been employed in Trafford Park in its early days to convey Westinghouse employes to and from the Park entrance.

The AUTHOR, in replying, commented on the excellence of the seatless car for moving crowds; it seemed out of place to mention this type of car in a paper urging comfort for passengers. He agreed that if women drivers were employed, air brakes should be used. More comfort must be given to passengers if the great competition of the present day was to be successfully met. As regarded the Huddersfield drum brake, its action appeared to be exceedingly sensitive and rapid, and there was no sticking. He agreed that truck design required overhauling; he could not afford new rails for renewals, and referred to the satisfactory result of welding old joints.

The afternoon's visit to the Milman Street training centre of the London General Omnibus Co. was of the greatest interest to those taking part in it. A site area of some 30,000 sq. ft. is occupied by a training yard for driving, class-rooms in which the drivers are initiated into the internal mysteries of engines, gear boxes, brake mechanism, &c.—actual sections and parts being used for demonstration—and in which the conductors (perhaps we should say "conductresses" in these days) are taught to handle the punch and ticket, and generally to perform their future duties. In this connection a kinema hall, to seat 400, is provided, in which educational films are shown illustrating actual service working, points in connection with the avoidance of accidents being discussed during lectures at the same time. The average period of instruction is 14 days for a conductor and 28 days for a driver.

A mess-room is provided where learners can obtain food at practically cost price, and the company's clothing store is also situated on the site. 20 stock sizes being found to meet practically the whole of the requirements of the 10,000 uniformed staff.

After a general tour of inspection, the visitors were entertained to tea by the L.G.O. Co., at the conclusion of which Mr. Blain gave an interesting résumé of the objects which it was hoped to achieve at the dépôt, and of staff matters generally.

After pointing out that the withdrawal of men on the outbreak of war and since had emphasised the usefulness of the training dépôt, he mentioned that 18 mess-rooms connected with garages were also controlled from there, and that it was hoped to establish both waiting and mess-rooms at the main terminal points later; the influx of female conductors had rendered it necessary to obtain rooms in 200 houses on the various routes.

Some 3,800 drivers were now employed, and 50 per cent. of them had been newly trained in the school.

A very strong feature was being made of the "safety first" movement, and no effort was being spared to educate both the staff and general public in safe methods. There had been a noteworthy falling-off in accidents in recent months despite the more difficult conditions in the streets; accident claims payments had been reduced by 15 per cent. in three years, and since 1910 the number of accidents had been reduced by 68 per cent., to an average of 2.5 accidents per 10,000 miles run. This, he thought, excelled the Boston (U.S.A.) Elevated Railway's record reduction in accidents. They had found the kinema exceedingly useful in training employes how to avoid accidents. About 900 designs for 'bus lifeguards had been submitted to the company, and a standard type of side lifeguard was being fitted, which so far had saved 123 lives; they hoped to obtain official approval of a front lifeguard before long. In carrying out the "safety first" campaign, the daily Press had been systematically used, legends, which could be changed, were placed on 'buses, and recently 250,000 small pamphlets were distributed through

the L.C.C. schools. Accidents were analysed and reconstructed, and views made of them for instructional purposes.

Since the war commenced, 13,000 women applicants for employment had been interviewed, and one-third of the company's 'buses was now "manned" by women conductors. There were also 19 female timekeepers and 12 female cashiers. They had only lost 37 women, or 4 per cent., and only 20 gave up because the work was too hard.

Experience showed, moreover, that the work was not too hard for women, and probably owing to the open air life and good food it had been frequently found necessary to refit them with uniforms.

On the subject of cheap meals, provided by the catering department, the annual turnover of the latter represented 2½ million transactions, and gave them an income of £30,000, which met the cost of the food and the necessary staff. [We may add that the charges are exceedingly small, particularly under present conditions.—Eds.]

Mr. Blain gave an interesting percentage analysis of the commodities from which revenue was derived, including 36½ per cent. from meat and 14 per cent. from tobacco.

He felt that some day the whole of the traction people would be gathered into one association, and concluded by expressing the pleasure which it gave the company and himself to have them as visitors.

A vote of thanks having been accorded on behalf of the Association, Mr. Mandelick, Secretary of the L.G.O. and allied railway and tramway undertakings, expressed, in a few words, appreciation of Mr. Blain's work for the company, and incidentally mentioned that it was intended to provide a seat for the conductor on 'buses.

Subsequently the visitors were shown a series of kinema films illustrating the right and wrong way of driving and conducting 'buses, avoiding accidents, &c., the views being taken in London streets and realistically accompanied by bell, gong (when a tramway car was on the film), and hooter, operated by a demonstrator who lucidly explained each film as it was shown.

We cannot conclude without congratulating the company on the splendid work which it is carrying out, and although there are few organisations in this country with the money and means of the L.G.O. and its associated concerns at their disposal who could hope to emulate the thoroughness of the methods employed, yet these are of such value, and have apparently been so successful, that every tramway and 'bus manager could with advantage study them.

The only omission from the interesting series of films (and we commend it to the company's notice) was one which should show "crawling" 'buses (trying to spin out running time) approaching a railway terminus in the evening; if the demonstrator were at the same time to reproduce the remarks of the numerous passengers who have missed their accustomed train by about a minute, a very valuable lesson might be conveyed and a source of grievance removed.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION, 1916.—III.

Boiler House Design and Operation.

By W. W. LACKIE.

(Abstract.)

(Concluded from Vol. 78, p. 729.)

AN electric power station is simply a factory for the conversion of the chemical energy in coal into electrical energy, and the selection and purchase of fuel are matters of the most vital importance. They depend upon the geographical position of the site relative to the nearest coalfields, and upon the nature of the load. It is a recognised fact that a higher overload duty can be obtained from a boiler fired with good-quality coal with a given draught than can be got with low-grade fuel. It is often more economical to use the best coal because, with the higher overload thus made possible, the number of spare boilers can be kept down to a minimum.

It is now almost universal practice to buy fuel on a calorific basis, but along with calorific value and analysis there are to be taken into account physical properties. Actual boiler

tests must be made with sample truckloads of coal if the best and most economical selection is to be made.

In the Glasgow Corporation electricity department, if any particular kind of coal as delivered is below our previous year's experience of it, then that coal has a decreased figure of value allotted to it against the time when next it will be offered.

A practical test in a boiler specially equipped for the purpose is a very reliable guide to calorific value. A good unit of comparison is the cost of evaporation of 1,000 lb. of water from and at 212 deg. F. or the number of lb. of water evaporated for a pennyworth of coal, including coal and ash handling, which varies with the quality of the coal. The better unit to use for general comparison is the British thermal units per watt-hour, i.e., lb. of coal per unit \times B.T.H.U. in coal as fired \div 1,000. Even this is not perfect, as it does not allow for the variation in load factor between different power stations, but it does enable comparisons to be made irrespective of variations in calorific value. In two of the Victoria Falls power stations the economic result obtained in the way proposed gave in one station 27 B.T.H.U. per watt-hour and in another 26. Both of these stations had very high load factors, whereas in many of the London stations, where the lighting load is predominant, the average result is in the neighbourhood of 40 B.T.H.U. per watt-hour. Daily samples of coal, as delivered, should be sent to the laboratory of the undertaking for calorific analysis. An assistant, working with a bomb calorimeter, can test 12 samples a day, working from 9 to 1 and from 2 to 5 o'clock. These tests are recorded in a coal test book for reference. As the results of tests obtained by any or all of the methods above referred to are tabulated and arranged, an index of the pits in the coal-field, from which the fuel supply is mainly or wholly drawn, can be compiled, and coal prices as received can be equated on a calorific value basis.

An interesting experiment has been carried out in one of the Glasgow gas works recently. Gas coke breeze or gas coke riddings were burned successfully on chain-grate stokers with forced draught. A special form of arch had to be built. This breeze can be bought at 20 per cent. the price of coal, and it has a calorific value of at least 60 per cent. of coal. There is a large amount of ash, but the experiment went to show that with intelligent superintendence good results could be obtained with this class of fuel, although the actual output of the boiler was considerably reduced.

Twenty years ago a fireman in a generating station was truly a fireman. The firing of the boiler is now done by operating a rope or a lever. A fire has rarely to be stirred or nursed in any way except by the adjustment of dampers and rate of feed. The substitution of mechanical and electrical machinery for hand labour naturally led to the substitution of the boiler-house engineer for the aforesaid fireman. A competent boiler-house engineer is an indispensable adjunct to the boiler-house staff, and the man who knows his business can easily earn the substantial salary which he can command in this capacity. He, of course, trains his own labourers, but the human element should be and is being cut down as far as possible.

Everything possible should be done to obviate wastage of the heat value of coal in the boiler-house before the steam reaches the turbine. A saving of 1 per cent. in the coal bill of the Glasgow Corporation electricity department would this year represent a sum of £2,000.

It is only in recent years that we have come to realise the value of a pound better steam consumption in a steam turbine. We now put a money value on steam consumption per one-tenth of a lb., and stipulate for heavy penalties in the event of failure to comply with guaranteed consumption after allowing a tolerance of $\frac{2}{3}$ per cent. With an equipment such as has just been described, weekly returns can be prepared giving all the particulars any manager wants to satisfy himself that the plant is being properly handled and is doing its work efficiently. Turbine-room data being also available, a weekly sheet showing running statistics may be easily made out.

In American stations generally considerably more attention is now being given to boiler-house economy, no doubt due to the increasing price of fuel. The workmen in the boiler-house are educated to interpret the various gauges and recording instruments and encouraged to take an interest in improving conditions. The instruments are not to be erected and stored away in the chief engineer's room, but are to be in the boiler-room.

Several very fine records of efficiencies have been attained in America. At the Conner Creek plant of the Detroit Edison Co., which has been in operation for a year, they have two 20,000-kw. turbo-alternators, and each turbine is supplied with steam by two large boilers, each boiler containing 23,500 sq. ft. heating surface. The plant is operating at the present time and producing a kw.-hour on 1.42 lb. of coal, i.e., a little less than 20,000 B.T.H.U. per kw.-hour. This shows an efficiency from coal to electrical energy of 17 per cent. The Chicago Commonwealth Edison Co. in their Fiske Street station have two turbo-alternators of 20,000 to 25,000 kw. capacity. Over a whole year's run the coal used per unit of output was 1.92 lb., and the average value of the coal as fired was 10,120 B.T.H.U. per lb. This gives an average of heating units in the coal as fired per unit of output of 19,450, and also shows a thermal efficiency of some 17 per cent.

DISCUSSION.

Mr. S. E. FEDDEN (Sheffield), who opened the discussion, said the paper interested him because he was on the eve of a big boiler-house development, which he hoped would not be smaller than 100,000 kw. He could not quite agree with the author's suggestion that the main object in boiler-house design was maximum steaming capacity in minimum space. The first consideration in a prospective design was the load factor at which the boiler plant would work, as this controlled the amount of coal and ash to be dealt with, and the movement and storage of coal and ashes appeared to him to be the main consideration. It was necessary to decide whether to design for the future load conditions of the plant or for the present ones, and to consider how these alternatives would react on one another. The boiler-house was more important than the engine-house, and he was going to employ shift engineers solely to watch the boiler-house, and, eventually, a man to watch ashes, dumping, &c. With a well-covered grate, the riddings had a calorific value of 9,000 B.T.H.U., but when the grate was only half covered, this value dropped to 6,000 B.T.H.U. He was quite unable to obtain a greater average than 8 or 9 per cent. of CO_2 , and thought this applied to most boiler plants; moreover, he did not see much possibility of getting CO , with the percentage conditions of CO_2 usually obtainable. Data collected at Sheffield on grate maintenance showed that with chain grates using fuel of 14,000 B.T.H.U., and burning 25,000 tons of coal, the average cost of maintenance was 2.72d. per ton burnt; with fuel of 10-11,000 B.T.H.U. value and burning 37,000 tons, the maintenance cost was only .46d. per ton, and the effect of high calorific fuels on such grates was clearly shown. With underfeed stokers burning 53,000 tons of coal, the maintenance cost came to .57d. per ton burnt, but this cost would increase if there was much banking done. The cost of maintenance for the conveyor using washed coal was 1.18d. per ton handled, but if the coal was unwashed, and contained dust, the figure immediately increased. The conveyor maintenance cost for ash removal, however, worked out at the high figure of 17.76d. per ton handled, and he considered that it would save expense to purchase suction ash plant at the absurdly high prices charged rather than use a conveyor. He had been led to test the ashes dumped from the boiler-house, and found that they had a calorific value of 4,600 B.T.H.U.; attention was given to the question, and at the present time this value had been reduced to 3,152 B.T.H.U., representing a very considerable saving, which in the case of a 100,000-kw. station would mean a great deal of money. He disagreed with the author's statement that the condensate would show the amount of water evaporated; from experience, he found that 15 or 20 per cent. more steam was generated in the boilers than found its way through the condenser. Tests of the calorific value of soot in boilers showed that this varied from about 600 B.T.H.U. in the front tubes to 3,000 B.T.H.U. in the economiser, and this might account for some of the heat loss not usually allocated. Since the war commenced he had found a great decrease in the calorific value of the coal sent in, and an increased percentage of ash. An examination of the author's test data for old and new-type boiler plants seemed to show that reduced radiation losses largely accounted for the improved results of the newer plant.

Mr. CHRISTIE (Brighton) said he believed that gas-firing would have a great influence on boiler-house design in the future, and he asked: why not face this problem boldly at the present time? With gas firing the fuel plant could be placed on any convenient site, some distance from the boiler-house, and connected to it by pipes, which would solve the coal storage difficulty, remove dirt and dust from the boiler-house, and, at the same time, enable a by-product recovery plant to be conveniently worked. He was most strongly urging his committee to come to an arrangement with the British Coalite Co. for gasifying 200 tons of coal a day, from which the company would secure the by-products, while the Corporation purchased the gas for boiler-firing purposes.

Mr. S. L. PEARCE (Manchester) felt much sympathy with Mr. Fedden's opening criticism. Space was not the sole criterion in boiler-house design. In connection with the new Barton station of the Manchester Corporation, careful investigation showed that a two-storey arrangement of the boiler-house, with boiler and economisers on one floor, effected a saving in construction cost of 20 per cent. over the three-storey arrangement, due to lighter steel work, &c. It was rarely that a reasonable amount of natural light entered a boiler-house, but the Barton design gave good roof lighting; the question of lighting was bound up with chimney design, and the deposit of ash, soot, &c., from the latter on adjoining roofs. The Barton boiler plant fitted nicely as regarded space with the engine-house, and so long as this was so, he felt that there was little advantage in adopting a three-floor boiler-house. He thought that 20 h.p. per sq. ft. of engine room was rather a high estimate; at Barton, with 20,000-kw. sets, there would be 10 h.p. per sq. ft. The superstation of the future would need large spare capacity. He proceeded to describe the Barton boiler and coal storage arrangements (which were illustrated in the ELECTRICAL REVIEW of January 8th, 1915), and expressed the view that the reciprocating feed pump could not compare with the turbine pump for efficiency. Amongst points to be considered were the division of the coal bunkers to avoid fires, and the separation of ashes from soot, to obtain the utmost value

for them as by-products. A comparison of boiler data for the new Manchester, Chicago, and Detroit stations showed that British practice favoured design for long-continued operation with a considerable margin of capacity.

Mr. JOHN ROBERTS (Durban), president of the recently-formed South African Municipal Electrical Association, after referring to the latter and mentioning that its members were favourably inclined towards federation with the I.M.E.A., said he thought that perhaps attention should have been directed to the self-contained boiler, combining superheater, economiser, feed heater, &c., as a development of the future.

Mr. DAVID WILSON referred at some length to the results obtained in modern water-tube boiler plants abroad, mentioning that it was recognised that for boilers worked at high rates, the water must be pure, and special distilling plants were in use on the Continent to provide such water. The correct efficiency of any well-known boiler type was definitely known, and evaporation was largely a question of combustion; the type of furnace also was largely dependent on the system of draught used. He was inclined to agree that it did not pay usually to burn low-grade fuel, as it required more supervision. The evaporation per sq. ft. of ground area of a modern boiler would come up to approximately 200 lb.

Mr. C. H. WORDINGHAM thought the author's conclusions were generally sound, and pointed out that he had referred to other considerations in design in addition to steam output. The practice of building boiler ranges at right angles to the engine-house necessarily increased the losses in pipe lines, &c. He asked whether there was any real gain in using such big generating units as 50,000 kW., if such difficulty was encountered in the boiler-house design. There was a great future for the gas-firing arrangement referred to by Mr. Christie; he (the speaker) had advocated it in the past, and he believed that some arrangement was possible with the gas people, who were specialists in this branch.

Mr. W. M. SELVEY pointed out that there was not necessarily any relation between the areas occupied by boiler house and turbine room, the latter being more or less an annex—a small matter when in addition to boiler plant, cooling towers and coal storage were considered. Analysis of the test data led to the conclusion that efficiency had little improved in eight years, but output for space had improved. Further space economy could be obtained by developing boilers of the Yarrow type and increasing grate area. Since the Coventry meeting of the Association, many developments had occurred in grate design, but the older grates, due to improved methods of manufacture, were holding their own against newer types. He had previously advocated an emergency speed for travelling grates with increased draught for meeting overload conditions; it was no good using thick fires for such conditions. With so much capital invested in the electricity supply industry, it would pay to investigate thoroughly the fuel problem at considerable cost. He thought that the idea that the gas interests would assist towards a solution of the fuel problem was a mistaken one, that the future rested with coal fuel, not gas firing, and that the gas turbine had to overcome enormous difficulties before it would become practicable. Co-operation with the coal interests was a possible solution of the fuel difficulty, the return for coal value being given in the form of electrical energy.

Mr. THOS. ROLES (Bradford) said there were very few boiler houses in the country in which a saving of 1 per cent. could not be obtained. The question of increasing grate area required attention, and it would be possible to do this with land-type water-tube boilers if they were lifted. Bradford used the same steam pressure, 200 lb., as 30 years ago, but boiler makers were talking of pressures of 350 lb. per sq. in., and it seemed necessary to decide on the future standard of pressure in view of the boiler plants which would have to be put down after the war ended. He thought the subject should be discussed by those interested. At Bradford it had not paid to install any special coal storage appliances, the coal being heaped on spare ground. High evaporation rates could be obtained by cutting down heating surface as compared with grate area, but it paid rather to have a margin of heating surface. It also paid to buy best coal, as that at 15s. or 16s. a ton was cheaper in use than coal costing 11s. or 12s. a ton.

Mr. BOWDEN (Poplar) said, with reference to the author's 100 lb. evaporation per sq. ft. of ground space of boilers, that at the Poplar works they were getting 113 lb. He stated that steam flow meters were quite satisfactory in his experience, and asked whether the ashes could not be conveyed hydraulically, as in the case of coal at the Hammersmith works. Rotary-type feed pumps were, in his experience, much more satisfactory than reciprocating pumps, not requiring the close attention necessary for the latter.

Mr. GEORGE WILKINSON (Harrogate) congratulated Mr. Christie on his gas-firing proposal, but thought the difficulty would be to get rid of the coke.

Mr. J. P. GREGORY (of the B.T.H. Co.) expressed disappointment with the fact that although Mr. Lackie had referred in his paper to the adoption of steam pressures up to 250 lb. in the States, apart from the comments made by Mr. Roles, the whole subject of using higher pressures and superheats had not been discussed. He referred to the importance of giving this matter close study, both from the commercial and from the engineering standpoint, in view of the fact that with increased pressures and temperatures, and

the utilisation of steam turbines, it was now possible to obtain very much higher over-all thermal efficiencies than hitherto. He also pointed out that high thermodynamic efficiency on a turbo-generator did not necessarily mean the highest over-all thermal efficiency for the whole generating plant. To make his point clear, he stated that his company decided some considerable time ago to install as an experiment, at their Rugby works, a high-pressure and high-superheat plant. As the result of daily running over a considerable period, this plant had become a permanent part of the company's power installation. The equipment comprised a marine-type tubular boiler, with integral superheater, economiser, induced-draught fan, and chimney, 1,600-kw. Curtis turbo-generator, surface condenser, and turbine-driven boiler feed pump, the latter exhausting into the feed-water tank. Incidentally, the hot air from the alternator was turned into the boiler furnace. The working pressure was 350 lb. per sq. in. (gauge), the plant being designed to give 700 to 750 deg. F. total temperature to the steam. Tests had shown remarkably good results, which would doubtless be published in due course. He noticed that Mr. Lackie referred to a thermal efficiency of 17 per cent. being obtained on one of the large plants in the States, and he presumed that this result was being obtained at pressures higher than those normally used in this country in the majority of the stations hitherto. For comparative purposes, he assumed a boiler efficiency of 80 per cent., which could be modified if necessary when making comparisons with any other boilers. It had been shown at Rugby that with 350 lb. per sq. in. gauge pressure, 264 deg. F. superheat, and 2½ in. vacuum, the over-all efficiency of the unit was 19.12 per cent. A similar unit at 200 lb. per sq. in. gauge, 200 deg. F. superheat, 2½ in. vacuum, would show 17.3 per cent. The comparison would show still more in favour of the higher pressures and superheats adopted on this plant at Rugby if the comparison were made with boiler pressures and temperatures still lower, and more in line with those used up to the present in this country. The speaker also showed that by reducing the pressure from 350 lb. per sq. in. gauge to 200 lb., but retaining the same degree of superheat, i.e., 264 deg. F., the over-all thermal efficiency would come out at 18.5 per cent. In other words, whereas the decrease in thermal efficiency when retaining the high superheat was 3 per cent., by decreasing both pressure and superheat the loss in efficiency was nearly 10 per cent., as compared with the results at the pressure and superheat used on the Rugby plant.

The operation of the plant referred to by Mr. Gregory—which is self-contained in its own power-house—as compared with their normal works plant, has shown a saving of 1 lb. of coal per unit generated. This result is being obtained in spite of the fact that the company's ordinary power-house plant consists of modern engines and turbine plant operating at the usual pressures and temperatures prevalent in the average municipal station.

Baillie W. B. SMITH (Glasgow) mentioned that coal purchases in Glasgow for the various departments were made by a joint committee, and that most surprising and encouraging results were being obtained with low-temperature carbonisation of coal in the experimental plant which the Glasgow electricity department had installed, with a view to adopting gas-firing under boilers. The coke could well be burnt under boilers also, and he believed that the value obtained from by-products would far exceed the cost of gasifying the coal, which had been the drawback in the past.

Owing to the protracted nature of the discussion, in which several other speakers had intended to take part, Mr. Lackie decided to reply in the *Proceedings*.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

60-cycle Transformers on 25-cycle Systems.

Referring to the article on 60-cycle transformers appearing in this week's issue, the reason why some transformers will operate on a lower frequency than that they were designed for, is due to their having a large quantity of iron in the cores. When the iron of a transformer is worked below the saturation point, the magnetising current varies directly as the amplitude of the induction wave, but as soon as it is worked above the saturation point the magnetising current and core losses rise to a very high figure. Since the amplitude of the induction wave varies inversely as the frequency, it can be readily followed that when the frequency is reduced, the magnetising current and core losses increase.

Some transformers contain sufficient iron to enable the frequency to be reduced 50 per cent. or more, and still operate with the amplitude of the induction wave below the saturation point, whilst others, containing less iron, if worked under this condition would operate with the amplitude of the induction wave above the saturation point, thus causing the losses to become so excessive that the transformer would burn out even on light load.

However, this objection can be overcome, owing to the fact that the primary and secondary windings also varies inversely as the voltage. Therefore, if the frequencies are reduced to per cent, and the voltage is reduced to per cent as well, the induction will remain almost the same.

From the above it follows that if two five-cent transformers, one for each side, are connected in series on the primary side, and in parallel on the secondary side, they will operate quite satisfactorily at 100 cycles per second, both the voltage and frequency in this case are reduced by about the same percentage. In order to enable easily connecting in to the main 220-volt supply, the primary winding of each unit is divided into two equal parts, and the parts connected in series or in parallel, as desired.

W. D. Lovell.

Manchester, June 26th, 1916.

The course proposed in our correspondents' last sentence appears to contradict the effect of connecting the transformers in series. This LURE REVEALS.

Decimal Coinage.

In his letter, which appears in No. 2,011 of the REVIEW, under the heading "Decimal Coinage," Mr. Alfred Bridges says, "Yet has he, or any other man, ever seen in modern French currency a centime piece, of which the French 'penny' is a multiple of 10?"

I beg to enclose one centime and one two-centime coins.

I would like to add that these coins, although not in common use, are not by any means a rarity. As a matter of fact, these coins are daily paid out at the French Government cash offices.

Secretary.

Compagnie des Câbles Sud-Américains.

Paris, June 1st, 1916.

TRADE STATISTICS OF EGYPT.

The following statement, showing the imports of electrical and similar goods into Egypt during the year 1915, is taken from the recently-issued trade statistics. The figures for 1914 are added for purposes of comparison, and notes of any increases or decreases are given.

	1914. £E.	1915. £E.	Inc. or dec. £E.
Rails.			
From Great Britain	8,000	500	- 7,500
Germany	140,000		140,000
United States		3,500	+ 3,500
Belgium	18,000		18,000
Total	166,000	4,000	162,000
Steam engines, including boilers, &c.			
From Great Britain	85,000	29,000	- 56,000
Germany	13,000		13,000
Belgium	4,000		4,000
France	5,000	3,000	- 2,000
Holland	1,000	2,000	+ 1,000
Italy	13,000	2,000	- 11,000
Other countries		1,000	+ 1,000
Total	121,000	37,000	84,000
Mechanical machinery.			
From Great Britain	13,000	11,000	- 2,000
Germany	2,000		2,000
Austria-Hungary	9,000		9,000
Belgium	1,000	1,000	-
United States		1,000	+ 1,000
France	2,000	1,000	- 1,000
Italy	1,000	1,000	-
Switzerland	7,000	2,000	- 5,000
Other countries	1,000	1,000	-
Total	36,000	18,000	18,000
Pumps and hoisting motors.			
From Great Britain	74,000	19,000	- 55,000
Germany	21,000		21,000
Italy	15,000	1,000	- 14,000
Switzerland	35,000	15,000	- 20,000
Other countries	7,000		7,000
Total	152,000	35,000	117,000
Lamps of all kind.			
From Great Britain	6,000	1,000	- 5,000
Germany	14,000		14,000
Austria	14,000		14,000
France	7,000	5,000	- 2,000
Italy	7,000	3,000	- 4,000
Sweden	5,000	1,000	- 4,000
Holland	1,000	2,000	+ 1,000
Switzerland		2,000	+ 2,000
Other countries	1,000	2,000	+ 1,000
Total	49,000	19,000	30,000

	1914. £E.	1915. £E.	Inc. or dec. £E.
Copper, manufactured.			
From Great Britain	8,000	5,000	- 3,000
Germany	26,000	1,000	- 25,000
Belgium	3,000		3,000
France	17,000	5,000	- 12,000
Italy	6,000	1,000	- 5,000
Other countries	2,000		2,000
Total	62,000	12,000	50,000
Scientific instruments.			
From Great Britain	35,000	14,000	- 21,000
Germany	13,000		13,000
Austria	8,000		8,000
United States	500	2,000	+ 1,500
France	9,000	5,000	- 4,000
Italy	3,000	1,000	- 2,000
Switzerland	2,000		2,000
Other countries	14,500	2,000	- 12,500
Total	85,000	24,000	61,000
Other machinery (except agricultural).			
From Great Britain	79,000	39,000	- 40,000
Germany	21,000		21,000
Austria	2,000		2,000
Belgium	6,000		6,000
United States	35,000	8,000	- 27,000
France	15,000	8,000	- 7,000
Italy	3,000	4,000	+ 1,000
Switzerland	11,000	1,000	- 10,000
Holland	2,000	2,000	-
Other countries	1,000	2,000	+ 1,000
Total	175,000	64,000	111,000
Copper, hammered, drawn or sheet.			
From Great Britain	88,000	25,000	- 63,000
Germany	15,000		15,000
Belgium	2,000		2,000
France	7,000	1,000	- 6,000
Other countries	2,500		2,500
Total	114,500	26,000	88,500
India-rubber and gutta-percha, raw or manufactured.			
From Great Britain	8,000	24,000	+ 16,000
Germany	10,000		10,000
Austria	2,000		2,000
France	5,000	11,000	+ 6,000
Italy	5,000	3,000	- 2,000
Switzerland	500	1,000	+ 500
Belgium	1,000		1,000
Other countries	1,500		1,500
Total	33,000	39,000	+ 6,000
Electric, telegraphic, and telephonic apparatus.			
From Great Britain	35,000	29,000	- 6,000
Germany	13,000		13,000
Austria	8,000		8,000
Belgium	10,000		10,000
United States	500	1,000	+ 500
France	9,000	9,000	-
Italy	3,000	8,000	+ 5,000
Sweden	5,000	1,000	- 4,000
Switzerland	2,000	3,000	+ 1,000
Total	85,500	53,000	32,500

£E = £1 0s. 6½d.

WAR ITEMS.

Exports to China.—The "London Gazette" for July 4th contains a further list of names of persons to whom articles may be exported in China and Siam.

To be Wound-up.—The Board of Trade has prohibited the following firm from carrying on business after September 29th, 1916:—

Turner & Burger, 149, Farringdon Road, London, E.C., electrical accessories merchants. Controller: J. E. Percival, 6, Old Jewry, E.C.

Contraband.—The following articles have been added to the list of those to be treated as contraband of war:—Electric appliances adapted for use in war, and their component parts.

Asphalt, bitumen, pitch and tar.

Felspar.

Export Prohibitions.—The "London Gazette" for June 30th contains further lists of persons or bodies of persons with whom trading is prohibited in Argentina, Morocco, Norway, Netherlands, Spain, and other countries.

Controlled Works.—The addition of a further 339 establishments to those under the control of the Ministry of Munitions makes the present total 3,916.

Finance and Trade: A Government Committee.—The Board of Trade has appointed a Committee "to consider the best means of meeting the needs of British firms after the war as regards financial facilities for trade, particularly with reference to the financing of large overseas contracts, and to prepare a detailed scheme for that purpose." The Committee includes, as the following list of members shows, Mr. F. Dudley Docker, C.B., who brings a wide industrial financial experience to the Committee table, and Mr. Walter Leaf, who, in addition to being a deputy-chairman of the London County & Westminster Bank, which it will be remembered recently entered into arrangements for assisting Italian industries financially, is a director of two electric supply companies. The remainder of the members are eminent bankers and insurance or other financial authorities. The complete list is:—

The Lord Farington (chairman),
Mr. B. P. Blackett, C.B.,
Sir W. H. Clark, K.C.S.I., C.M.G.,
Mr. F. Dudley Docker, C.B.,
Mr. Gaspard Farrer,
Mr. W. H. N. Goschen,
Rt. Hon. F. Huth Jackson,
Mr. Walter Leaf,
Hon. Algernon Mills,
Mr. J. H. Simpson, and
Mr. R. Vassar-Smith.
Mr. Hartley Withers will act as secretary to the Committee.

Salford Electricity Staff.—Of the employés of the Salford electricity department, 71 have gone on active service—13 from the offices, 3 from the stores, 29 from the power station, and 26 from the mains and motor departments. Five have been killed—Sapper E. A. Greenhalgh (draughtsman), Sergeant H. F. Andrews (switchboard attendant), Stoker C. Cooper (fireman), Acting Petty Officer H. Foulkes (labourer), and Private N. Higgins (labourer). Four men have been discharged owing to wounds or ill-health. Mr. T. E. Dransfield, first assistant mains engineer, and Mr. F. Birch, superintendent of the motor department, have recently been granted commissions in the R.N., and are on service with the Fleet in the North Sea.

After-the-War Problems.—The Prime Minister, in March last appointed a Committee of the Cabinet entitled the Reconstruction Committee, over which he presides, to consider and advise upon the problems that will arise on the conclusion of peace, and to co-ordinate the work already done by the departments in that direction. Suggestions from individuals or organisations should be addressed to Mr. Vaughan Nash, C.V.O., C.B., Secretary to the Committee, 6a, Dean's Yard, Westminster.

Sydney Electricity Employés.—The city electrical engineer of Sydney (Mr. Mackay) has reported complaining of the serious inconvenience that has been caused in his department by the fact that 170 of his employés have enlisted. So far he has done nothing to discourage enlistment, but a position of affairs has now arisen which renders further complacency on his part detrimental to the continued efficiency of the electric lighting service. The Lord Mayor has followed up the report by a minute expressing the opinion that the endorsement of the head of the electricity department should be required, subject to the supervision and concurrence of the Town Clerk, in each case where skilled labour is affected by enlistment.

Lighting Prosecution.—William Dix, a cleaner at the York Corporation tramway sheds, was fined £5 at the local police court for having failed to effectively shade lights at the tramway shed. There were about a dozen electric lights burning, and they could be plainly seen through a glass roof. The Bench expressed the opinion that the Corporation should pay the fine.

Exemption Applications.—At the Darlington Tribunal, Conn. J. E. Hodgkin applied for total exemption as a minister of the Society of Friends. His occupation was described as that of a consulting electrical engineer, and most of his time was taken up with religious and philanthropic work. Total exemption was granted.

At the City of London Tribunal last week, Miss V. Darnieres, of 21, Water Lane, Great Tower Street, E.C., agent for products and electricity, appealed for her brother, Mr. Andre Darnieres. It was stated that Mr. Darnieres had been in sole charge of the business for his sister for the last ten years. He was born in England, of French parents, the latter returning to France ten years ago. He was the only man left in the business, which had to provide for various members of the family. Another brother assisted in the business, but he was called up and was now in the Army. Miss Darnieres stated that the business dealt with the export of chemicals and carbon to France and elsewhere. Postponement for three months.

On the application of the Fooks Cray Electricity Supply Co., the manager, Mr. A. Wright, and a cable joiner were given conditional exemption on the ground that the business was in the national interest.

At Oxford, exemption was granted to W. T. Cooke (27), mechanical and electrical fitter and lead burner, on the application of Hill, Upton & Co. It was held that the occupation was a starred one.

An electrical contractor at Leigh, Southend-on-Sea, applied

for the third time for exemption. He said that his late partner was engaged on munition work, and the business was run entirely by his own personal exertions. Final exemption until August 1st was allowed.

Whitehaven Tribunal has given until the end of the year to the only employé left with a local electrician.

Conditional exemption has been allowed at Hollingworth to Mr. Walter Powell, electrician.

The proprietress of an electrical business at Southport appealed for a qualified employé who has been in the business for 13 years, and has assisted in its management since the death of her husband. As the man is single, and there are two other experienced men, over military age, in the business, the appeal was refused.

Exeter Tribunal has given three months' exemption to Mr. C. H. Steele (37), electrical engineer, in charge of the local stores of a firm of cable makers and engineers, to enable him to train women electricians.

At Aldershot, Mr. Vertue, of Messrs. Birch & Vertue, electrical engineers, asked for further exemption for Albert Huggard (35), electrical fitter and wireman. Mr. Vertue said that they were the only firm of electrical engineers in the town. They were responsible for the upkeep of about 60 electric motors in factories and workshops. Three months were allowed.

Mr. Mason, manager of the South Metropolitan Tramways, appealed at Croydon for 15 employés. Five, whose ages range from 28 to 33, were each given final exemption until August 31st; the rest were exempted altogether.

Kendal Tribunal has given conditional exemption to Mr. F. Collings, of the Corporation electricity works staff.

Canterbury Tribunal has granted conditional exemption to Mr. F. Lewis (35), chief assistant engineer at the Corporation electricity works, and to Messrs. P. W. Kemp (40), stoker; S. T. Tite (33), shift engineer; and G. H. Lock (38), coal trimmer.

Broadstairs Tribunal has given a month's exemption only to a local electrical engineer.

At Nunceaton, on June 27th, Mr. P. H. Howe (27), electrical engineer, applying for exemption, said that he had been in business for five years, and had lost the only man he had. On condition that he joined the Volunteer Training Corps he was given until November 1st.

At Barnes, exemption was claimed by Mr. W. Ellis, electrical engineer, who is engaged on Government work, and is in business in the town. Asked why he did not obtain a badge, he said that it was hopeless to apply owing to the enormous number of applications sent in. Conditional exemption was allowed.

Burnham (Somerset) Tribunal has conceded conditional exemption to Mr. E. G. Sandford, resident electrical and mechanical engineer to the Burnham Electric Light Co., Ltd.

Three months' exemption has been allowed by the Epsom Rural Tribunal to Mr. W. West, electrician, of Cobham.

At Wimbledon, a local firm of electrical engineers appealed for a wireman engaged on important contracts. The firm's staff has been reduced from 170 to 125, and out of 10 wiremen two only are left. The Tribunal granted two months.

Exemption has been given at Whitby to Mr. J. W. Figgott (36), electrical engineer with the Urban Council.

On the ground of business and family reasons, Watford Tribunal has conditionally exempted Mr. W. E. Warrilow (39), electrical engineer.

Holsworthy Tribunal has exempted Mr. J. W. Gibson (30), manager of the local Gas & Electric Supply Co., on the ground that he is in a certified occupation.

Croydon Tribunal has granted exemption to Mr. E. Staples, chief clerk and accountant in the Corporation electricity department, who served until discharged with the Surrey Yeomanry in Gallipoli, but who re-attested under the new Act, and to 30 employés in the tramway department.

Before the West Sussex Appeal Court, an Eastbourne firm engaged on Government work, appealed for an employé in charge of the electrical plant. The Court dismissed the appeal, but allowed three weeks' grace to allow the firm to apply for the employé to be badged.

Provisional exemption has been allowed to the engineering manager and the engine driver of the Frinton-on-Sea Electric Light & Power Co., they being indispensable to the carrying on of the undertaking.

The Surrey Appeal Court has refused an appeal by a Merton electrical engineer, in charge of the plant at a cinema, who had been refused exemption by the Local Tribunal.

At Aberystwyth, Mr. E. P. Perkins, works engineer and manager, was appealed for by the Electric Light Co. Mr. Perkins said that they now had only two engineers, and it would be impossible to run the works with a less staff than they now had; five had joined the Army. He was granted conditional exemption, together with Mr. G. Pollitt, assistant engineer, in charge of a shift at the works.

At Aberystwyth, the Military appealed against exemption until September 9th granted to B. W. Cheetham, electrician at the Kinema Theatre. The period of exemption was confirmed, but made final.

Before the Caterham Tribunal, Mr. Howard, manager of the Caterham Electric Supply Co., appealed for exemption for Mr. A. H. L. Hewer (36), book-keeper and clerk, and claimed that he should be starred. He stated that the firm had released 300 employés, and every station was short-

At Uckfield (Sussex), Mr. D. W. Froshfield, J.P., claimed exemption for his electrical engineer, Mr. J. Thompson. Exemption was given until December 31st, on condition that the residence remains a hospital.

Exemption until October 1st has been conceded to Mr. G. Gear, electrical engineer, engaged at Normanhurst Hospital in Isle of Dogs.

At Epsom, exemption was granted by Mr. E. E. Beaver, for Sidney G. Wenham (23), electrical engineer, who was stated to be indispensable. Temporary respite for medical examination was conceded.

At Burgess Hill (Sussex), on Monday, the manager of the electric light works successfully appealed for conditional exemption for the chief engineer and the meter reader and inspector, and both were directed to join the Volunteers.

Bridlington T.C. has decided to appeal to the Local Tribunal for Mr. F. French, of the electricity works, to be conditionally exempted from military service.

LEGAL.

HUDSON & COUNTY TAILORING CO., LTD.

In the City of London Court, on June 29th, before his Honour Judge Rentoul, K.C., a claim was made by Mr. Arthur G. Hudson, electrical engineer trading as A. G. Hudson & Co., Wells Court, How Lane, against the County Tailoring Co., Ltd., 1, Hoxton Square, to recover £5 for an electrical radiator supplied and fitted on their premises.

For the plaintiff it was stated that the defendants complained about the radiator, and plaintiff went and inspected it a month after it had been supplied. Then he found, after testing the radiator, that it had received a blow. The electrical circuit was all right, but the four formers were broken. The mere fact that the fireway became hot showed that the electrical part of the radiator was not defective, as alleged. The defective working was entirely due to the damage which the radiator had received.

PLAINTIFF said he had been in business as an electrician for 16 years. He had purchased the radiator from the General Electric Co., Ltd., and when the defendants complained about the radiator not working properly, he took it to the company and had it tested. It worked properly, but had evidently been knocked over. Defendants had suggested that the voltage supplied by the Shoreditch Borough Council of 240 was too high for the radiator in question. If that were the case, the wires would have fused, but the firelay would not have been affected. The difference between 240 volts and 220 volts was practically nothing when one was dealing with a radiator. He had offered to do the repairs for a sovereign, which was the cost price, but the defendants refused to pay.

JUDGE RENTOUL, K.C.: If the current were too strong, might it not destroy the radiator?

PLAINTIFF: If there was excessive pressure, say, 500 volts, the elements would melt immediately, but it would not break the fire-lay part of it.

In cross-examination, PLAINTIFF said he had been working for the defendants before. He knew the Shoreditch Borough Council voltage was 240, and that the radiator in question had a ticket on the back of it showing it was for 200 to 220 volts. That meant that 220 was the limit.

MR. WALTER WATTS, of the heating department of the General Electric Co., said they were the largest manufacturers of electrical appliances in the country. He had been five years in the heating department and 15 years in the electrical trade, having served his apprenticeship as an electrical engineer. During the last two years between 5,000 and 10,000 radiators had passed through his hands of the type in question. When the plaintiff brought the radiator to their office with a complaint from the defendants, the wire coil was intact. The firelay was broken across the back. He came to the conclusion that it had been knocked over on its back, and that that was the sole cause of the radiator not burning properly. It was certainly not due to any defect of the electrical part. With their radiators they gave a guarantee for 12 months against defective workmanship or heating elements. If the wire part burnt out in 12 months, or if there was a flaw in the elements, it would have been made good free of charge. As the radiator in question had had unfair usage, he refused to replace it free of charge. The radiator was suitable for 240 volts. If the voltage had been too great, the elements would have gone, but nothing would have happened to the firelay. With the radiator in question all the elements were interchangeable, and they often changed them. 250 was the highest voltage permissible. With 240 volts it was not necessary to have a radiator of less than 210. One of the salesmen in the General Electric Co.'s employment, named W. H. Lake, had written the defendants stating that the radiator in question could not be used on account of the 240 voltage in Shoreditch, that it would burn out, and that the defendants would have to have a 230 to 250-volt radiator.

JUDGE RENTOUL said if the defendants had sent the radiator back and said it was a 220-volt one, while the pressure in Shoreditch was 240, they would have been within their rights.

HERBERT POTTER, in the service of the defendants, denied that the radiator had been knocked over or damaged in any way.

MR. COHEN, electrical engineer, Golders Green Road, who said he had had 20 years' experience, stated he had examined the radiator in question. He saw that the voltage was wrong, and that would cause all the damage that had taken place. The coils were being run at a much greater heat than they should have been, and that would cause the wires to be burnt out. They had gone at the top, which was the weakest point. If the radiator had been dropped, they would have broken towards the centre, as the strain was on the centre when the radiator was dropped. He found that the coils were brittle through overheating. In cross-examination, he said radiators would stand very little above the voltage for which they were marked. He did not agree that the radiator was suitable for 240 volts. The heat would be very much greater. He would not expect a radiator to go wrong on the first day if the damage was due to overheating. On the contrary, it would go on for three or four weeks. The radiator was brought to him for repair, and he recommended that one of a higher voltage should be obtained.

JUDGE RENTOUL, K.C., held that the current was too strong for the wire. Plaintiff had practically guaranteed to put in a suitable radiator, and he did not think he had done so. Judgment for the defendants, with costs.

MONOMETER MANUFACTURING CO., v. ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD.—JUDGMENT.

MR. MUIR MACKENZIE, one of the High Court Official Referees, gave judgment on Monday in this action, already reported.

The OFFICIAL REFEREE, in giving judgment, said that the claim of the plaintiffs was for supplying furnaces and for extra work done in connection with those furnaces, and the defence was that the furnaces supplied were not in accordance with the contract, and were, consequently, valueless. As to a number of other things claimed by the plaintiffs, the defendants pleaded that they did not order them. The defendants also counterclaimed compensation for injury alleged to have been sustained by them owing to the default of the plaintiffs. There were two questions for consideration. The first was, what were the obligations of the plaintiffs? and the second, did they fulfil them?—both of which matters required careful consideration. At the end of 1914 the defendants were erecting new foundries for casting fuses for the Government, and for that purpose they were anxious to get the best furnaces. Attracted by an advertisement in which plaintiffs said they could supply furnaces in which the consumption of gas was less than that of any other furnace, and that they would melt aluminium without compressed air or other forced draught, they approached the plaintiffs, and, as a result, entered into a contract with them to supply three furnaces with a melting capacity of 1,000 lb. each, with 8 to 10 burners each, at a cost of £230 each; 12 smaller furnaces with a capacity of 140 lb. each, to be used in conjunction with the larger ones, for £52 each; two others of a like capacity with pouring spouts and valves, for £62 each, and three of 1,000 lb. capacity for melting aluminium swarf, for £248 each. The contract to supply these furnaces was entered into on January 15th, 1915. Subsequently, the defendants required certain alterations, and they made arrangements with the plaintiffs to carry them out. The defendants contended that it was part of the contractual obligations of the plaintiffs, first, that the furnaces should be capable of securing an output of from 50 to 60 tons a week; and, secondly, that the small furnaces should produce castings free from flaws and other defects, and that they should be fit for melting aluminium with copper. It was clear that, notwithstanding the written contract, the additional obligations contended for could have been made binding upon the plaintiffs by verbal understandings. The plaintiffs undoubtedly knew that the furnaces were required for turning out with rapidity castings for fuses, and that the metal to be used would contain a mixture of zinc, but he could not find that the plaintiffs entered into any obligation with respect to the furnaces beyond those expressed in the contract, and the question was whether the plaintiffs had made default in regard to those obligations. One cause of complaint was that the large furnaces did not provide sufficient output to feed the smaller furnaces, and that the iron pots were defective. As regarded the large furnaces, the complaint was that the defendants did not get the quantity of molten metal required; but plaintiffs had not entered into any legal obligation that they should do so. The main cause of the trouble in the smaller furnaces was due to the mixture of other metals with the aluminium. The plaintiffs did not undertake that their iron pots would not be subject to damage by alloys being melted in them. He therefore found and decided against the defendants on the main issue. The plaintiffs were not in default. The plaintiffs' claim included a large sum for extra work done, and the defendants admitted that they ordered part of the work claimed for. As regarded nearly all of the items claimed for, he decided in favour of the defendants, who were not liable for additional work unless it had been ordered by them. The person who had contracted to have things done for a certain sum was entitled to resist all claims outside the contract. He decided that the extra items, which in the aggregate amounted to £648, should be struck out. There would be judgment for the plaintiffs for £1,723 on the claim, and the counter-claim would be dismissed. As to the costs, he ordered that the defendants should pay four-fifths of the taxed costs. The case was one of the most difficult he had ever had to deal with, and therefore, without being asked, he would order a stay of execution for 14 days, and if either party lodged notice of appeal in the meantime, the stay would continue until the appeal was heard.

Judgment was entered accordingly.

FRASER & CHALMERS, LTD., v. THE WHITECROSS CO., LTD.

In the Commercial Court of the King's Bench Division, on Monday, Mr. Justice Rowlatt heard a claim for over £4,000 brought by plaintiffs, of Brith, against defendants, of Warrington, for a No. 3 Bettington boiler with two pulverisers, one driven electrically and the other by steam turbine supplied to the defendants for use at their wire drawing works. The defendants alleged, in reply, that the plaintiffs had committed a breach of the contract, and they counterclaimed for over £8,000 for expenses, delay, &c.

Mr. Colefax, K.C., and Mr. Moritz were counsel for the plaintiffs, and the defendants were represented by Mr. Leslie Scott, K.C., and Mr. Paddon.

MR. COLEFAX dealt at length with the technicalities of this boiler, and explained that broadly the contract provided that it should be used in conjunction with a Green's economiser, and there were certain stipulations as to output and efficiency. The boiler was prepared at Erith and sent up to Warrington. The defendants were to provide the plant necessary to give the draught required for the efficient running of the boiler. There were certain difficulties and mishaps, and an alleged defective draught accounted for some of the trouble. Eventually, the plaintiffs asserted, the defendants turned them out of the works, and would not allow them to further proceed with the putting of the boiler into working order, and they claimed the price of the boiler from the defendants. The defendants asserted, in effect, that the boiler did not conform to the contract, that its work was useless, and that it failed to produce the guaranteed results.

The case was eventually adjourned till November next.

BUSINESS NOTES.

Glover's Almanac.—The flight of time is brought home to us by the receipt of Glover's Almanac for 1916-17. This is the fifteenth issue, a fact which speaks for itself: how many such publications have developed into—well, perennials, for annuals is clearly not the appropriate word like this production? Very few, we are sure. The natural inference is that Glover's Almanac is welcomed by the electrical engineering community, which values it not only for the wit and humour of pen and pencil, but also for its pithy and informing extracts from technical publications. Long life to it! We have an eye on some items which we will reproduce—when the due date arrives; it is not fair to anticipate the source.

Book Notices.—"Memorandum by the Electrical Inspector of Factories on the Electricity Regulations." London: Wyman & Sons, Ltd. Price 4d.

The July issue of the *Chamber of Commerce Journal* contains the usual annual supplement regarding "Trade Products of the British Empire."

"Localisation of Faults in Electric Light and Power Mains." By F. C. Raphael. London: The *Electrician* Printing and Publishing Co., Ltd. Price 8s. 6d. net.

Telegraph and Telephone Journal. Vol. II. July 1916. No. 22. London: The Editing Committee. Price 3d.

Dissolutions and Liquidations.—**BRITISH EXPORTERS' ASSOCIATION, LTD.**—This company is winding up voluntarily, with Mr. R. W. W. Spooner, 182, High Holborn, W.C., as liquidator.

VICTORY SMOKE CONSUMER AND FUEL ECONOMISER CO., LTD. Oldham.—This company is winding up voluntarily, with Mr. J. C. Atkins as liquidator. A meeting is called for August 4th, to hear an account of the winding up.

OMEGA ELECTRIC LAMP CO., LTD. Hammer-smith.—This company is winding up voluntarily, with Mr. R. T. Cuff, 8, Bream's Buildings, Chancery Lane, W.C., as liquidator. Creditors should send particulars of their debts, &c., by July 7th.

BOILER SCALERS, LTD.—Creditors should send in the usual particulars to the solicitors to the liquidator (Saunders, Bradbury and Saunders, 37, Temple Row, Birmingham), by July 22nd. A meeting is called for July 31st, to hear an account of the winding up.

NAYLOR BATTERY CO., LTD.—This company is winding up voluntarily with Mr. H. Everett, 3-7, Southampton Street, Strand, W.C., as liquidator. A meeting of creditors is called for July 13th, at the Hotel Cecil.

DOWNES & DAVIES, electrical engineers and merchants, Stanley Street, Liverpool, and 78, King Street, Manchester.—Messrs. H. L. Downes (deceased) & P. L. Davies have dissolved partnership. The latter will continue the business under the same style and will attend to debts.

COLSTON ELECTRICAL WORKS, LTD., 9, Denmark Street, Bristol.—The first meeting of creditors herein was held at the Official Receiver's office, 26, Baldwin Street, Bristol, on June 28th, when it was decided to leave the matter in the hands of the Official Receiver, who will act as liquidator, in conjunction with a Committee of inspection.

Catalogues and Lists.—**MESSRS. FALK, STADELMANN AND CO., LTD.**, 83-87, Farringdon Road, London, E.C.—Twelve-page illustrated and priced catalogue of "Lucifer" portable electric flash lamps and torches of British manufacture, also cases of various descriptions, of which large stocks are held, and lamps and batteries for which all demands can be met this season; a page of electro-medical apparatus is also included.

FROM MR. WILLIAM MCGEEGE OF ANCHOR CO. LTD.—They have received a list of prices, together with a specimen packet, of steel grit for counterweight fittings.

MESSRS. T. W. BROADBENT, LTD., Victoria Electrical Works, Huddersfield.—Eight-page pamphlet, part of their new catalogue, giving specification, price list, &c., of their "G" type C.C. generators for direct coupling.

THE FULLER ACCUMULATOR CO., LTD., Chadwell Heath.—Twenty-four page illustrated catalogue of Fuller accumulators. The five sections of the list are devoted to Block accumulators, "Sparta" accumulators, Plate type accumulators, hand lamps, and motor-car wire. The batteries, which are well shown and priced with tabular data and code-words, are for house lighting, motor-car starting and lighting, telegraph and telephone service, train lighting, &c. Owing to the large numbers of American cars in use in this country, the majority of which are fitted with starting batteries, a real need exists for a good British battery to replace the American cell. Import restrictions are now very rigid, and the Fuller Co. have met the position by making a very full range of sizes to meet the need of car-owners.

MESSRS. HOLT & WILLETS, Lion Works, Cradley Heath. Illustrated price leaflet of the "Handy" movable crowbar (Lash's patent).

Private Arrangements.—**THOMAS ROYCROFT**, 50, Sea-view Road, Liscard, Cheshire, electrical engineer.—The creditors interested herein were called together on June 30th, when the statement of affairs presented showed liabilities amounting to £685, to meet which there were net assets of £629, after allowing for the claims of preferential creditors, the estate disclosing a deficiency of £55. It was reported that the debtor commenced business in Park Street, Liscard, about April, 1902, without capital. Owing to the fact that proceedings had been threatened by one or two creditors, and to an action to recover £161 being pending, a deed of assignment had been taken in favour of Mr. Parkin Stanley Booth, of Liverpool, to protect the estate. The debtor was not now prepared to submit any offer, and, after discussing the position, it was decided that the deed of assignment should be confirmed, and a Committee of inspection was elected to consider any offer made. The following are creditors:—

Barnes & Biss, Ltd.	1774	Messrs. J. A. Smith	1500
Drake & Co. (Ltd.)	32	Wolfe, Hy. & Co.	10
Downes & Davies	34	Wardell & Sons, Ltd.	33
Falk, Stadelmann & Co., Ltd.	66		
General Electric Co., Ltd.	87		

Trade Announcements.—**MESSRS. WAYGOOD-OTIS, LTD.**, announce that they have concluded arrangements with the liquidator of the Easton Lift Co., Ltd., for acquiring the goodwill, patents, stock, and work in progress of that company.

MESSRS. ELECTRICAL CONDUITS, LTD., have transferred their offices to Anchor Works, Birch Street, Walsall, and all communications should be addressed there—not to Birmingham.

MESSRS. J. H. HEATHMAN & CO., of Parson's Green, who are prepared to increase shipments to the markets of the world, have opened extensive showrooms for their ladders, trestles, steps, trolleys, trucks and barrows, as well as portable telescopic scaffolds, at 35, Aldersgate Street, E.C., near the General Post Office, at which those manufactures can be inspected.

MESSRS. JOHN C. FULLER & SON, LTD., the FULLER ACCUMULATOR CO., LTD., and FULLER'S WIRE AND CABLE CO., LTD., have transferred their offices and works to new and larger premises at Grove Road, Chadwell Heath, Essex, where all communications should be addressed. The works are in the London telephone area, and for the present the number will be "Ilford 173."

Bankruptcy Proceedings.—**R. E. CONNOLD**, Canterbury.—July 18th is the last day for receipt of proofs for dividend by Mr. G. E. Corfield, the trustee, 119, Finsbury Pavement, E.C.

LIGHTING AND POWER NOTES.

Australia.—A deputation from the South Brisbane Municipal Council has interviewed the Queensland Home Secretary, with a view to enabling the municipality to obtain an electric supply for lighting and power. The Council asked for authority to supply the power itself, or to obtain it from the City Electric Light Co., or any other company. The Mayor stated that the Council was not able to undertake a scheme for many reasons, as it could not enter into competition with the South Brisbane Gas and Light Co., even if the finances would permit it, and as, in the future, there might be a Greater Brisbane scheme, it would be unwise for the Council to undertake to install plant and machinery. The Home Secretary agreed that electric power was necessary for the running of factories, of which they needed many more, and promised to bring the matter before the Cabinet.—*Tenders.*

The Sydney City Council has notified holders of electric motors that owing to the increased cost of motors and materials necessary for their maintenance, it has been found necessary to increase the hiring charges as from August 3rd next.

The Liverpool N.S.W. Municipal Council has passed a resolution that, with a view to ensuring an efficient lighting service to the town and ratepayers, negotiations be entered into for an electric supply in the present lighting area.

The Melbourne City Council has decided that the price for electricity for battery vehicles be 1d. per unit when charging between 10 p.m. and 8 a.m.

Barnstaple.—**THE INCREASE.**—The T.C. has increased the price of electricity for the year ending September next, the new rates being as follows:—Domestic, 12d. per unit; commercial, 15d. per unit; industrial, 18d. per unit. The increase is due to the fact that the cost of coal has risen from 10s. 6d. to 12s. 6d. per ton.

Bingley.—**THE ELECTRICITY AND THERMAL COMMITTEE.**—The Bingley Electricity and Thermal Committee has decided to accept the recommendation of the Bingley Thermal Committee, and to purchase the electricity required for the power station from the Bingley Thermal Committee. The committee has also decided to purchase the electricity required for the power station from the Bingley Thermal Committee.

Belfast.—**A PROPOSAL OF THE FULHAM AND E.L. COMMITTEE.**—The Belfast Electricity and Thermal Committee has decided to accept the recommendation of the Belfast Thermal Committee, and to purchase the electricity required for the power station from the Belfast Thermal Committee. The committee has also decided to purchase the electricity required for the power station from the Belfast Thermal Committee.

Bury.—**YEAR'S WORKING.**—The report of Mr. Watson, Bury's electrical engineer on the working of the Council's electricity undertaking for the year ending March 31st shows that 13,500,000 units were sold at a net profit of 10s. 6d. and 2 millions respectively for gas and electricity, the maximum load being 1,800 kW. and 1,000 kW. respectively. The output increased by 26 per cent. as compared with the previous year, motor supply and bulk supply showing respective increases of 30 and 30 per cent. The revenue for the year was £41,308, the total generating costs were £25,455, and after meeting financial charges, the net surplus was £2,003. There were 1,009 motors connected, of 8,513 H.P., 62 of 588 H.P. being hired. Commenting on the year, Mr. Watson pointed out that 13½ million units were generated at the new Chamber Hall station, and about a million at the old works on account of plant extensions being deferred; this required a coal consumption of 2,504 tons at the old works, costing £1,972, whereas the new works could give the same output for 1,300 tons, costing £1,040. There are 7,000 kW. at three-phase plant at Chamber Hall and 1,000 kW. of D.C. plant at the old station. The department now supplies H.P. current in bulk to the Heywood generating station. Generating costs averaged 45d. per unit (coal, 25d.); all-in costs were 69d., and average revenue, 73d. per unit.

Chester.—Speaking on the electricity department's annual accounts, Mr. John Owen stated, at a meeting of the T.C., on the 27th ult., that the hydro scheme had been the salvation of the concern. The hydro scheme had generated 1,567,300 units, and the steam plant 1,900,023 units. The hydro scheme had exceeded their anticipations and estimate. The increased cost of coal had been £940, and if they had relied upon their steam plant, their coal bill would have been £2,283 more.

Continental.—**SPAIN.**—It is announced from Madrid that the Sociedad Minera y Metalurgica de Penarroya is about to establish an electricity generating station with a capacity of 20,000 H.P. in the coal mining district of Puertollano. The generators will be operated by gas engines using gas obtained from inferior qualities of coal available at low prices at the collieries in the district. The Penarroya Co. is also establishing a similar station of 12,000 H.P. capacity near its mines in the Belmez district. The current generated will be principally utilised in connection with the various railways belonging to the company, which are being electrified, notably the line from Puerto del Arco to Belmez, and a new line from Comares to Puertollano.

Dalkeith.—**PRICE REDUCTION.**—The Electric Supply Corporation, Ltd., London, has informed its consumers in Dalkeith that owing to increased costs the rate for lighting will be 5½d. per unit, and for domestic heating and cooking 2d. per unit. Supply for power will be charged according to the aggregate brake H.P. of motors supplied through each meter and the number of units used in any one quarter.

Eccles.—The Public Lighting and Electricity Supply Committee has decided that the surplus of £668 on the revenue account, for the year ended March 31st last, be transferred to the credit of the reserve fund.

Edmonton.—The Guardians have refused to accede to a request of the North Metropolitan Electric Power Co. for an increased charge for current supplied.

Farnham.—The Board of Trade has extended the electric lighting order for a year.

Finchley.—**YEAR'S WORKING.**—The accounts of the U.D.C. electricity department, for the year ended March 31st last, show total working expenses amounting to £15,417, a total revenue of £24,415, and a net profit of £8,998 after meeting all charges, the net profit for the year amounted to £301.

Gloucester.—**PRICE REDUCTION.**—On the recommendation of the Electricity Committee the Council has decided to increase the ordinary charge for current from 10d. to 12d. and power price to 15d. per unit.

Haslingden.—**LOAN SANCTION.**—The T.C. has received the sanction of the L.G.B. for borrowing of £1,450 for mains and 250 for electric lighting in connection with the electricity undertaking.

Hford.—**PRICE INCREASE.**—From the passing of the meters for the period ending September next the charge for current on all accounts will be increased by 12½ per cent. The Daylight Saving Bill has affected the undertaking considerably. On account of the difficulty in obtaining coal, a scheme has been drawn up for utilising the steam from the dust destructor.

Kendal.—**YEAR'S WORKING.**—There is a deficiency of £390 on the working of the electricity undertaking for the year ended March 31st last.

Leek.—**NEW PLANT AND MANAGEMENT.**—The Lighting Committee, after consideration of Prof. Watkinson's report, decided that the engineering should be instructed to take control of the producer gas plant at the electricity station, and Mr. Henson, the electrical engineer, tendered his resignation, which was accepted. It was stated that owing to the improbability of its being able to obtain a loan at the present time, the Committee was not in a position to carry out the whole of Prof. Watkinson's suggestions. It was proposed that the Campbell gas engine and dynamo be sold at once; that a new gas engine and dynamo of about 200-kw. capacity be installed, at a cost of about £3,000; that the Stockport engines, which during the past six months had had to bear a very heavy strain, be thoroughly overhauled; that Mr. Ginn, the gas engineer, who had a fair knowledge of electricity work, be appointed general manager also of the electricity station, and that a chief assistant be appointed at a salary of £160 per annum.

Lianduno.—**YEAR'S WORKING.**—There has been a loss of £1,499 on the working of the electricity undertaking for the year ended March 31st.

London.—The Brompton and Kensington Electric Supply Co. notifies a further increase in the price of electricity of 10 per cent.

Hammersmith.—The Electricity Committee recommends that an Underfeed stoker be fitted to a Stirling boiler at the electricity works, at a cost of £446, plus the cost of fixing and alteration of brickwork, which is estimated at £200.

L.C.C.—The Finance Committee recommends the Council to sanction the borrowing of £2,500 by the Fulham B.C. for electricity purposes.

Woolwich.—The charge for steam generated from refuse for electricity purposes, for the year ended March 31st last, has been fixed at 55d.

Having regard to the linking-up arrangements now completed with adjoining undertakings, and in order to meet further requirements, the Committee finds that it will be necessary to install an additional boiler at Globe Lane station. A boiler, superheater and economiser are to be obtained for £5,890. Subject to approval of the application for sanction to borrow, mains are to be extended at a cost of £618, for the supply of electricity to certain workers' hotels; it is expected that, when the premises are fully occupied, the revenue will be substantial in amount.

Loughborough.—**YEAR'S WORKING.**—During the year ended March 31st last the Council's electricity undertaking had a revenue of £8,291, and gross profit of £3,795, while after meeting financial charges a balance of £302 remained. The total output sold amounted to 1,303,341 units, as compared with 929,000 units in 1914-15; of the total 1,091,229 units were sold for power. The total connected load was 1,694 kW., and the maximum load 772 kW.; 186 motors of 1,100 H.P. are in use. The total working costs averaged 77d. per unit, coal costing 27d.

Luton.—**YEAR'S WORKING.**—The total working expenses of the electricity undertaking for the year ended March 31st last amounted to £27,639, the income was £44,366, and the gross profit £16,727, being £2,954 more than last year. The gross profit equals 108½ per cent of the capital expenditure. The net profit amounts to £6,227, being £1,797 more than last year. The following accounts have been charged against profits:—House services, £734; meters, £893; new fence, £68; alterations at depot, £44; railway wagons, £215; additional contribution to district fund account, £200; leaving a balance of £4,072 to be appropriated. The capital repaid, or in sinking fund, was £39,933, leaving a net debt at the end of the year of £84,480; the reserve and renewals fund amounted to £6,021. The Electricity Committee recommends that the working balance (at present standing at the wholly inadequate sum of £4,416) should be supplemented by £4,010, and that meter rents be reduced as from April last.

NEW PLANT.—The electrical engineer reports that an increased demand of over 1,500 kW. is anticipated next winter, and that it will be necessary to install two boilers, with stokers and an economiser; also an additional feed pump and water-softening plant, and that provision must now be made for dealing with the ashes and clinkers from the boilers and soot from the flues and economiser. Tenders for the plant represent an expenditure of £13,574, and the engineer advises that immediate application be made to the L.G.B. for sanction to borrowing the amount. The ash and soot handling plant requires some further modification, and the engineer hopes to place definite tenders shortly. The Electricity Committee has recommended the Council to adopt the engineer's report and suggestions.

Middleton.—A local newspaper recently hinted that the report of the electricity department would show a loss of over £1,000. The journal added that the cheapness of electricity was governed by the largeness of production, and everything pointed to the wisdom of the Committee eventually adapting the Middleton works to a transforming station, and buying the current elsewhere.

New Zealand.—LAKE COLERIDGE ELECTRICITY SCHEME.

The report of the first year's working of the Lake Coleridge supply to the Christchurch City Council's electricity department shows that the revenue from sales of electricity amounted to £27,807, working expenses to £14,646, interest to £1,445, and sinking fund to £2,181, leaving a balance for depreciation and extension of £8,535. Mr. F. Black, who acted as adviser to the Council, estimated that there would be a probable loss of between £1,600 and £1,700 at the end of two years, and that the undertaking would take from four to five years to be self-supporting; the figures, however, show that not only is the department self-supporting, but that it has a substantial balance after paying all charges. Although, owing to difficulties consequent on the war, the Council has been unable to embark upon an active campaign to obtain new business, the number of consumers during the year increased from 1,623 to 2,930, and the connected load at the end of the first year's working is now 5,592 kW.

At the end of the first year of the Lake Coleridge supply, with a peak load which had been kept down with the aid of the steam plant and the storage battery to only 1,020 kW., and a connected load of 5,592 kW., the Council paid the Government only £6,200, an average of £1 2s. 1d. per kW. of connected load.—*New Zealand Shipping and Commerce.*

Nottingham.—YEAR'S WORKING.—The working expenditure of the Corporation electricity undertaking for the year ended March 31st last amounted to £69,408. The income totalled £109,544, leaving a gross profit of £40,057. After meeting interest, sinking fund and other charges a balance remained of £11,677, of which £5,000 will go towards the rates, and the remainder will be transferred to reserve fund. The number of units sold during the period under review amounted to 13,854,461, an increase of 994,113 as compared with 1914-15; 6,406,000 units being for traction purposes, 4,125,833 for power purposes, and 3,232,593 for lighting. The last figure showed a decrease of 182,079 as compared with 12 months ago, representing a loss of revenue of £6,736. The number of 32-watt lamps or their equivalent connected at March 31st last was 526,830, an increase of 31,275 for the 12 months, being the largest increase since 1903. Two hundred and thirty-nine motors, aggregating 1,126 H.P., had been connected to the mains, making a total of 2,008 motors and 8,063 H.P., the largest increase since the supply started. The demands for current still continue, those for power purposes being specially noticeable.

Oldham.—DAMAGED CABLES.—At a meeting of the Electricity Committee, held on the 28th ult., it was reported that the Committee had approved of a suggested compromise with the Post Office Department of long-standing claims concerning damaged cables.

Salford.—The Electricity Committee has decided to revise its terms of supply to homes for Belgian refugees. An agreement is to be entered into with Zama, Ltd., for a supply of energy for a period of five years, or such further period up to 10 years as the company occupy their premises. The Committee has acceded to the application of the Peel-Conner Telephone Co., Ltd., for the supplies of energy to their premises in Upper Cleminson Street and Silk Street to be treated as one supply under certain conditions. Application is to be made to the L.G.B. for sanction to borrow (1) £2,279 to cover the cost of provision of additional plant and switchgear; and (2) £750 to cover capital expenditure in connection with the undertaking in respect of loans sanctioned by the Board prior to March 12th, 1915.

Shipley.—LINKING-UP PROPOSAL.—Preliminary steps have been taken with a view to considering the advisability of linking-up the Bradford and Shipley electricity undertakings, and the respective engineers are to report to their Committees on the subject, with a view to joint discussion later. Both undertakings now generate three-phase, 50-period current at 4,000 volts, and the Bradford authority has a duplicate H.T. main running to the city boundary, where it is within a short distance of a similar capacity H.T. main of the Shipley Council, so that the cost of interconnecting would be very small. It may be added that the Bradford Corporation and Yorkshire Power Co. have for some time been linked-up at Thornbury.

Stalybridge.—YEAR'S WORKING OF JOINT BOARD.—The working of this joint electricity undertaking for the year ended March 31st last resulted in a total revenue of £74,932; the gross profit amounted to £28,556, and after meeting interest and sinking fund charges, the surplus was allocated as to sums of £1,120 and £3,713 to reserve and £1,536 in capital payments. During the year 28,351,600 units were generated, as compared with 22,683,680 in the previous year; 21,713,151 units were sold to private consumers, and 1,968,766 units for traction. The total production cost per unit was '375d., coal figuring at '24d.; interest, sinking fund, &c., amounted to '25d., while the revenue from the total supply averaged '661d. per unit, private supply giving '62d. per unit. It may be noted that a revenue of £50,378 was derived from private power, and £10,761 from private lighting consumers.

Stoke-on-Trent.—PROPOSED "EXTENSION."—The Federated Council has referred back the recommendation of the Electricity Committee to spend £12,000 on the extension of the plant at the power house, in order that the Committee may prepare a statement showing how the proposed outlay will benefit the undertaking.

Sutton.—PRICE INCREASE.—The manager of the E.L. Co. has informed the U.D.C. that, as a temporary arrangement, the price of energy for lighting will be increased from 5½d. to 6d. per unit, and for power and heating by from 1d. to 1½d. per unit.

York.—YEAR'S WORKING, &c.—The Corporation electricity accounts for the year ended March 31st show a gross revenue of £37,860, and an expenditure of £21,300, leaving a surplus balance of £16,560, which is reduced to £14,56 by interest, sinking fund and other charges.

The Electricity and Tramways Committee has authorised the town clerk to apply to the Board of Trade for an extension of the period fixed for the laying of mains in the Bishopthorpe and Accomb districts authorised by the York Electric Lighting (Extension) Order 1911, which is about to expire.

Yeovil.—The Board of Trade has extended the period for order for a year.

TRAMWAY and RAILWAY NOTES.

Australia.—TRAMWAY ELECTRIFICATION.—The electrification of the Newcastle tramway system was urged by a deputation representing the Mayors of Newcastle and neighbouring boroughs who waited on the Minister for Railways (Mr. Hoyle) recently. The Minister, who expressed his sympathy with the deputation, pointed out that the difficulty in the way was the lack of money. As soon as the necessary money was available the work would be proceeded with.

Continental.—ITALY.—A decree has been published approving a convention between the Italian Government and the Roma Nord Tramway and Railway Co. for the construction and working of an electric railway from Rome to Viterbo, *via* Civita Castellana.

Chester.—YEAR'S WORKING.—The tramway accounts for the past year show a surplus of £1,185, compared with a surplus of £903 for the previous year, the increase being mainly accounted for by the reduction in the power expenses—£1,828 (1.39d. per car-mile), compared with £2,256 (1.56d. per car-mile). Traffic revenue showed an increase of £73, and the car-mileage last year was 30,727 less than in the previous year. The reserve fund stands at £6,557, which represents 8 per cent. of the total capital expenditure.

Croydon.—A report has been submitted to the B.C. by the Tramways Committee recommending certain increases in wages and payments for overtime, at an estimated cost of £1,865 per annum; it was pointed out that on the year's working up to March 31st the surplus, if any, would be small, the cost of electricity during the year had increased by £2,893, war allowances and bonuses had absorbed £5,906, and stores and materials showed a great advance in prices. In order to meet the proposed improved conditions for employes, the Committee recommended a revision of fare stages. The question was adjourned until the next meeting.

It was stated that the strike had almost collapsed, only eight more motormen being required to make up the normal number.

Darwen.—The Corporation has decided to increase the charge for electricity supplied to the tramways to 1½d. per unit (equal to £400 per year). This is imposed at a time when the tramway receipts show a fall over a period of three months of over £100. New rails are so expensive that arrangements have been made with the Blackburn authority for the loan of apparatus to cut out the bad portions, with a view to replacing them with short lengths.

Glamorgan.—The Rhondda Tramways and Electric Supply Co. appealed against the assessments of the generating station at £2,500 and the tramway undertaking at £5,500 rateable values; the appeal with regard to the generating station was dismissed with costs, and the assessment of the tramway undertaking was reduced to £1,500 net.

Halifax.—The Tramways Committee has appointed a Sub-Committee to consider the question of tramways at Helden Bridge, and all matters connected therewith, between the District Council and the Corporation, with full power to obtain such expert advice as is necessary.

Keighley.—TRAMWAY ORDER EXTENSION.—The Corporation proposes to apply to the B. of T. for a prolongation of the period limited for the completion of the works authorised by the Keighley Corporation Tramways Order, 1903 (confirmed by the Tramways Orders Confirmation (No. 2) Act, 1905), and of the periods limited for the commencement and completion of the works authorised by the Keighley Corporation Tramways Order, 1909 (confirmed by the Tramways Orders Confirmation Act, 1909).

London.—WOOLWICH.—The B.C. has consented to the proposal of the L.C.C. to lay additional tramway tracks in High Street, Plumstead.

Manchester.—**YEAR'S WORKING.**—During the year ended March 31st and the Corporation tramcars carried 299,877,067 passengers, a total mileage of 1,486,419 miles on considerably less mileage than in 1915 when some 7 million passengers were carried. Financially, the total revenue amounted to £939,470, and, after deducting working expenses, £561,439, and war service allowances, £292,888, the gross profit was £285,222 and including added interest, £299,740. From this amount interest, sinking fund, rent and tax charges are deducted, leaving a balance of £121,181, of which £100,000 was contributed to the rates and the balance to reserve. In the previous year the rates received a similar amount, but a reserve balance of £18,284 was available for the reserve. However, war service allowances alone absorbed £60,000 more this year than last. The earnings per car-mile were the highest so far recorded, viz., 12'19d., an increase of '897d. over 1911-15, while working expenses only increased by '117d. per car-mile. The tramways department purchased some 28,700,000 units from the electricity department at 1'08d. per unit and used 155 units per car-mile. The Corporation now operates 195 miles of single track, with 685 cars, it also operates some motor-buses, which ran 82,711 miles and carried 758,064 passengers. The buses cost 8'6d. per mile, including depreciation, to run, and earned 9'1d. per mile approximately.

Sir George Askwith (Chief Industrial Commissioner) has communicated with the Tramways Committee, and has forwarded a copy of a letter from the Tramway and Vehicle Workers' Association respecting the application of the society on behalf of certain grades of men for an additional war bonus. The Committee has decided to inform Sir George Askwith that it cannot see its way to grant the additional war bonus asked for, and that there appears to be no other course open than for the matter to be referred to the Committee on Production for settlement.

A Special Committee of the City Council has been appointed to take into consideration the advisability of running motor-buses in place of tramcars in certain of the busiest thoroughfares in the city. It is stated that 3,000 cars traverse Market Street every work day.

St. Helens.—The Highways Committee has appointed a deputation to visit several towns where motor sweepers are in use, and to submit a recommendation thereon to the next meeting.

York.—**YEAR'S WORKING.**—The tramway accounts for the year ended March 31st last show a gross revenue of £35,735 and an expenditure of £24,532, leaving a balance of £11,203. This balance is reduced by interest and sinking fund contributions to £1,792.

The B. of T. has issued a certificate of approval of the Hull Road tramways extension, and the system is now in operation with a 15 minutes' service throughout the day.

The traffic returns for May show increases from £2,896 receipts during the corresponding month to £3,189, and the number of passengers carried increased from 679,419 to 717,698.

TELEGRAPH and TELEPHONE NOTES.

Cable Tariffs.—Telegrams may now be forwarded to Ocean Island at 5s. per word, and to places on the Persian Gulf at 2s. 2d. to 2s. 10d. per word.

Telegraph Money Orders.—The Telegraph Money Order Service, which has hitherto been available, so far as the British Overseas Dominions are concerned, for Egypt, Canada, and Newfoundland only, has been extended to certain other Colonies. The telegrams of advice can be sent at the deferred rates, which will reduce the telegraph charges by one-half.

The Postal Services.—On Monday last, Mr. J. A. Pease, the Postmaster-General, presented the annual estimates of his department in the House of Commons. Referring to the telegraph service, he stated that the surcharge of 3d. on telegrams had brought in £207,000, instead of £170,000 as anticipated. The increase in the cost of telephone calls to 3d. produced only £115,000, instead of £205,000 as estimated. The total revenue from the additional charges imposed on all services in 1915 was over a million, compared with £928,000 expected; economies amounting to a million had been effected in the home service of the department during 1915-16, and the profit balance was £3,320,000, against £3,380,000 in the previous year and £6,650,000 in the year before the war. The total revenue had increased by four millions over the previous year to £33,650,000. Expenditure due to the war amounted to six millions. On the Post Office tube railway £364,000 had been spent, but owing to the demand for electrical plant, the completion of the tunnel would be delayed, building construction had also been curtailed.

Out of 30,000 postal servants of military age 32,000 were serving with the Colours. Of 21,700 starred men under the Derby scheme, 6,000 belonged to the engineering and signalling services, and were regarded as indispensable for telegraph and telephone maintenance at home. Of the men over military age, good work had been done by 300 members of the Volunteer Training Corps. The work of the women, who had volunteered to do duty at night

at telephone exchanges during Zeppelin raids, deserved very high praise. During the storm in March last, 2,150 poles were broken, 6,050 were uprooted, 33,300 were blown over, and 41,500 had to be re-erected apart from the railway telegraphs. Broken copper wire measured 17,000 miles in length and weighed 1,500 tons. Underground communication saved the situation, but was very costly; after the war it would be extended. Recently 7,000 new telephones were erected for the Army.

Referring to the Marconi contract, and statements made at the meeting of the company on Friday last, reported in our "City Notes" to-day, Mr. Pease said that a contract was sanctioned in August, 1913, but there was considerable delay prior to the outbreak of war in carrying it out. Disputes arose, and the P.M.G. gave notice to the company to cancel the contract, subject to reimbursement for expenses incurred. The company protested against the cancellation of the contract, and the P.M.G. then said that the Government was willing to proceed on the original terms, but the company declined to go on with the contract except upon compensation. Negotiations were re-opened in June, and the company and the Admiralty arrived at a provisional agreement requiring the sanction of Parliament by a given date. In the autumn, however, the First Lord dropped the negotiations, as the Admiralty's needs did not justify proceeding with the contract. The result was that a petition of right was sent to the Home Office in December. When he became Postmaster-General in January, and found this litigation threatening the Government, Mr. Pease consulted the Admiralty, War Office, Colonial Office, and India Office, and they came to the conclusion that four stations ought to be proceeded with. The Government had definitely offered the Marconi Co. the following terms:—That the 1913 contract should be varied, and that the erection of only four stations at the present time should be one of the variations; compensation for any actual loss which the company might prove they had sustained owing to the delay of the work so far as this might have been caused by any act or omission of the Postmaster-General, and owing to the variation of the 1913 contract; that compensation should be settled by impartial arbitrators with judicial experience, or failing agreement, by a Court of Law. In the event of these terms being accepted, they would be submitted to Parliament for ratification. There seemed, however, to be no prospect of agreement being arrived at with regard to the two points to which he had referred, and some kind of reference seemed to the Government to be the right course to adopt, with a view to securing an amicable and satisfactory settlement. The Post Office was now awaiting a reply to this offer.

Wireless Record.—An operator on the American mail steamer *Lebanon*, on a voyage from San Francisco to Sydney, claimed to have made a new record, receiving signals from the Tuckerton station over a distance of 9,000 miles with the aid of the Audion detector.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—July 7th. Corporation. One 5,000-kw. turbo-alternator with surface condenser and auxiliaries, for the Electricity Department. See "Official Notices" June 23rd.

Australia.—**PERTH.**—July 19th. P.M.G. Supply of insulators (Schedule 510). See "Official Notices" June 9th.

August 16th. P.M.G. Distilling apparatus (Schedule 502), telegraph and measuring instruments (Schedule 498). See "Official Notices" June 16th.

MELBOURNE.—July 26th. Victorian Railway Commissioners, 400 signal lighting transformers.*

August 8th. Deputy P.M.G. Standard battery material:—Porous pots, jars, zinc and carbon rods, and chemicals. Schedule 1,327. High Commissioner's Office, 72, Victoria Street, S.W.

SYDNEY.—August 17th. Portable internal-combustion engine and dynamo (2½-kw.) for the Departmental Stores, Sydney, for P.M.G.*

August 24th. P.M.G. Automatic switchboard and apparatus for North Sydney Exchange. Schedule No. 511.*

BRISBANE.—July 31st. P.M.G. Power board and accumulators, Schedule No. 381.

Barrowford.—July 8th. U.D.C. Automatic control electric screen cleaning gear for the sewage disposal works. Mr. F. Sutcliffe, Surveyor to the Council.

Manchester.—July 11th. Electricity Committee. (a) Electric or hydraulic coal-wagon lift and turntable; (b) saddle tank steam locomotive. Specification, &c., 21s. (returnable), from Mr. F. E. Hughes, Secretary, Electricity Dept., Town Hall.

Morecambe.—Corporation. 1,200 tons of rough slack. See "Official Notices" to-day.

New Zealand.—**INVERCARGILL.**—September 28th. Borough Council. Steam turbo-alternator, condensing plant, and switchgear. Specifications from the Tramway Office. Contract No. 49.*

Plymouth.—July 20th. Corporation. Rotary steam boiler feed pump for the Electricity Department. See "Official Notices" June 30th.

Rochdale.—July 12th. Electricity Committee. Paper-insulated cable for 12 months. Mr. C. C. Atchison, Engineer and Manager, Dane Street.

Warrington.—July 11th. Electricity Department. 7,000 tons of slack coal for six months, or alternatively 12,000 tons during 12 months. Mr. F. V. L. Mathias, Borough Electrical Engineer.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Birmingham.—Corporation Lighting Committee. Overhead electric runway, including a travelling electric pulley-block and bogey trolley, £421: Herbert Morris, Ltd.

Bridlington. T.C. 1,000 tons of Bulkhead Main washed small coal, for the electricity works: W. B. Wilson York, 19s. 9d. per ton.

Buxton.—U.D.C. Pilsley hard slack coal (2,500 tons) for the electricity works: Day & Ferguson.

Glasgow.—Tramways Committee. Iron and steel bars for three months: P. & W. MacLellan, Ltd.

Halifax.—Tramways and Electricity Committee. Steel bridge, &c., over the dam at the electricity works: Joseph Webb and Sons, Ltd., £369.

Ilford.—Electricity Committee. 500 tons of Graigola large Welsh coal, at 28s. 5d. per ton: E. Foster & Co.

Kingston-on-Thames.—Town Council. Fitting the new crankshaft to the Diesel engine recently damaged, at £400, inclusive of work in connection with the fly-wheel alternator: Belliss & Morcom.

London.—FULHAM.—The Electricity Committee recommends the acceptance of the tender of Messrs. Cory Bros. for 2,000 tons of Copicke slack coal, at 20s. 10d. per ton.

HAMMERSMITH.—The Electricity Committee recommends the acceptance of the offer of the Underfeed Stoker Co. for one Class E Underfeed stoker, at £446; and that the offer of Messrs. Cory Bros. and Co., Ltd., be accepted for the supply of 3,000 tons of Gedling High Hazel peas, at 25s. per ton; 2,000 tons ditto Top Hard peas, 23s. 6d. per ton; 2,340 tons Hucknall High Hazel $\frac{1}{2}$ -in. slack, 22s. 2d. per ton. These deliveries, with the coal in stock, will meet the requirements up to December next.

WOOLVICH.—B.C. Electricity Committee:—

Siemens Dynamo Works, Ltd.—Switchgear and recording meters, £134.
Babcock & Wilcox.—Additional boiler, superheater and economiser, £5,800.

Luton.—Electricity Committee:—

Clarke-Chapman & Co.—Two boilers and stokers complete, £7,648.
E. Green & Sons.—Economiser, £1,001.
W. T. Avery, Ltd.—Coal-weighing machines, £440.
Harris Anderson Patent Feed Water Filter Co.—One water softener, £455.
Hayward, Tyler & Co.—One rotary feed pump, £258.

Manchester.—Electricity Committee:—

One coal staker, supplied with 420-volt, a.c., three-phase motor.—Fraser and Chalmers, Ltd.
Three electric capstans.—Sir W. G. Armstrong, Whitworth & Co., Ltd.
Scrap cable and copper.—B. I. & Helsby Cables, Ltd.
Cables.—Pirelli-General Cable Works, Ltd.; Western Electric Co., Ltd.;
W. T. Glover & Co., Ltd.; Callender's Cable & Construction Co., Ltd.;
B. I. & Helsby Cables, Ltd.; Chas. Macintosh & Co., Ltd.
Tramways Committee. Steam coal. John Smith & Co.

Northampton.—Corporation Tramways Committee. Renewal of woodwork at cooling tower: G. W. Souster & Son, £389.

Salford.—Tramways Committee. Steel car-wheel tires and axles, at a schedule of prices amounting to £279: Hadfields, Ltd.
Electricity Committee. Work in connection with the installation of two water-tube boilers at the Frederick Road station:—

J. Gerrard & Sons, Ltd.—Foundations and structural work, £1,100.
New Conveyor Co., Ltd.—Coal conveyors, bunkers and chutes, £1,504.
J. Russell & Son, Ltd.—Mild-steel piping, £211.

Coal during 12 months:—

Clifton & Kersley Coal Co.—18,000 tons No. 2 washed slack, at 17s. 6d. per ton, £15,750.
Andrew Knowles & Sons, Ltd.—12,000 tons washed slack, at 17s. 6d. per ton, £10,500.
Earl of Ellesmere.—6,000 tons best washed slack, at 18s. 4d. per ton, £5,500; 4,000 tons ditto, at 16s. 8d. per ton, £3,335.

Tyldesley.—The Electricity Committee has accepted the following tenders:—

Lead pipe.—Glover & Co., Ltd.
W.I. tubes and fittings.—J. Spencer, Ltd.
Steel mains.—British Mannesmann Tube Co., Ltd.
Coal.—Unsworth & Cowburn; W. Reay & Co.; Abram Coal Co., Ltd.
C.I. pipes.—Sheepbridge Coal & Iron Co., Ltd.

Wolverhampton. Corporation, Willans & Robinson, Ltd. One 5,000-kw. Zoelly-type turbine, running at 3,000 r.p.m., with Siemens generator; also a surface-condensing plant (W & R) with Rees-Roturb pumps for use in conjunction with it.

FORTHCOMING EVENTS.

Chief Technical Assistants' Association. Saturday, July 8th. At 4 p.m. At the Tavistock Hotel, W.C. Discussion on "The Effect of the War on Electric Supply Undertakings," to be opened by Mr. P. MacAlister.

NOTES.

Correction.—In a number of copies of this issue, in the announcement of Messrs. Scholey & Co., Ltd., appearing on page 6 of our Advertisement Supplement in the letterpress relating to the Paragon earth, one an error occurs. Where the clause "constructed of permanent copper" appears, it should, of course, read "*permanently copper*."

Books for British Prisoners Abroad.—British prisoners of war desirous of carrying on serious reading can obtain, free of charge, educational books on almost any subject by writing to Mr. A. T. Davies, at the Board of Education, Whitehall, London, S.W. All applications for books should be sent through, or endorsed by, the senior (or other responsible) British officer or N.C.O. in the camp. Where for any reason (which should be stated in the application) this course is impracticable, requests from individual prisoners will, as far as possible, be acceded to.

Electric Vehicle Progress.—The June issue of the *Electric Vehicle* bears witness to the continued progress of the "Electric" in Great Britain, the number of such vehicles in use, or on order, having now reached 740, as compared with 150 two years ago. It is satisfactory to note that the Midland Railway Co. now heads the list of English industrial users with 73 vehicles, in addition to seven platform trucks, as against the 70 of Messrs. Harrods, Ltd., the former record holders. Quite a respectable number of municipal sanitary departments have invested in electric dust vans, and the list of electric supply authorities who are (and, of course, all ought to be) users of the "Electric" has grown considerably.

An instructive article deals with the success of the Sheffield dust vans, and it is worth noting that Mr. Priestley, the cleansing superintendent, recommends the expansion of this method of cleansing, with the ultimate view of centralising the work at one depot, and one destructor capable of dealing with the whole of the city's refuse.

Reference is made to the 12 months' experience of electric buses at York, where Mr. Hame estimates the working expenses, including tire maintenance, at 5½d. per bus-mile, including standing charges.

The results obtained from the Ilford 4-ton coal-tipping wagon, used in connection with the electricity works, are tabulated, the all-in-cost, averaged on 65 days' use, being 9½d. per ton carried. We note that two 5-ton electric wagons have also been ordered by the Bradford Electricity Committee to deal with 100+ tons of coal weekly; also that the Blackpool electric street watering wagon covers 48 miles of road in an average nine-hour day, using 18,000 gallons of water, and requiring only 70 units, also that it has displaced six horse-drawn watering carts, which facts we commend to the notice of London Borough Councils who are "economising" in street watering because of the shortage of labour.

Electricity as a Tree Pest Cure.—Isidore Kitsee, a Philadelphia inventor, has recently patented a process for the destruction of insect and germ life harmful to plants and trees, by applying a solution such as saline water where the ground is to be treated, and then causing a current of electricity to be passed through the soil, whereupon the gas generated will rid the soil of germs, larvae and insects without the least injury to the vegetation. When the plant itself is to be treated, it is sprayed with a solution after electrolysis.

Engineers' Wages.—The Government Committee on Production have awarded engineers employed in steel works throughout Scotland an increase of 1d. per hour, which raises the minimum rate to 10½d., or £2 6s. 9d. a week.—*Daily Telegraph*.

Enemy Holdings in British Companies.—In the House of Commons on Monday, Mr. Harcourt, replying to a question, said: "Shares and debentures held by enemies in British companies of the nominal value of £1,300,000 have at present been vested by the Board of Trade in the Public Trustee for the purpose of sale. He has completed the sale of shares of the nominal value of £102,000, and is negotiating for the sale of the remainder. These shares have been sold by private treaty and on the Stock Exchange in cases where there is a quotation. In several pending cases the shares are being put up for sale by public auction."—*Times*.

Alien Enemy Patents.—Application has been made to the Board of Trade by the Suffolk Electricity Supply Co., Ltd., for the avoidance or suspension of Patent No. 4908/09, granted to Aust, in connection with internal-combustion engines.

Inquiries. Makers of portable telephones for rescue work in mines, and of special drums and winding gear are asked for.

Educational Notes. **CITY AND GUILDS OF LONDON INSTITUTE.** The report of the Council for the year 1915 states that the duties of many members of the staff on active service threw on extra work of those left behind and on the heads of departments. The staff and some of the senior students undertook much new and original work in connection with the design and construction of munitions of war during both the vacations and term time. The delay in the completion of the *Geometric Construction* Extension of the City and Guilds (Engineering) College, caused by the prolonged building strike before the war, necessitated the postponement of the equipment of the new laboratories. The Delegacy of the City and Guilds (Engineering) College reports that during the session 1914-15, 382 students were in attendance, exclusive of 131 students who were on the register of the College as due to return, but had joined the Forces. During the session, 192 students went on active service, making a total of 233 on military service, exclusive of past students. Thirty more had entered munition work outside the College, and 31 members of the staff had joined the Forces. The Roll of Honour totalled 811 names (to November 10th), 541 being commissioned officers and 297 N.C.O.s and privates. Very important work was being done by P.F.O. Dalby and Mather in connection with war problems. Of 382 students, 202 were engaged in Civil and Mechanical Engineering, 71 in Electrical Engineering, and 56 in special courses, while 44 students of the Royal College of Science were attending the College for Applied Electricity. The average age of candidates for matriculation was 18.7 years.

Out of 39 second and third year students attending the City and Guilds Technical College, Finsbury, 40 joined the Forces. Important work in connection with the war had been carried on at the College. The number of day students attending the College in the winter of 1915 was 121, of whom 48 were in Electrical Engineering. The evening classes had been suspended.

In the Department of Technology the number of candidates for examination fell off considerably from 23,119 to 15,623 for the United Kingdom. The total number examined was 18,327.

The total income of the Institute in 1915 was £27,666, and the expenditure £26,308. The expenditure of the Delegacy on the C. and G. (Engineering) College was £24,081, and that of the Technical College, Finsbury, was £10,311.

COMMITTEE ON NEGLECT OF SCIENCE. A meeting of the governing body of the Imperial College of Science and Technology was held on Friday last, at which Lord Crewe, who presided, referred to two memorials which he had received from the professional staff with regard to the teaching of science. He stated that a Royal Commission on the subject would not be appointed, but the Prime Minister's Reconstruction Committee would undertake the work of supervising the changes that must be made in the national system of education, being able to take immediate action. A Special Committee, of which he would be the chairman, would be appointed to inquire into the alleged neglect of science in our educational system, in close concert with the President of the Board of Education, and to advise the authorities how to promote the advancement of pure science and the interests of industries dependent on the application of science. The further provision of scholarships and bursaries would be considered, and the need of amending the system of examination for the Civil Service would be dealt with. The investigation would be made as wide as possible without delaying prompt action.

The report of the Board of Education for 1914-15, issued last week, stated that the Board was fully alive to the importance of the problems which pressed for solution in all branches of education, and in particular to the necessity of encouraging and developing the higher branches of study concerned with science and research.

COUNCIL FOR ORGANISING BRITISH ENGINEERING INDUSTRY. The Committee on Engineering Education and Research, appointed by the Council, has presented its report, with which we will deal in an early issue.

MANCHESTER MUNICIPAL SCHOOL OF TECHNOLOGY. The Sub-Committee has established a Lectureship in Fuel. Two rooms are to be adapted for use as mechanical and electrical research laboratories.

Electricity Regulations.—A second edition of the Memorandum of the Electrical Inspector of Factories on the Home Office Electricity Regulations for factories and workshops has been issued, dealing with points which have arisen since the first edition was published. A note has also been added regarding low-pressure and medium-pressure switchboards, with special reference to distribution boards and motor-starting panels: it is pointed out that these are included under the term "switchboards," a fact which is sometimes overlooked, with serious consequences. Where the pressure is not more than 125 volts A.C. or 250 volts D.C., of course the installation is partially exempt, but otherwise all the regulations are applicable, and the note explains how they can be complied with, even in the former case the requirements of Regulations 1, 2, and 11 must be met.

More Sniping in Dublin.—A military sentry who was guarding the municipal electricity station in Fleet Street, Dublin, was, according to the *Times* correspondent, shot in the leg and badly wounded on Tuesday morning. It is supposed that the shot was fired by a sniper on one of the high houses which surround the works. The sniper escaped.

Volunteer Notes.—1ST LONDON ENGINEER VOLUNTEERS.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Saturday, July 8th.—Instructional Class, 2.30, Company Commander Fleming.

Sunday, July 10th.—Technical for Platoon No. 9, 16, Regency Street, S.W. Squad and Platoon Drill, Platoon No. 10. Signalling Class and Recruits.

Tuesday, July 11th.—Officer Instructional Class, 6-7. Recruits, 7-8. Lecture, 7.15, "The System of Command," Company Commander W. Hyman.

Wednesday, July 12th.—Platoon Drill, No. 3 Platoon.

Thursday, July 13th.—Platoon Drill, No. 7 Platoon. Recruits, 5.15-7.45. Instructional Class, 5.45.

Friday, July 14th.—Technical for No. 10 Platoon, 16 Regency Street, S.W. Squad and Platoon Drill, No. 9 Platoon.

Saturday, July 15th.—Parade, Golder's Green Station, 3 sharp. Uniform.

Sunday, July 16th.—Entrenching duties. Parade, Victoria (S.E. and C. Railway Booking Office), 8.35 a.m. Uniform, haversacks, and water bottles. Midday rations to be carried. Railway vouchers will be provided.

MACLEOD YEARSELEY, *Adjutant*.

3RD BATT. (OLD BOYS) CENTRAL LONDON VOLUNTEER REGIMENT.—Battalion Orders by Capt. R. J. C. Eastwood (Commandant). Thursday, July 6th, 1916.—

Week-End Parades.—*Saturday*.—The Battalion will Parade at Wembley Park, at 3 p.m., for Drill under the Commandant. The Commandant desires members who did not pass the Examination last Saturday to attend for re-examination.

Sunday.—The Battalion will Parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 9.30, and proceed by train for Entrenching duties.

Recruits will Parade at Wembley Park on Saturday at 3 p.m., and Sunday at 11 a.m., for Recruit Drill.

G. H. F. DUNCAN, *Acting Adjutant, O.B.C.*

Electrical Worker's Claim.—At the Southampton Munitions Court, an electrical engineer, whose home is at Bournemouth, made a claim for compensation against his employers on the grounds that he was discharged at one hour's notice really to save a dispute with a trade union on account of his not being a member of the union. He also alleged that the day foreman refused to send him to work on the night shift, although the night foreman particularly wished for his services, as he liked the speed and finish of his work. The application was dismissed.

Industries of the Empire Fair.—The Board of Trade announces that the representatives in London of the self-governing Dominions and their respective Governments are not participating in this exhibition, concerning which a circular, recently issued, stated that the principal Colonial Governments would be exhibiting thereat.

Appointments Vacant.—Chief assistant electrical engineer (£550) to the Government of Tasmania Hydro-Electric Department; engineer and manager (£300) for the Borough of Loughborough electricity undertaking. For further particulars, see our advertisement pages to-day.

Australian Patents.—A Bill to suspend partially the Patents Act during the war, passed through the Australian House of Representatives on May 23rd.

Vacuum Cleaners.—IMPORTS PROHIBITED.—A notice has been issued prohibiting the importation of vacuum cleaners as from July 6th, except under special licence from the Board of Trade.

Standard Electrical Fittings for U.S. Motor Cars.—One of the features of the summer meeting of members of the American Society of Automobile Engineers, which has just taken place, was the presentation and adoption of a lengthy report by the Electrical Equipment Division of the Standards Committee. Included in the report was a complete list of sizes and dimensions for flexible steel conduit for encasing ignition and lighting wires; 15 sizes are provided for, ranging from $\frac{1}{8}$ th to 1 in. inside diameter. It was reported that the Sub-Committee, which had been at work on the question of lamp standardisation generally, had conducted a number of tests of lamps and bulbs at the National Lamp Works, and had discovered certain important facts with respect to the shape of filaments and reflectors. Among the recommendations of the Lamp Sub-Committee which were adopted were:—That sockets for bulb should be so set in lamps that the pins on the bulb base are vertical; that lamps should be mounted not less than 3 ft. high, measured from the ground to the centre of the lamp, and that dimming devices are not to be recommended for the purpose of eliminating glare. A standard form of bracket for motor headlights was adopted, three sizes being provided for as meeting all requirements.

Electrical Smelting.—A company has been formed in Stavanger, with a capital of 1,000,000 kroner, for the purpose of utilising the Flord waterfall, near Lysefjorden, for electrical smelting. The necessary advances are said to have been secured from Norwegian banks, and the company will proceed with the building of factories. The waterfall, which is calculated to produce 12,000 horse-power, is said to be one of the cheapest propositions in Norway as regards constructional expenditure.—*Financier and Bullionist*.

Institution Notes.—Institution of Electrical Engineers.—The Council of the Institution, on June 8th last, appointed a Committee to consider the suggestions made in Mr. E. T. Williams's recent paper, and in the discussion on "The Present Position of Electricity Supply in the United Kingdom." After consultation with the Incorporated Municipal Electrical Association and other similar bodies connected with electricity supply, the Committee will embody its recommendations in a report to the Council. The chairman of the Committee is Mr. R. A. Chattock, and the other members are Mr. C. P. Sparks (President, I.E.E.), Mr. C. H. Merz, Mr. G. W. Partridge, Mr. S. L. Pearce, Mr. T. Roles, and Mr. W. B. Woodhouse.

A deputation of seven representatives of gas and electricity undertakings, including Mr. R. A. Chattock and Mr. C. P. Sparks, waited on the Board of Trade on June 29th, 1916, and laid before one of the officials the various difficulties which were being encountered by these industries at the moment, more especially in connection with the making of new contracts for coal for the next twelve months, both as regards quantities and prices. The deputation was received by Mr. Marwood and Mr. Carhill, who, after the various members of the deputation had stated their case, informed them that the Board of Trade were prepared, if approached by gas, electricity, or water undertakings, to use their influence through the medium of the District Coal Committees which had been established in the various colliery areas to procure the necessary quantities of coal required by them. With regard to prices, it was further stated that if any undertaking which had cause to complain of the prices proposed to be charged for new contracts would bring such cases before the Board of Trade, the Board would be prepared to take steps, if thought necessary, so that the prices charged should be justified by the provisions of the Price of Coal (Limitation) Act.

In pursuance of the resolution dealing with the membership of alien enemies, the Council is taking steps to ascertain the nationality of all members, and in the case of unnaturalised British subjects, their status as regards the country of which they were formerly subjects. A list of those who will cease to be members under the new clause will be published as soon as possible.

As we go to press we have received the *Journal* for June, which contains the third Roll of Honour, the third list of military honours awarded to members, and the eighth list of members on military service, as well as the following list of recommendations which are to be submitted by the President to the Board of Trade Committee on the Electrical Trades, on behalf of the Council:—

1. Some combination of British electrical firms, especially with regard to overseas trade, is desirable.
2. A Government Tribunal of the most independent character that can be devised to be appointed to control the electricity supply industry of the country, and also to prevent indiscriminate addition or extension of power stations or systems undesirable from the point of view of size, locality, or system.
3. In view of the necessity of securing the home market and that none other than British electrical apparatus be purchased in the United Kingdom, a protective tariff to be set up, notwithstanding such benefits as will in any case result from patriotism.
4. A permanent Advisory Committee to be appointed to ensure that, as far as possible, raw materials and parts as well as whole apparatus necessary to the trade of the British Empire shall be produced within the Empire.
5. (i) British-born electrical attachés to help in the Consular service, and (ii) trade commissioners (scientific and technical) commissioners are suggested by Mr. Pollard Digby, *I.E.E. Journal*, vol. 53, p. 799, 1915), to be appointed.
6. British engineering standards to be adopted throughout the Empire.
7. The use of the metric system to be made compulsory after a reasonable period; and during this period all trade catalogues to make use of both the British and metric systems.
8. The Institution to be granted a Charter so as to improve the status and training of electrical engineers.
9. A Central Engineering Board, consisting of representatives nominated by all the important Institutions, to be established whom all engineers (other than mechanics) would be required to satisfy as to the sufficiency of their technical training and general education before they could be recognised as proficient, so as to ensure that every engineer shall qualify for his profession in the same manner as a doctor or solicitor.
10. Closer co-operation of manufacturers and other employers of electrical engineers with the technical colleges is desirable to ensure that students are trained to meet the future needs of the industry.

The foregoing recommendations indicate that the views of the Council as to the limitations of the functions of the Institution have been profoundly modified; while at this hour it is impossible to comment on the proposals at length, we hasten to congratulate the Council upon its declaration of policy, and upon the new spirit by which it appears to be animated.

Association of Mining Electrical Engineers.—A meeting of the Council of the Association was held in Manchester on June 24th, at which the principal business was the consideration of a report by the Central Committee, which consists of Mr. A. B. Muirhead, representing Scotland; Mr. Wm. Maurice,

representing England; and Mr. Theo. Stretton, representing Wales. With some modifications the recommendations of the Central Committee were adopted, and the above gentlemen were then appointed as the Management Committee of the Association. They will report to the General Council meeting in October next regarding certain proposals to alter the Articles of Association, the classes of membership, and the subscription. The *Proceedings* for next session will be issued in twelve monthly parts as supplements to the official journal—*The Iron and Coal Trades Review*. The next annual general meeting will be held at Manchester on October 7th. A number of members were elected to serve on the Mining Committee of the Advisory Council for Scientific and Industrial Research.

American Institute of Electrical Engineers.—In the *Proceedings* for June, an interesting account is given of a National Meeting of the Institute, held after the Annual Meeting at New York on May 16th. This National Meeting was held simultaneously by means of long-distance telephony in Boston, New York, Philadelphia, Atlanta, Chicago, and San Francisco; every person in attendance at each of these cities was provided with a separate telephone receiver, and each of the gatherings took an active part in the conduct of the meeting. All the speakers, from Boston to San Francisco, were distinctly heard by everyone in attendance. Mr. J. J. Carty, the President, presided in New York over the entire meeting, which comprised over 5,000 members. Mr. C. le Maistre, the special delegate of the British Engineering Standards Committee to the A.I.E.E. Standards Committee, was present, and greeted the members on behalf of the International Electrotechnical Commission and the Engineering Standards Committee. Resolutions were moved and seconded, amended, and voted upon at this unique "meeting."

National Electric Light Association.—At the recent convention in Chicago, within the short space of three-and-a-half days, there were presented at more than 20 sessions some 2,500 printed pages of material in the form of reports, papers, and addresses. This was far in excess of any previous convention. One reason for this exceedingly large amount of material was the inclusion in the Association of the Electric Vehicle Association. In spite of the fact that there was such a great mass of material, many authors insisted on reading their entire report or paper, although each report was accompanied by a sufficiently comprehensive abstract. It is estimated that the discussion amounted to 500 pages of printed matter. The attendance was remarkably good, especially at the technical sessions.—*Electrical World*.

Chief Technical Assistants' Association.—This Association will meet to-morrow, Saturday, at 3 p.m., at the Tavistock Hotel. The chief discussion will be on the effect of the war on electricity supply undertakings. It will be opened by Mr. A. P. MacAlister, the hon. secretary.

The Mannesmann Tube Works Purchased.—It is reported that the works of the British Mannesmann Tube Co., at Swansea, are being purchased by Baldwins, Ltd., iron and steel makers, of South Wales and the Midlands, who, it is stated, have already taken over a slag brick-making establishment which was in German hands at the outbreak of war.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station Officials.—MR. CHARLES A. NETHERCOT, accountant to the Bath Corporation electricity department, was successful at the recent examination (Intermediate) of the Society of Incorporated Accountants and Auditors.

The Dundalk U.C. received three applications for the post of assistant electrical engineer in room of Mr. J. E. M'Entee. Mr. B. MAYNAGH, Dundalk, was appointed.

General.—MR. WILLIAM GUY, who has been editing the *Practical Engineer* since the middle of March, terminated his engagement at the end of last month.

Battery Scout CYRIL F. BARROW, formerly assistant engineer at the Bolton Corporation electricity works, has been gazetted a second-lieutenant in the Royal Engineers (Signal Section).

MR. ERIC STEADMAN, until recently in the electrical department of Messrs. Harland & Wolff, Ltd., Belfast, has received a commission in the Royal Flying Corps.

London Gazette notices.—Territorial Force. Royal Engineers:—

City of Edinburgh (Fortress) Engineers. *Electric Lights Company.*—Sapper JAMES VITCH, from a Field Company, Canadian Engineers, to be Second-Lieutenant (on probation). *London Electrical Engineers.*—Second-Lieutenant (temporary Lieutenant) H. F. G. ROOSE is restored to the establishment.

In the list of Naturalisation Certificates granted during June we find the following entry:—
AXEL ORLING, electrical engineer (Sweden), residing at Streatham.

Brilliant Arc Lamp & Engineering Co., Ltd.—A memorandum of satisfaction to the extent of £1,800 on May 13th, 1916, of debentures dated June 18th, 1915, securing £3,000, has been filed.

Duram, Ltd.—Particulars of £20,000 debentures, created March 23rd, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £6,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Perfection Light Co., Ltd.—Particulars of £396 debentures, created March 25th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Karabon Co., Ltd.—First mortgage debenture dated June 5th, 1916, to secure £150, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: D. Burke, Caxton House, Westminster.

Strode & Co., Ltd.—Particulars of £17 5s. debentures, created by resolutions of January 20th, 1913, and February 23rd, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £2,500. Property charged: The company's undertaking and property, present and future, including uncalled capital subject to a prior agreement. No trustees. Also issue on May 26th, 1916, of £2,500 debentures, part of a series of which particulars have already been filed.

Iffracombe Electric Light & Power Co., Ltd. (71,378).—Capital, £15,000 in 35 shares. Return dated March 27th, 1916. 67 shares taken up; £335 paid. Mortgages and charges: Nil.

Keswick Electric Light Co., Ltd. (28,820).—Capital, £20,000 in 41 shares (15,000 paid). Return dated April 10th, 1916. 3,420 ord. shares taken up; £3,420 paid. Mortgages and charges: £10,100.

Brompton & Kensington Electricity Supply Co., Ltd. (25,913).—Capital, £30,000 in 20,000 pref. and 40,000 ord. shares of £5 each. Return dated April 17th, 1916. 6,007 pref. and 32,993 ord. shares taken up; £5 per share called up on 6,007 pref. and 32,993 ord.; £195,000 paid; £5,000 considered as paid on 1,000 ord. Mortgages and charges: Nil.

City of Carlisle Electric Tramways Co., Ltd. (62,601).—Capital, £60,000 in 21 shares. Return dated April 14th, 1916. All shares taken up; £60,000 paid. Mortgages and charges: £38,850.

D. & M. Syndicate (Hollister's Patents), Ltd. (133,893).—Capital, £2,500 in 11 shares. Return dated June 13th, 1916. 2,300 shares taken up; £2,300 paid. Mortgages and charges: Nil.

CITY NOTES.

Edison Accumulators, Ltd.

LORD MONTAGU OF BEAULIEU presided, on June 22nd, at the annual meeting. He said that the profit for the year had been £7,398, from which must be deducted the loss on the first year's working of £1,669, leaving the profit for the two years at £5,729. This was satisfactory considering that they had been working during a period of great war stress. Their prospects were good, and they had the basis of a sound business. There was a large amount of abnormal business in consequence of the war, such as orders received in connection with munition supplies and industrial trucks for Government contract work, but normal business had been held back. As people came to realise the advantages of the electric vehicles in towns, and in districts like Lancashire and Yorkshire, where numbers of towns were situated close together and where power was cheap, they might look forward to prosperity. There had been great difficulties in getting parts of batteries and equipment through the Custom House, and Mr. Monnot, the managing director, had worked very hard to overcome these difficulties. They were now experiencing less difficulty in getting delivery of their batteries and trucks. The expansion of the business, which was three times that of the previous year, had necessitated the employment of further capital, which had been found in various ways. It was because of the immediate necessity of further working capital to meet developments that no dividends were to be distributed this year. Messrs. Harrods already had a fleet of the company's delivery vans, and were going to use more. After referring to the advantages of "electrics" in municipal service, and to the present prices of petrol, which ought to give a stimulus to electric vehicles of all kinds, Lord Montagu mentioned that in the case of commercial vehicles the "electric" needed fewer repairs than vehicles with reciprocating engines did.—Col. Sir H. C. L. HOLDEN seconded the adoption of the report, and it was carried.

Marconi's Wireless Telegraph Co., Ltd.

MR. GODFREY ISAACS, presiding at the annual meeting on June 30th, first went over the figures in the balance sheet, and then referred to the profit and loss account. The balance of the contracts, sales, and trading account had increased by £210,000. The improvement of £145,000 as compared with the previous year was highly satisfactory, particularly bearing in mind that there were substantial items not yet settled by the Government and that they had written off £53,000 in respect of depreciation of exchanges and investments. No actual loss had been incurred in exchange, as it had not been necessary to bring home from abroad the moneys which were lying at banks upon interest, nor had it been necessary to sell the investments. There was every reason to believe that before it was necessary for them to bring their money home, the

exchanges would have become normal, and that they might be able to realise their securities at a substantial profit. The company's business had certainly not been normal. There was considerable work in certain parts of the world which they should have been doing but for the war, but they had received many additional orders at home and from Allied countries. The company's relations with the Admiralty had been most agreeable; that department fully appreciated how much it was indebted to the company for the admirable service rendered by it and its employees. Their associated companies had not been able to make the progress that they would have done but for the war. This applied particularly to the Spanish and Argentine companies, to the Relay Automatic Telephone Co., and to the American company. The new direct trans-Atlantic service with New York, which was ready to open when war broke out, and to which they had attached the very first importance, had continued in enforced idleness, the stations on this side having remained in the service of the Government. For this they hoped to receive due compensation. As soon as the war came to an end this new trans-Atlantic service should be productive of very considerable revenue to their American company—as well as to their own—which, added to the profits which they were now making, should place them in a position to pay substantial dividends. Independently, however, of this, they had in view in conjunction with the American company a new and very considerable programme, which it would be inexpedient for him to divulge at that moment. In regard to the carry-forward, they were satisfied that in harbouring their resources they were unquestionably acting in the best interests of the company. Had they known their position with regard to the several matters in respect of which they had to receive payments from the Government they could have made a more generous distribution, but until they knew a little more of their position in that direction it was better to act conservatively. The chairman went on to discuss the four heads under which considerable sums were stated to be payable by the Government to the company. To the end of 1915 they handled foreign messages in transmission, reception, and delivery which represented in the aggregate over 20,000,000 words. With regard to compensation, they had just completed the construction of their Carnarvon and Townyn stations, and in America, the American Co. had just erected its New Brunswick and Belmar stations, all of which represented a very considerable outlay, for the purpose of opening a direct telegraph service between Europe and America. Traffic during the period of the war had shown a very considerable increase, and there was no doubt whatsoever that the business they would have done would have been on a very large scale indeed, and the profit realised each year since the outbreak of war would have run well into five figures. They were of opinion that they should receive a substantial sum to compensate them for this loss, and they had every hope that the Government would appreciate the value which their stations and services had been to the nation and remunerate and compensate them fairly, if not generously. He had every hope that this matter would be settled in the very early future. On Monday morning last he had the assurance of the Postmaster-General that these questions were receiving his earnest consideration, and every endeavour would be made to deal with them at once. After discussing the company's claims against the Admiralty and the War Office, the speaker went on to refer to the payment to be made by the Post Office by way of compensation for their withdrawal from the Imperial Chain contract. Unfortunately, they had not yet been able to arrive at terms which they considered they would have been justified in accepting. After several inquiries without result, and many months of patient waiting, they realised that there was no alternative but to proceed with their claim for compensation, and they took the necessary steps to that end. Whether they were able hereafter to arrive at an agreement or not, there was every reason to hope that the whole matter would be dealt with and disposed of by the end of the year. But they were not in any sense depending on a settlement of this matter to carry out their promise of a substantial bonus. They looked to any one of the other three heads of their claims for that purpose. They were of opinion that they were entitled to a very large sum under each of these heads, and whichever one of them was settled first should enable them to carry out their promise. Both classes of shares would receive whatever bonus it might be decided to pay. The chairman proceeded to pay a tribute to the staff and to refer to the new invention which had matured as the result of Mr. Marconi's research work in Italy.—Capt. H. RIALI SANKEY seconded the adoption of the report.

Bastian Electric Heating Syndicate, Ltd.

The report for the year ended March last, submitted at the annual meeting, held on June 26th, showed that the net profit, including £925 brought forward, and after writing off £308 for sundry depreciations and allowances, amounts to £1,258. A dividend of 5 per cent. for the year, less income-tax at 3s. in the £, absorbs £650 and £608 is to be carried forward, subject to excess profits duty. The report is considered satisfactory under the circumstances. With a view to extending the scope of the business after the war, the directors consider that a more general name would be advisable, and the name of the company is accordingly to be changed to the Bastian Electric Co., Ltd.

**British Elec-
tric Traction
Co., Ltd.**

The annual meeting was held on Friday last week at the Holborn Restaurant. Mr. E. GARRETT, who presided, said that in time of war the first duty of every institution, as well as every individual, was to make all possible sacrifice to defeat the enemy. At the same time, it was important that the undertakings which as taxpayers and otherwise contributed to the financial resources of the country should be preserved and continued. It was in this spirit that the directors of their associated companies had conducted their undertakings. The first thing they did on the outbreak of war was to encourage the employees of the companies to join the Forces, and they responded magnificently. The enlistment of so many of their men had caused a good deal of disturbance in their organisation, and in other respects changes had been brought about in consequence of the war which had in many ways altered the character of the business. Not only had they had fewer men to do the work, but they had had to pay higher wages. The higher wages earned by the labouring classes, however, were in a very direct way an advantage to tramway companies, for the tramways did better when the masses were earning good money than in times of commercial depression. But other effects of the war had been prejudicial to the business. There was great scarcity of material, and the material they were able to obtain cost them more. Altogether, their working expenses had increased considerably, and it had to be remembered that they were not able to charge correspondingly more for their services. Their tramway fares and the rates they charged for the supply of electricity were fixed by Acts of Parliament, and in most cases could not be increased. If, therefore, they showed larger profits it was because they had done very much more work, for they had earned less per passenger and per unit. An Act had been passed taxing heavily all profits made during the war in excess of those of a pre-war period. There was no injustice in that, speaking generally, but tramway and electricity supply companies occupied a most exceptional position. These businesses, if they were profitable, were taken over by local authorities on the expiration of specified periods, and the price paid was generally less than the capital expended. Therefore these companies were bound to make large reserves out of profits, and it was only after the undertakings had been developed for several years that they were able to do this. A tax on profits in these cases was thus also a tax on capital. They suggested to the Chancellor of the Exchequer that the Act of Parliament should give special protection to such companies, but the only concession they had been able to obtain was that these cases should receive special consideration by the referees. They must therefore hope for the best—that no injustice would be done. Proceeding to refer to the accounts, the chairman said that the revenue from investments and sundry profits amounted to £241,000, or £8,500 more than in the preceding year, and the general expenses were £27,749, or £1,500 more. The average yield obtained on all their investments for the past year represented 5.19 per cent., which was a little higher than the figure for the preceding year after making adjustments necessitated by the reduction of capital. They had a balance profit of £209,000 to deal with, or about £11,000 more than in the preceding year. After paying debenture interest of £91,259 and the dividend of 6 per cent. for the year upon the cumulative participating preference stock, requiring £42,764, they had a balance of £75,146, besides the amount of £71,398 brought forward from the preceding year. The question of what amount should be placed to reserve had received careful consideration. Now that the capital had been reduced and past depreciation had been written off, there was not the same need as before to make large additions to reserve, but it was prudent to put aside some portion of the year's profit as a provision against further depreciation, and they thought the right course was to consider the position carefully each year. Last year nothing was placed to reserve because they did not wish to alter the figures of the reserve while the scheme of reduction of capital was in progress. They thought that an addition of £20,327 to reserve, raising it to £410,000, was the right thing to do this year without, however, making any rule in regard to the amount to be placed to reserve in future years. With regard to the dividend on the new ordinary stock, when the scheme of re-arrangement of capital was formulated, he intimated that in the first year after the scheme had been carried through they would be in a position to pay on the new ordinary stock a dividend of 4 per cent., and that they might expect the dividend to gradually improve. The accounts showed that their estimates were well founded, and that they could easily pay this year a dividend on the ordinary stock of more than the 3 per cent. they suggested, but the estimate was made before the outbreak of war, and the circumstances had since completely altered. He still believed that they would not be disappointed in future, and that their estimates of progress would be realised, but it must be remembered that the Government had placed restrictions upon issues of new capital, and some of their companies would not for some time be able to raise the additional capital they might require for the development of their business; it was probable that several of them would have to keep their profits in the business instead of paying increased dividends; that, moreover, some of the companies would apply to that company for financial assistance, and as they

were in the nature of departments of their business, it behooved them to support them. It was important, therefore, that they should keep in a liquid form some part of their profits, especially as the present was not a favourable moment for the realisation of their investments. For those reasons they did not recommend the payment of a larger dividend on this occasion, and they were sure that the stockholders would approve a cautious policy in regard to the payment of dividends, especially during the war period. Having dealt with the chief items in the balance sheet and referred to the important interests which the company had in the London and Suburban Traction Co., Mr. Garcke said that the loss to their organisation of the Bombay Electric Supply & Tramways Co. was to them a matter of much regret on sentimental as well as on business grounds. They initiated this important enterprise some 12 years ago. They took substantial risks and made moderate profits in connection with it and it was an enterprise they had every reason to be proud of, but the burden of the double income-tax proved very heavy for the large number of small Indian shareholders. There were about 4,000 shareholders of the company in India, holding less than six shares each, and it could be well understood that the burden of the heavy English income-tax in addition to the Indian income-tax, induced the shareholders to move the direction and management of the company to India. It was a policy which the directors of the company could not regard otherwise than with sympathy, for all their efforts to obtain relief from this taxation had proved unavailing. In conclusion, he would repeat shortly what he said at the last annual meeting in regard to the industrial importance and value of their undertakings. Statutory public service undertakings had this advantage over other industrial concerns, that while in normal times the profits might not be so high, their capital values were not likely to suffer during great national crises to the same extent as was the case with some other industrial enterprises. They did not think that the war would materially affect their capital values. When this terrible war was concluded by the defeat of those who had wantonly disturbed the peace of the world, the need for recuperative enterprise would manifest itself, and that company would occupy a position of strength under the altered conditions to enter upon new undertakings at home and abroad. With regard to their manufacturing departments, it was a hopeful augury that the commercial community within the British Empire was now thoroughly aroused to the necessity of being prepared not only to resist a renewal of that apparently peaceful invasion to which their industrial interests were exposed before the war, but also to establish a closer union between the parts of the Empire and with their Allies for their mutual advancement instead of, as formerly, to further the aggrandisement of their enemies.

Mr. C. S. HILTON seconded the motion.

In reply to the shareholders, the CHAIRMAN said that the directors never lost sight of the point whether anything could be done to improve the net profits, but the mere raising of fares was not always profitable. Sometimes when they had increased the fares they had found that the result was prejudicial in its net effect. There was no doubt as to the fundamental truth of the statement that the services which the company was rendering to the public were inadequately remunerated, and among the many things which Parliament would have to deal with when the time arrived would be the very important one of whether public service enterprises which had done such excellent work for the poorer sections of the community should not receive more liberal and more sympathetic treatment at their hands than had been the case in the past. The Board of Trade, in view of the altered circumstances which would obtain after the war, had already appointed an Electrical Committee for the consideration of those various matters, and their managers were now preparing evidence to submit to the Committee with, he hoped, good effect.—The report was adopted.

**British Thom-
son-Houston
Co., Ltd.**

The report for 1915 shows that the buildings and machinery at Rugby, Coventry, and Willesden had been maintained in first-class condition. The usual inventory of the Rugby main factory, which was impossible in 1914, was taken in 1915, and the figures show a considerable increase over the book figures and fully justify the forecast made in the last report. The profit, after deducting all expenses and charges other than interest on debentures and loans, is £262,361, plus £13,798 brought forward. Interest paid on debentures and loans amounted to £57,922, £144,878 is to be transferred to reserves and depreciations, and £73,359 is to be carried forward. [For the year 1914 the profit was £130,868.] The transfer to reserves and depreciation was £73,309.] The carry-forward includes a reserve to cover the sum payable to the Government for excess profits, which cannot be accurately determined at present. Under the terms of the trust deed securing the issue of the company's debentures, the company has this year to pay to the trustees £4,452, to be applied by them in redeeming debentures at 105 per cent. by drawings. Since the closing of the books debentures of the par value of £4,240 have been redeemed, making the total par value of debentures retired to date £34,265, and leaving a net amount outstanding at June 28th, 1916, of £177,735, as against £181,975 at December, 1915. The directors have followed their usual practice in making reserves to cover risks

in connection with bad debts and other contingencies. Annual meeting: London, July 14th.

J. G. White & Co., Ltd. Mr. W. C. BURTON presided, on June 29th, at the annual meeting. He said that business and the future outlook were so affected by the war that their operating conditions were far from normal, engineering constructional works in all parts of the world being stopped. The raising of new capital for such enterprises was not only impossible from the intrinsic conditions, but had been officially prohibited; therefore any new work that they could secure was necessarily very limited. They were fortunate in having been able to meet all their expenses and to show a net profit sufficient to cover 6 per cent. on the capital, with a comfortable margin. Their expenses were reduced drastically at the beginning of the war, and they still remained much below the pre-war standard. The work of looking after the operation of various foreign utility companies which they supervised from that office had been increased by the war, and the difficulty of securing the necessary supplies for these companies was now great. The company had for some time had more of its resources invested, and consequently under present conditions tied up, than was desirable. They had, however, been able to maintain a comfortable position as to cash in hand. With their large reserve it might appear that they could pay a larger dividend, but their resources were not, in the present situation, sufficiently liquid, and therefore this would not be desirable. With a business such as they were interested in, future development depended upon there being a supply of capital available for new constructional enterprises, and this could only be expected after the restoration of normal peace conditions. In the meantime they must husband their resources, keep together, so far as possible, the essential elements of the staff, and be in a position to take prompt advantage of the first opportunities. They were also endeavouring to develop new channels in which their experience could be utilised, more particularly by increasing and broadening the scope of their commission purchasing department, and in connection with J. G. White & Co. (Inc.), of New York, securing business with those American interests who were now for the first time giving serious attention to foreign business in South America and elsewhere.

Consolidated Electrical Co., Ltd.

Mr. H. ALLEN presided at the annual meeting on June 27th. He first referred to the death of Mr. Taunton, who had been secretary of this company and of the original company that preceded it. The company was to be congratulated on its earning capacity during the year, and on the condition of its finances. The total income was in excess of that of the previous year. The balance at credit of profit and loss account might have justified a 3 per cent. dividend on the ordinary shares, as before, but that would have necessitated the distribution of rather more than the net earnings for the actual period. It was wiser to submit to a slightly reduced dividend, conserving the resources. They had made no attempt at a valuation of their investments, which figured in the balance sheet at cost. The only two that gave them real cause for anxiety were the shares and bonds of the Constantinople Telephone Co. The fate of the English proprietors of that undertaking must depend largely upon the fate of Turkey at the end of the war. Political influences apart, the Constantinople Co. was a most promising undertaking. Then what was almost their best investment—one made shortly before the war—had turned out to be the worst in the matter of depreciation, though it now showed some slight signs of recovery. Taking the middle price for all their securities, and assuming the Constantinople money as lost entirely, the total depreciation represented barely 10 per cent.

Bombay Electric Supply & Tramways Co., Ltd.

According to the *Financial Times*, the report for 1915 shows that the total revenue from all sources amounted to £310,770, an increase of £8,200. The expenditure amounted to £142,091, a decrease of £2,895. The net profit aggregated £168,679, an increase of £11,095. After providing for interest on debentures, placing to sinking fund account £6,732, to depreciation fund account £28,000, providing for the annual payments for redemption of second debentures of equivalent par value £8,000, and making a contribution to officers' and employees' provident fund of £2,507, there remains an available balance of £87,670, plus £8,326 brought forward. The directors recommend a dividend on the ordinary shares at the rate of 7 per cent. per annum, free from all income-tax, £50,400, leaving to be carried forward £9,602. The gross receipts from tramways amounted to £172,051, as against £169,884 for the previous year, while the working expenses were £79,664, against £85,297. The balance of receipts over expenses was £92,386, compared with £84,587. The gross revenue from electric supply for the year, including the amount represented by sale of current to the tramways, aggregates £188,020, compared with £182,669. The working expenses were £58,132, against £55,734, and the resulting balance, £79,888, compares with £76,935 for 1914.

German Electrical Companies.

The A.G. für Elektrische Unternehmen, of Munich, reports a net surplus of £2,290 for 1915, as compared with £1,870 in the preceding year. It is proposed to pay 5 per cent. on the preference shares, being 4 per cent. for 1914 and 1 per cent. for last year.

The financial statement of the *Treuhand Bank für die Elektrische Industrie, of Berlin*, which is associated with the A.E.G., shows that £500,000 out of the total capital of £1,250,000 was paid up at the end of 1915 and invested in securities. The gross profits earned last year reached £4,300, as against £38,000, the final result being a loss of £600, as compared with net profits of £21,000 and a dividend of 4 per cent. in 1914.

Companies to be Struck Off the Register.—The following are to be struck off and dissolved unless cause to the contrary is shown within three months:

Acoustic Patents.
Anglo-Swiss Asbestos Co.
Animatophone Syndicate.
British Motobloc Syndicate.
British Tungsten Lamp Co.
Bullough's Adjustable Rail Joint Support Co.
Carlton Engineering Co.
Compagnie Generale Electrique de la Compagne.
Cone-Jackson Engineering Co.
Didelon Regulators.
Electrical Advertising Co.
Electric Safety Boiler Cleaner.
Ernest Scott & Mountain.
Glamorgan Tram & Constructional Works.
J. Deries & Sons.
Kewan Electric Co.
Machine Drying & Peat Fuel Co.
Mica Manufacturing Co.
National Lighting Corporation.
Platinum Corporation.
Southgate Engineering Co.

Telegraph Construction & Maintenance Co., Ltd.—An interim dividend of 12s. per share (5 per cent.) is announced.

STOCKS AND SHARES.

TUESDAY EVENING.

THE second half of the year has opened auspiciously in Stock Exchange markets. Savings and profits provide plenty of capital for investment, Consols have been strong, touching a price at which the return is less than 4½ per cent. on the money, as against the 5 per cent. offered by Exchequer bonds. Plain evidence, this, of how the investor regards the outlook for money after the war. Plain hint, also, to the holder of good stock that he had better keep it. Removal of minimum prices has had the anomalous effort of fortifying other gilt-edged securities. The despair of the conscientious broker at the result of his efforts to find unimpeachable investments of long date to pay 5 per cent. on the money would be comical were it not so sincere.

All investment stocks and shares are hard as nails, to use the expressive colloquialism of Throgmorton Street. People ask what is the use of selling anything if they don't know where to get better value for their money. The City is openly optimistic in regard to the war, but only the unconstructed would lay much stress upon the rise in Consols as an index of approaching peace. Forced sales of American securities is the main factor in the Consols advance.

Even Mexico is undergoing one of its periodical spasms of settling-down. "President" Carranza is said to have given way to the United States on all essential points. Oddly enough, this news had a very bracing effect upon American Rails and Canadian Pacifics, and hardly any at all upon the shares of the railroad and utility companies in Mexico itself.

The Committee for the Protection of Bondholders in the Mexico Tramways, Mexican Light & Power, and Pachuca Companies have convened a meeting for Friday, July 14th, to discuss the lengthy report prepared by the Hon. F. H. Phippen, K.C., and Mr. E. D. Trowbridge. The Committee have the support of 7½ million sterling of bonds, out of the total of £12,330,371. That the value of the Mexican dollar should have fallen from a florin to three-halfpence is one principal reason why the companies have had to suspend interest payments. Bondholders will do well to make every effort to attend what promises to be a highly important meeting.

Electric lighting shares hold all their substantial rises of last week. County ordinary put on another 2s. 6d., and Westminster's further hardened, to 6½. Besides the demand for ordinary and preference shares, there is active competition for every scrap—literally—of debenture stock that comes to market.

The Marconi meeting at the end of last week served to add fuel to the fire of bullish expectations. The chairman inferred that the gallant Senator had perfected developments of the system which would mean remarkable expansion after the war. Accordingly, the price is 11/32 at 3 7/32. At the same time American Marconia spurted sharply to 19s., and Canadians recovered to half-a-guinea.

Anglo-Argentine Tramways issues are no worse for the passing of the interim dividend on the second preference

shares. Maybe there were some who thought that this might have to come, but after all it is considered as a postponement of the payment. The shares are cumulative, and as soon as the Argentine Republic manages to secure a larger proportion of shipping, industry will go ahead at a rapid rate. Brazil has been less handicapped than Argentina in the matter of freights, and this the course of prices has abundantly witnessed. Brazilian Tractions are shaking off some of their recent dullness, and this week the price shows a slight improvement.

Adelaide Supply preference shares are a good spot; the price is 4 up to its par value of 5.

In the Telegraph market, there is another goodly string of rises. The Eastern group is firm, with Eastern ordinary, Western Telegraphs and Eastern Extensions all up to the equivalent of 150 for stock. Globe ordinary and preference are both 5s. better, helped by the increase in dividend on the former. Great Northern is 10s. to the good. Investors are trying to buy Telephones, too; United River Plates and Chiles are 2s. 6d. up.

The manufacturing group is very firm. Edison and Swan fully-paid shares are coming into prominence again, and at 35s. are 5s. higher on the week. British Westinghouse preference put on a further sixpence. Babcock & Wilcox touched 34, but lost the fraction, the high price tempting out a few shares. Industrials of all kinds display considerable activity, only in the rubber department is there any noticeable dullness. There, the steady dwindling in the price of the raw material has discouraged buyers, particularly as the shrinkage is accompanied by vague statements that no real improvement can be expected until the late autumn. Copper shares also keep dull and heavy, there being little present indication of substantial recovery in the metal.

SHARE LIST OF ELECTRICAL COMPANIES.

	HOME ELECTRICITY COMPANIES.		Price	Rise or fall	Yield
	Dividend				
	1914.	1915.	1915.		
Brompton Ordinary ..	10	10	105	—	5 14 2
Charing Cross Ordinary ..	5	5	94	—	7 10 9
do. do. do. 4½ Pref. ..	4½	4½	34	—	6 13 6
Chelsea ..	5	5	4	—	6 13 4
City of London ..	9	9	124	—	6 12 0
do. do. 6 per cent. Pref. ..	6	6	104	—	5 14 3
County of London ..	7	7	112	+	6 11 9
do. do. 6 per cent. Pref. ..	6	6	112	—	7 11 0
Kensington Ordinary ..	9	9	54	—	6 16 7
London Electric ..	4	3	112	—	6 15 8
do. do. 6 per cent. Pref. ..	6	6	44	—	6 13 4
Metropolitan ..	34	3	44	—	6 6 4
do. do. 4½ per cent. Pref. ..	4½	4½	8	xd	7 10 0
St. James' and Pall Mall ..	10	8	6	—	6 13 4
South London ..	5	5	24	—	8 13 10
South Metropolitan Pref. ..	7	7	14	—	6 4 3
Westminster Ordinary ..	9	7	14	+	6 14 9

TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref. ..	6	6	105	—	5 14 2
do. do. do. ..	30	33 6	23	—	7 10 9
Chile Telephone ..	8	8	42	+	6 3 1
Cuba Sub. Ord. ..	6	6	74	—	6 13 4
Eastern Extension ..	7	8	15	+	5 6 8
Eastern Tel. Ord. ..	7	8	163	+	5 6 8
Globe Tel. and T. Ord. ..	6	7	13	+	5 6 8
do. do. Pref. ..	6	6	11	+	5 9 1
Great Northern Tel. ..	22	22	374	+	6 18 0
Indo-European ..	13	13	49	—	6 13 8
Marconi ..	10	11	35	—	3 2 0
New York Tel. 4½ ..	4½	4½	1024	—	4 7 10
Oriental Telephone Ord. ..	10	10	10	—	5 0 0
United R. Plate Tel. ..	1	1	64	+	5 0 0
West India and Pan. ..	8	8	207	—	9 6 1
Western Telegraph ..	7	8	15	xd	5 6 8

HOME RAILS.					
Central London, Ord. Assented	4	1	73	+	5 9 7
Metropolitan ..	12	1	274	+	3 12 9
do. District ..	Nil	Nil	194	+	Nil
Underground Electric Ordinary	Nil	Nil	112	—	Nil
do. do. Income ..	6	6	274	—	5 17 0

FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref. ..	6	6	5	+	6 0 0
Anglo-Arg. Trams, First Pref. ..	54	54	31	xd	7 9 2
do. do. 2nd Pref. ..	54	54	34	—	8 9 2
do. do. 5 Deb. ..	5	5	31	—	9 9 0
Brazil Tractions ..	4	4	62	+	6 19 0
Bombay Electric Pref. ..	6	6	112	—	6 15 8
British Columbia Elec. Riv. Pnce.	5	5	60	—	8 6 8
do. do. Preferred ..	Nil	Nil	40	—	Nil
do. do. Deferred ..	Nil	Nil	38	—	Nil
do. do. Deb. 4½ ..	4½	4½	62	—	6 17 1
Mexico Trams 5 per cent. Bonds ..	Nil	Nil	40	—	Nil
do. do. 6 per cent. Bonds ..	Nil	Nil	54	—	Nil
Mexican Light Common ..	Nil	Nil	80	—	Nil
do. do. Pref. ..	Nil	Nil	82	—	Nil
do. do. 1st Bonds ..	Nil	Nil	41	—	—

MANUFACTURING COMPANIES.					
Babcock & Wilcox ..	14	15	3	—	5 0 0
British Aluminium Ord. ..	5	7	251	—	5 7 8
British Insulated Ord. ..	15	174	104	—	7 10 8
British Westinghouse Pref. ..	74	72	486	+	6 4 0
Callenders ..	15	20	124	—	8 0 0
do. do. 5 Pref. ..	5	5	44	—	5 17 8
Casner-Kelmer ..	20	—	—	—	6 5 8
Edison & Swan, £3 paid ..	Nil	—	1074	—	Nil
do. do. fully paid ..	Nil	—	12	+	Nil
do. do. 5 per cent. Deb. ..	6	74	163	—	8 16 8
Electric Construction ..	6	6	94	—	9 16 8
Gen. Elec. Pref. ..	6	6	94	—	6 3 1
Renley ..	20	25	15	—	6 6 8
do. do. 1 Pref. ..	44	44	4	—	6 13 6
India-Rubber ..	10	10	124	—	8 8 4
Telegraph Con. ..	30	30	89	—	5 4 0

* Dividends paid free of income tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, July 5th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ..	per lb.	1/8	..
a Ammoniac Sal ..	per ton	£75	..
a Ammonia, Murate (large crystals)	..	£54	..
a Bisulphide of Carbon ..	..	£23	..
a Borax ..	..	£30	..
a Copper Sulphate ..	..	£51	£2 dec.
a Potash, Chlorate ..	per lb.	2/6	..
a " Perchlorate ..	..	2/4	..
a Shellac ..	per cwt.	95/-	..
a Sulphate of Magnesia ..	per ton	£18	..
a Sulphur, Sublimed Flowers ..	..	£14	..
a " Lump ..	..	£10	..
a Soda, Chlorate ..	per lb.	1/44	..
a " Crystals ..	per ton	120/-	..
a Sodium Bichromate, cakes ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2 to 12" basis)	per lb.	1/4 to 1/44	1d. dec.
c " Tubes (solid drawn) ..	..	1/34 to 1/4	1d. id. do.
c " Wire, basis ..	..	1/44 to 1/44	1d. dec.
c Copper Tubes (solid drawn) ..	..	1/44 to 1/7	1d. dec.
g " Bars (best selected) ..	per ton	£162	24 dec.
g " Sheet ..	..	£152	24 dec.
g " Rod ..	..	£152	24 dec.
d " (Electrolytic) Bars ..	..	£134	24 dec.
d " Sheets ..	..	£161	24 dec.
d " Rods ..	..	£140	24 dec.
f Ebonite Rod ..	H.C. Wire per lb.	1/44	1d. dec.
f " Sheet ..	..	9/-	..
n German Silver Wire ..	..	2/3	..
h Gutta-percha, fine ..	..	6/10	..
h India-rubber, Para, fine ..	..	2/84	34d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual. ..	..	£25 10	..
l Lead, English Pig ..	..	£16 12 6 to	£2 10 dec.
g Mercury ..	per bot.	£16 15	..
e Mica (in original cases) small ..	per lb.	7d. to 8/-	..
e " " " medium ..	..	8/6 to 14/-	..
e " " " large ..	..	7/6 to 14/- & up.	..
d Silicium Bronze Wire ..	per lb.	1/84	..
r Steel, Magnet, in bars ..	per ton	£85	..
g Tin, Block (English) ..	..	£177	£1-£2 dec.
n " Wire, Nos. 1 to 16 ..	per lb.	3/-	..

Quotations supplied by—

a G. Boor & Co.	g James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	g Edward Tilt & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	i Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	n P. Ormiston & Sons.
Telegraph Works Co., Ltd.	r W. F. Dennis & Co.

Cuban Telephone Co.—The report shows that a gross increase in rentals and service for 1915 amounting to \$154,203 was handled, with an increase in operating expenses of only \$4,013, the net gain in operating income, therefore, being \$150,190 for the year. This gain was partially offset by heavier expenditures for interest, and as a result the net surplus shows an increase of \$105,426 as compared with 1914, or about 43 per cent. The depreciation for the year 1915 on depreciable property based on 4 per cent. of the cost was \$178,478, less replacements chargeable to reserve of \$76,814, leaving a net increase in the account for the year of \$101,669, and a total reserve for depreciation at December 31st, 1915, of \$677,467. Nearly \$450,000 of the company's accumulated net cash surplus has been used this year for the purpose of carrying on the construction work required to be done under its concession and to provide for the constantly increasing additions to both the local and long-distance systems.—*Financial Times.*

Dublin United (Electric) Tramways Co.—The directors have declared interim dividends for the half-year ended June 30th of 6 per cent. per annum, less income-tax, on the preference, and 4 per cent. on the ordinary shares. The reduction of 1 per cent. on the ordinary shares is due to the loss of over £13,000 in receipts during the period of the recent rebellion, when the entire service was at a standstill.

St. James' & Pall Mall Electric Light Co., Ltd.—Interim dividends at the rate of 7 per cent. per annum on the preference and 5 per cent. per annum on the ordinary shares are announced for the past half-year.

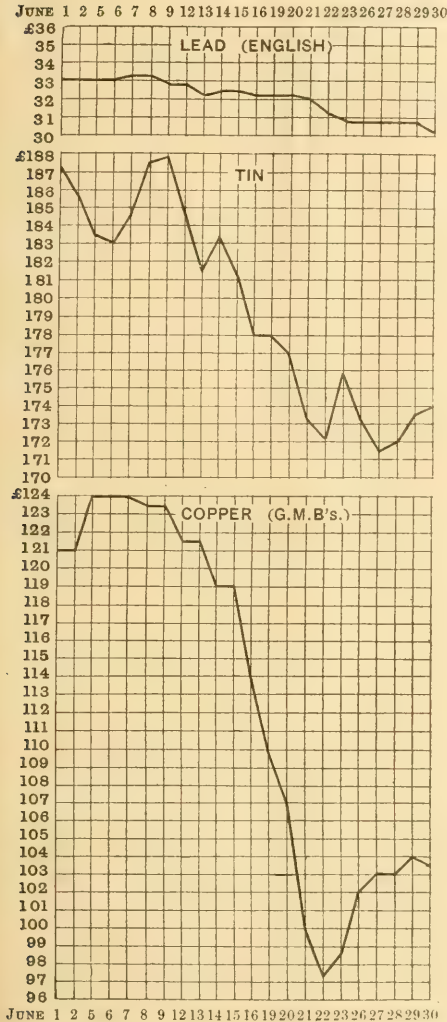
India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.—Interim dividend, 5s. per share, free of tax, on the ordinary shares.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—Interim dividend for the quarter to March 31st, 3s. per share, free of income-tax.

O. C. Hawkes, Ltd.—After paying 5 per cent. on the preference shares, £4,193 is to be carried forward.

METAL MARKET.

Fluctuations in June.



ELECTRICITY ON THE FARM.

THE advantages of electricity in agriculture to the farmer, to the central-station engineer, and to the nation as a whole have been fully discussed in the REVIEW during the past two years.

We have obtained some particulars of an electrical installation on a farm on the outskirts of a northern town, where the electric supply has been used since 1904. The supply is given at 500 volts for power, and 250 volts for lighting, from the central station situated about a mile and a half away, and the service cables consist of two .022 sq. in. and one .012 sq. in. cables, insulated with bitumen and laid solid underground in bitumen. The original installation consisted of one 10-H.P. Royce motor and 45 lighting points, but was later increased by the addition of a 2-H.P. motor in the milk-house.

The lighting installation was carried out partly in screwed tubing, but wood casing was used in the farmhouse and in some of the outbuildings. The stables and byres were at first wired in screwed enamelled steel tubing, but on account of moisture gathering in the tubes and causing deterioration of the rubber, the enamelled tubing was subsequently replaced by galvanised tubing in these buildings. In the haylofts, sheds, barns, &c., where the enamelled tubing protection was fitted, no trouble has been experienced through insulation breakdowns.

The charge for lighting was 4½d. per unit in 1904, but the rate was reduced to 4d., then 3½d., and now it is 3d. per unit. The annual bills for electric lighting were as follows:—

Year.	Units.	Rate.	Total bill for Lighting.
1904-05	266	4½d.	£4 19 9
1905-06	318	4d.	5 6 0
1906-07	324	4d.	5 8 0
1907-08	324	4d.	5 8 0
1908-09	323	4d.	5 7 8
1909-10	391	4d.	6 11 4
1910-11	381	4d.	6 7 0
1911-12	408	3½d.	5 19 0
1912-13	479	3d.	5 19 9
1913-14	417	3d.	5 4 3

The average cost of lighting for the 10 years was £5 13s. 1d., the units per annum averaging 363. During the year 1914-15 the farm buildings were occupied by the military, and the lighting bill thereby greatly increased.

The 10-H.P. motor, which displaced a gas engine, drives a line of shafting extending through the wall of the motor house to the mill house. In the latter is installed a thrashing machine, a bean bruiser, and a turnip pulper. Above, in the loft, is a cake bruiser and a straw cutter. In addition to these machines, the motor also drives a bone crusher for hen-fodder, and a turning lathe and boring machine in a small workshop adjoining the mill.

The first four years' power bills are shown below, the charge being made on a sliding scale commencing at 2½d. per unit down to 1½d. per unit.

Year.	Units.	Average Price.	Account.
1904-05	856	2½d.	£8 13 10
1905-06	885	2½d.	7 18 0
1906-07	1,672	2½d.	14 5 0
1907-08	383	2½d.	3 12 0

During the greater part of this period the farmer made full use of the motor, but in 1908 the farm changed hands, and the new tenant placed his orders for bean-meal and hay with a local grain merchant. He continued, however, to make use of the cake bruiser, straw cutter, turnip pulper, and bone-crushing machine in his farm, but the 10-H.P. motor was, in consequence, less frequently in operation, and the accounts for energy used by this motor fell off very greatly.

The price of fodder has increased enormously on account of the war, and the present tenant of the farm intends to make use again of the thrashing machine and bean-crusher, as his predecessor did before him.

In 1911 a 2-H.P. motor was installed for churning, and also to drive a small milk separator for double creaming.

Advertising Electrical Apparatus.—Referring to the letter of "A. J. G.," entitled "O ye of little faith," in our issue of June 23rd, Mr. Harry S. Ellis, borough electrical engineer, South Shields, has sent us a set of leaflets illustrating the advantages of domestic electrical appliances on the lines advocated by "A. J. G." Each leaflet carries on the front page an interesting picture of the particular feature concerned, such as electric cooking at the breakfast table, electric heating, electric cooling (with a fan), vacuum cleaning, ironing, &c., a few brief phrases pointing out the benefits derived from their use, including data regarding costs to buy and run, and on a tear-off leaf an account form bearing the statement of the amounts due from the consumer to whom the leaflet is addressed. On the back of the latter is an explanation of the tariffs in force and the discounts allowed for prompt payment. This excellent series shows fertility of resource and an eye for persuasive effect which should prove highly captivating; and Mr. Ellis assures us that this method of advertising has been found both cheap and effective.

Decimal Coinage and the Metric System.—At yesterday's meeting of the Court of Common Council of the City of London, a resolution was to be moved in favour of the nation immediately adopting the decimal system of money, weights, and measures.

The cost of electricity for these purposes, at the same rate, has been as follows:—

Year.	Units.	Cost.
1911-12	142	£12 6
1912-13	151	13 9
1913-14	110	1 2 11
1914-15	88	0 18 4

The farmer expresses himself as well pleased with the assistance he obtains from the electricity supply, and does not know how he could manage otherwise, without having to engage several additional farm-hands. The milk separator and churn are especially handy, and he contemplates adding an electrically-driven refrigerator to his plant. He is also considering other uses for the electric supply, such as a milking machine for the 50 odd cows on the farm, an electric incubator, an electric horse clipper, and a motor-driven washing machine. As the water supply is furnished by gravity from a spring on the hillside, he has no use for pumps, but he wishes to install electric heaters in the byre and milk-house to keep the temperature above freezing point in the winter. Good lighting in the byres and milk-house in the winter mornings has enabled the farmer to carry out the milking expeditiously and satisfactorily, and he emphasises the safety of electricity for lighting in hay-lofts, sheds, &c., where inflammable material is kept.

From the station engineer's point of view, the load obtained is a good one, since the farmer uses his machinery during the early part of the day, and the maximum demand, both for lighting and power, takes place in the early morning.

ELECTRICITY SUPPLY IN GREENOCK: TWO YEARS' GROWTH.

ON May 2nd, 1916, an inaugural ceremony took place at the Greenock electricity works, the occasion being the addition to the plant of a fifth steam turbine and generator. This makes the second machine of 5,000 kW. capacity installed at the Bellinzoni Works.

Councillor McCallum, Convener of the Electricity Committee, on that occasion gave some remarkable figures in connection with the growth of the undertaking during the last few years.

In 1913-14 it was thought that the output to Greenock consumers had reached its maximum, and that any increase

The units sold during 1914-15 totalled 14,207,575, an increase of 24 per cent. over the preceding year, of which 14 per cent. represented the additional output in Greenock alone.

With the advent of the financial year 1915-16, new applications came in from all classes of consumers. The management immediately took steps to cope with the larger demand: the boiler capacity was increased by the installation of new economisers, and all that was possible was done to get the maximum duty out of the existing boiler equipment. During this period full steaming power had to be obtained with all the boilers in commission, and with no reserve, so that a breakdown in any one boiler would have necessitated the curtailment of supplies.

The most serious difficulty experienced, however, during the past winter was the shortage of water for condensing purposes, owing to the drought. Extensions to pumping plant had to be rapidly laid down, and the cooling towers—which had been originally installed for the night load, when no water flows down the Cut—had to be brought into commission during the daytime.

The new scheme of extensions, for which the Corporation is at present seeking powers to borrow £45,000, includes two new boilers and a large cooling tower, as well as feeders and converting plant at the various substations. As indicating the necessity for these further additions to the plant, it may be stated that since the end of the last financial year applications have already been received for electricity supplies amounting to 1,310 kW. in Greenock and 663 kW. from Port Glasgow users, and when negotiations with several other prospective consumers are completed, a further demand of 905 kW. may be expected. The units generated for the nine months ended on March 31st last numbered 17,152,641, and the amount of energy produced for the complete year will probably exceed 20 million units generated, or nearly 100 per cent. more than the output two years ago.

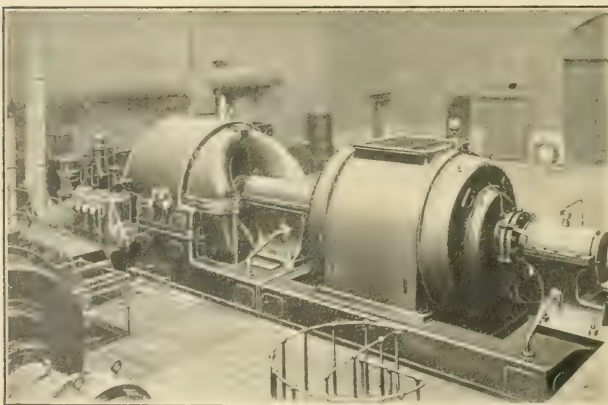
The daily demand during the month of May has exceeded last year's daily demand for the corresponding period by over 1,000 kW. This represents 25 per cent. increase on last year's maximum demand, and is a very marked indication of what may be expected when the shorter days arrive, and the lighting load overlaps the power load.

The prospects for the undertaking during the next few years appear to be excellent. Shipbuilding and engineering firms expect to have plenty of work in hand for some time to come, and the sugar refineries have lately been extending their electrical machinery. In other trades, too, electric motors are being installed, despite the prevailing high prices of machinery.

The turbine set which has recently been placed in service is a duplicate of plant supplied to the Greenock Corporation by the British Westinghouse Co., about two years ago. The turbine is of the Westinghouse-Rateau high-pressure impulse type, rated at 5,000 kW., and running at a speed of 1,500 R.P.M. The alternator is of the patent compensated type generating three-phase current at 50 periods, 3,300 volts, and takes an overload of 25 per cent. for one hour. This set is provided with a direct-coupled exciter. Regulation is carried out by means of a rheostat in the exciter shunt field, no main field rheostat being necessary. A wet-air filter has been supplied with the alternator.

Surface condensing plant has also been installed, but no circulating pump has been supplied, as the cooling water is fed by gravity. The Leblanc air and extraction pumps are driven by means of an auxiliary turbine, which exhausts into the feed-water heater.

The accompanying illustrations show the new set, and the interior of the engine room. Our congratulations are due to Mr. F. H. Whysall, the burgh electrical engineer and manager, on the remarkable development of the undertaking under his control.



WESTINGHOUSE 5,000-KW. TURBO-ALTERNATOR RECENTLY INSTALLED AT GREENOCK.

in the supply was to be looked for in Port Glasgow. The units sold for that year amounted to 11,451,438, and the first few months of the succeeding year showed a reduction in the output, but, as the winter approached, the demand began to rise, partly due to the introduction of the supply to the Port Glasgow shipbuilders; the main part, however, of the new business was due to the additional requirements of Greenock firms.

S.P.T.: A FINSBURY REMINISCENCE.

THE recent lamented death of Prof. Silvanus P. Thompson must have caused old students of Finsbury to recall their college days, and to regret that the visits which so many of them pay to the place for the sake of old times no longer carry the possibility of a meeting with the genial Doctor, whose friendly interest in the careers of his old pupils was always most lively and encouraging.

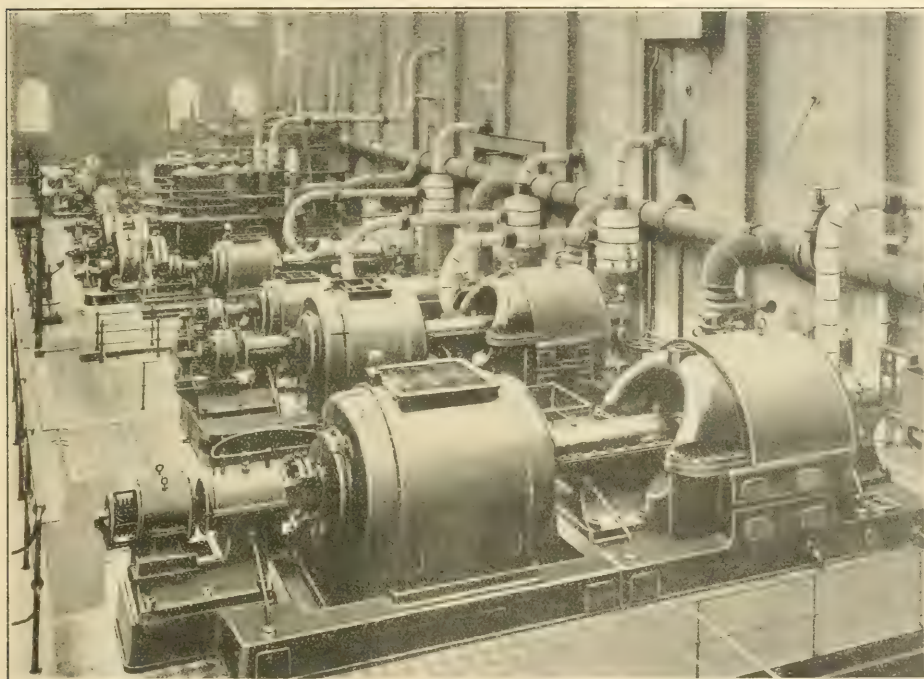
"S.P.T.," as we called him, seemed more like a permanent institution than an ordinary being, and it is hard to realise that we have seen him for the last time on earth.

He possessed great learning, and that in many directions. He kept abreast, with marvellous activity, of modern developments, whether scientific, industrial, or literary. He had a keen insight into practical problems, and was always ready to give helpful advice and criticism. He was liberal-

whom had spent a part of their vacation in some kind of employment, were brought back to the proper frame of mind by another glimpse of the Promised Land. Those who had gone out and found the milk and honey less plentiful than they had hoped for, or who were still struggling through the wilderness, sometimes came in, and were reheartened and filled with a new enthusiasm.

These reminiscences are mostly of about 18 to 20 years ago. In those days the Doctor used to lecture on Friday afternoons on abstruse matters connected with high electrical theory. The consideration of potential was described by a somewhat mystified student as "a Johnny rushing up from infinity and plugging a brick down, and rushing off for another one."

Any misdemeanour or inattentiveness in lecture was at once checked by a silent glare. I once brought this on myself by sighing loudly, whether with despair at my own obtuseness or for some other reason is not now certain, in



GREENOCK ELECTRICITY WORKS. INTERIOR OF ENGINE ROOM.

mind; a conspicuous instance of this was his attitude on the question of the laying-down of electric tramways in London, when his views, expressed more than once in speeches before the Institution of Electrical Engineers, were in marked contrast to the reactionary and stick-in-the-mud ideas of others in similar positions. He was eminent as a lecturer, with a style which could not fail to interest and attract, and he had a marvellous power of clear exposition, in which he had no superiors, and very few equals, among men of science.

His address at the opening of each session of the college was characteristic. New students, many of them fresh from school, were encouraged to pursue their new activities, and to keep at work, in spite of the novelty of being addressed as "Mr." by the exalted beings who now replaced their former schoolmasters, and of the removal of many restrictions. Those in the middle of their course, some of

the middle of one of the Friday afternoon lectures aforesaid, when sitting in the front row.

One student, whose disability in the world electric was so conspicuous that his first session was also his last, was inclined to favour the back of the theatre, so that his tendency to talk, sketch, or slumber would be less noticeable. When the Doctor called the roll, and noted from whence the answer came, he said: "No, Mr. H., come nearer. You must not hide your light under a bushel."

A demonstrator of the time, who, as I have since learned to realise, was very clever, not only at his work, but at many side-lines—natural history, for example—was an extremely nervous man, and he used to jig a little piece of chalk up and down in his hand while lecturing. His lectures used to be delivered to a running accompaniment of kicks on the desks, banging of notebooks, stamps on the floor, and other uncouth and ill-mannered noises. One day the lecturer, rebelled against this tyranny, announcing that he meant to carry through his lecture to its conclusion

on the lines he had laid down, and that if gentlemen eyes, we were called "a dioptrian" would persist in interrupting, he should keep them beyond the beginning of the luncheon hour. The time continuing, he did so, and the striking of the hour was the signal for yells of exhortation.

Suddenly the door behind the lecture bench opened. The Doctor's eyes were still in the throats of the students. The Doctor entered, and sat down on a chair behind the lecturer. He spoke no word. The proverbial pin might have fallen with an ear-splitting crash. The lecturer, who seemed purely as alarmed as the students, and was, consequently, more nervous than ever, went on to the end, still jiggling the bit of chalk up and down in his hand, and, so far as we knew, the incident closed.

At that time, and for some years after, the Physics Laboratory and the Drawing Office used to be at No. 5, a little way up the street towards the City Road. Sundry industrious experimenters discovered that a pleasing effect could be obtained by blowing down a tube attached to the gas-pipe, when Bunsen burners in the vicinity showed a livid and ghastly glare. I tried it myself, so I know. A certain student, now of some eminence as a designer of electrical machinery, but then quite the smallest person at the college, pursued this research rather too far, and extinguished all the burners in the laboratory, whereby he was discovered, and was duly reported to the Principal.

The next time all the "first-years" were gathered together in the Physics Lecture Theatre, the Doctor addressed them in grave and measured terms, pointing out the great iniquity of this practice and the danger of it, and the waste of time arising therefrom. Finally he ordered the culprit to leave the theatre: which done, he observed scathingly: "Are there any more little boys in knickerbockers?"

He was clever in the use of stratagems to fix points in the mind. On one occasion the subject was lenses and their curvature. How should we describe the curvature of a lens? This theme ran through the lecture from the beginning to the end of the hour's talk. In what unit should it be defined? And so he worked it up, till we were all quite excited and anxious to hear the answer to the question: "What is the unit of curvature?" At last, he said: "It is called one Dioptrie," and, writing the word on the board, he beamed upon the class - and said no more. I have not forgotten the dioptrie, though I have never since had any occasion to use it.

One could go on for a long time with memories of those days, now so far away, but it is time to draw to a close.

In a properly-constituted State such men as he would be knighted. Of course, I never heard him speak of the honour for himself, though he was of opinion that Dr. Ferranti and Mr. Siemens, Presidents respectively of the Electricals and the Civils, ought to have been knighted in the Coronation year.

One's cordial sympathy goes out to his staff, many of whom have proved their devotion by long service. How desolate the College must seem to them now, how forlorn the empty chair!

Let us hope a worthy successor will be found, one who understands Finsbury traditions, and who is in sympathy with the Doctor's ideals. Prof. Miles Walker, his old assistant, is one such man, and his choice would be welcomed by Finsbury men, present and past.—C.

interlocked with the main switch shown alongside of it, which cannot be put down into the running position unless the field switch is first closed, as shown: the lower contacts of the field switch place a resistance across the field terminals before the circuit is opened.

The regulating switch is also interlocked by the electromagnet seen on the lower right-hand panel: the motor cannot be started unless the armature of the magnet is pushed down by a projection attached to the regulating lever, which must be put back to the "all-out" position for this purpose, and cannot be moved forward to insert resistance in the field circuit until the starting operation is completed.

The main knife switch being closed, the next operation is to close the circuit-breaker on the left-hand upper panel, which is provided with an over-load release: on turning the hand-wheel, the contactors are pulled in successively, cutting out resistance from the armature circuit, until finally the double contactor on the right closes and short-circuits all the resistance. Each contactor is provided with two auxiliary contacts, one of which interlocks the



FIG. 1. E.A. CO. 100 H.P. MULTIPLE-CONTACT STARTER.

initial contactor, so that if any of the intermediate contactors stick up, the first cannot close; the other contact introduces an economy resistance into the circuit of the solenoid. If, in starting up, one of the contactors fails to close, none of the subsequent ones can close, and in such a case the starting hand-wheel must be returned to the first position and a fresh start made. The resistances are of the iron grid type, and are mounted on the back of the board; the economy coils are all brought together in a frame where they are readily accessible, with neat wiring to the corresponding solenoids.

In order to stop the motor without loss of time, dynamic braking is employed, three resistance steps being provided on the upper position of the main knife switch. The board is intended for the control of a motor of 400 H.P., taking currents up to 1,500 amperes: the contacts are therefore very substantial, and carbon sparking contacts are provided on all the contactors. In addition, the initial and final contactors, which are the only ones that may have to break the circuit, are fitted with magnetic blow-outs. The switchgear was shown to us in operation, and appeared to be a very satisfactory job in all respects.

Westinghouse Liquid Controllers.

The advantages of liquid controllers have increased as their drawbacks have diminished, with improvements in construction, and the modern type differs widely from the crude apparatus formerly available, being now a well-designed and reliable machine, which lends itself admirably to a variety of conditions. We illustrate herewith a hand-operated controller of this kind which has been got out by the BRITISH WESTINGHOUSE CO., LTD., of Trafford Park, Manchester, for use in connection with slip-ring reversing motors driving haulages, &c., in mines and quarries, for stator pressures up to 3,300 volts, stator currents up to 300 amperes, and rotor currents up to 750 amperes. The device comprises stator circuit oil-break switches, and liquid resistances for the rotor circuit, the latter being provided with a system of water-cooling pipes, as shown in section, fig. 3. The controller is operated with a lever, as shown in fig. 2, unless otherwise specified, and is so

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

E.A.C. Multiple Contact Starter.

We recently inspected a large multiple contact starter for a D.C. motor driving a rolling mill, made by THE ELECTRICAL APPARATUS CO., LTD., of Vauxhall Works, South Lambeth Road, S.W. It is of the contactor type, with full electrical interlocking. The starting hand-wheel is shown on the upper right-hand side of fig. 1, with the regulating handle below; a push-button contact operated by the hand-wheel closes the control circuit when moved forward, but opens it at once when the wheel is moved backward, thus throwing out the initial contactors. The shunt field switch is seen at the lower left-hand corner of the figure, and is mechanically

arranged that the oil switches close before any of the rotor resistance is cut out of circuit; the switches are of heavy construction, and are suitable for frequent operation under heavy load. The arrangement of the resistance tank is shown in the section, fig. 3.

The fixed electrode can be removed without disturbing the earthenware pots. The electrodes are provided with a sump below

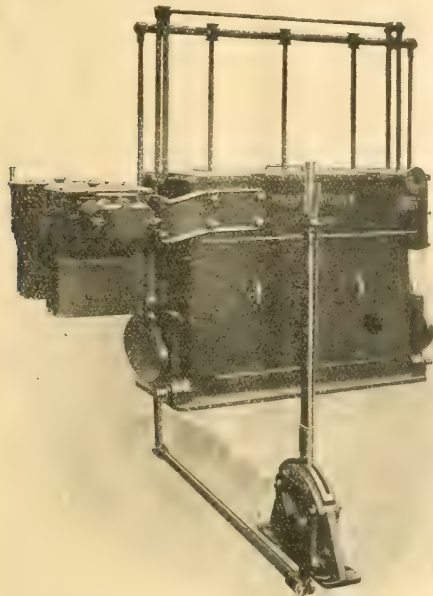


FIG. 2. WESTINGHOUSE LIQUID CONTROLLER.

the contact surfaces in which any sludge will collect, and from which the sludge can be drawn off by means of a cock. The earthenware pots can be withdrawn through the side of the controller, and new ones fixed in the same way, thus obviating the

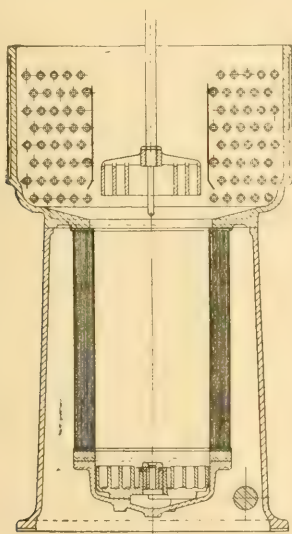


FIG. 3.—SECTION OF RESISTANCE TANK.

necessity of a pit below the controller for this purpose. The moving electrodes may be removed without disturbing the cooling pipes. Baffle plates ensure proper circulation of the electrolyte. The amount of water required is approximately 3.3 gallons per horse-power dissipated in the controller per hour.

ELECTRIC INCUBATORS.

THE advantages of electricity for hatching and brooding chickens and testing eggs are becoming better and better recognised, and the convenience and adaptability of electric devices over those operated by gasoline, gas, steam, and kerosene easily place them in the front wherever electric service is available.

Among the advantages claimed for electric incubators are simplicity of operation, close control of both heat and moisture, perfect ventilation, absence of smoke, soot, fumes, and odours, safety with respect to danger from fire, &c.

The incubator shown in fig. 1 is of metal construction, the outside casing being of heavily-enamelled sheet steel, and the inside, or egg-chamber, of heavy galvanised iron. The dead-air space between the two is insulated with a sanitary, fireproof material. Ventilation is controlled from the outside by a metal slide in the bottom of the incubator, by means of which the intake of air can be easily and correctly regulated. The moisture or humidifying tank is on a flange attached to the side of the egg chamber, sliding in or out, and being easily accessible. The electric wiring is placed between the outer and inner metal parts of the removable top lid of the machine, so that nothing is exposed except the sockets for the bulbs and the circuit-leader.

The egg trays are of heavy galvanised wire, and the sizes are graduated so that each tray will hold about 100 eggs, making the trays easy for anyone to handle. Where the dimensions permit, the egg trays are made in sectional squares, so that the positions of the eggs relative to the centre, sides, and corners of the container can be changed without actually touching the eggs themselves. Solid removable bottoms with perforated sheet and sliding venti-

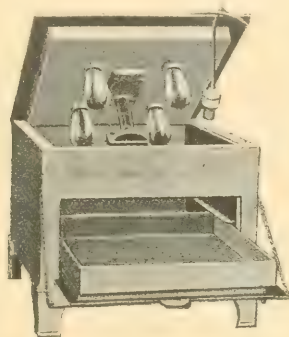


FIG. 1. ELECTRIC INCUBATOR WITH CAPACITY OF 65 EGGS.

lators are provided. In addition to the asbestos lining, the dead-air space in the top is packed with mineral wool, and the sides with a triple layer of prepared paper and felt. The machine is equipped with double-glass windows in the door, so that each part of the interior is always visible. A card slide is attached to the side of the machine for keeping records of the hatch.

The temperature of the incubator is controlled by a thermostat, which automatically regulates and controls the degree of heat required in the incubator. When the temperature rises a quarter degree above the point at which the thermostatic circuit-breaker has been set, the circuit is automatically broken, and the current is shut off from the lamps, which are of carbon-flament type. As soon as the temperature falls a fraction of a degree below the point at which the machine is set, the circuit is automatically re-established.

At a rate of 5 cents a kw.-hour it is said to cost only a trifle more to hatch by electricity than by oil or hot water. Where the rates are much lower, the difference in cost is either eliminated, or the advantage can be placed on the side of the electrically-operated machine. It is claimed, however, that at the above-named price the small additional excess in cost is more than offset by the increased percentage of chickens hatched, the time saved over that spent in operating other devices for hatching and brooding, the absence of worry as to the outcome, and the superior vitality of the young fowls, together with the absolute lack of fire risk. The all-metal construction of the machine shown herewith permits it to be easily cleaned, and it is, therefore, far more sanitary than the old types of wood machines.

Of course, in producing chicks by artificial means the mere hatching of the eggs is only "half the battle." The chicks must be reared, and statistics show that only about one-half of the chicks hatched reach maturity. This large mortality is caused, it is claimed, by disease, usually the result of improper brooding. In the absence of the motherly hens to watch over the broods produced by artificial incubation, and especially to keep them warm at night, electrically-heated hovers have been developed, of similar construction to that of the incubator described above, being of metal, light in weight, portable, and perfectly insulated. A curtain of felt is employed for providing shelter for the chicks. No thermometer is needed, because the proper degree of heat necessary to rear the chicks is computed in advance, and the hovers are equipped with bulbs accordingly. - *Electrical World*.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

SWITZERLAND.—With reference to the notice published in the *Journal* of January 28th, containing a list of electrical and other goods of which the Société Suisse de Surveillance des Consignes is the duly authorized consignee in Switzerland, it appears that a revised list of articles has been issued by the War Trade Department, in respect of which licences for export to Switzerland are only granted if the goods are consigned to the above-mentioned Société for account of the ultimate consignees. Certain articles in the list are allowed to benefit under the special scheme for small parcels (details of which were published in the *Board of Trade Journal* of March 23rd); in these cases licences may, at the discretion of the War Trade Department, be issued on application without the production of a certificate from the Société, in respect of parcels up to 11 lb. in weight by non-postal service, provided that they are dispatched by the special route stipulated. The following are among the articles appearing in the revised list; those printed in italic type can take advantage of the special scheme above-mentioned, while in the case of those not printed in italics a certificate from the Société is essential:—

Accumulators, electric, and accumulator plates.
Aluminium in all forms and aluminium manufactures.
Asbestos, crude and manufactured.
Batteries, electric, and parts.
Bauxite.
Belting (machine) of all kinds.
Cable, insulated.
Carbons, electric. (Carbons for electricity—except electrodes and carbon brushes for dynamos, can be sent under the small-parcel scheme.)
Celluloid, raw, in bulk, sheets, rods, tubes, clippings and waste (but not wares).
Chrome, ore and metal, in all forms.
Copper: Ore (including pyrites); pure metal and alloys of, in all forms; waste.
Corundum.
Detonators.
Electrical firelighters.
Electrical insulated wire and cables.
Electrodes, cells and component parts.
Emery, all forms, and emery wheels.
Ferro-chrome and ferro-nickel, and all other ferro-alloys.
Filings and scrap, of old copper, tin, zinc, and their alloys.
Fuses (miners').
Gloves (rubber).
Graphite.
Gutta-percha, all forms.
Instruments, nautical, observation, geodetical, and optical.
Lead, pure and its alloys; pipe; sheet, drawn and wire; lead ore; waste.
Machine tools and parts thereof.
Machinery (and parts) for use in marine and aerial navigation.
Machinery, electrical, electric dynamos, and motors.
Machinery, refrigerating.
Machinery oils.
Magnets.
Mercury; ore, metal, and preparations; fulminate.
Metal, anti-friction.
Mica, rough and worked.
Molybdenum; ore and alloys, also salts.
Nickel, ore, metal, pure and alloyed, all forms.
Packings, engine and boiler, including slagwool.
Rubber, vulcanised, in sheets.
Surgical instruments and apparatus.
Telegraphs and telephones, material for.
Titanium ore, metal and salts.
Tungsten in all forms.
Vanadium, ore, salts.
Vehicles of all kinds used in military or naval transport.
Zinc, ore; metal, pure and alloyed, in all forms.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Published expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 8,607. "Electronics of secondary batteries." E. HANCOCK & H. WINTER. June 19th.
8,618. "Electric knitting needles." E. T. BARTLETT & G. M. SIMPSON. June 19th.
8,620. "Electric conductors." W. P. GOSWELL. June 19th.
8,625. "Distributors for high-tension magnetos." G. S. HOLLAND and MOSGOS. Cambridge. June 19th.
8,633. "Alternating-current commutator motors." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. June 19th. (U.S.A., June 19th, 1915.)
8,639. "Arrangement of electric storage batteries in submarines and construction of submarines for that purpose." E. C. R. MARKS (Soc. Anon. Italiana G. Ansaldo & C.). June 19th.
8,669. "Means for assisting adjustment of trolley-pole of trolley, &c." R. MEYER. June 20th.

- 8,683. "New device." BRITISH THOMPSON-HOUSTON CO. (General Electric Co., U.S.A.). June 20th.
8,691. "Electric lamps." O. GREEN, H. J. HERINK & RELAY AUTOMATIC TELEPHONE CO. June 20th.
8,698. "A new process of electrically-operated carbon pressure." A. G. GIBBS. BIRMINGHAM. June 20th. (Germany, June 25th, 1915.)
8,712. "Electrically-operated wooden trip-pistons." H. WATSON. June 21st.
8,713. "Electric cable." C. J. BEAVER & L. A. CLARKSON. June 21st.
8,716. "Electric lamp." J. P. CASSIDY. June 21st.
8,719. "Electric device for controlling electric circuits." A. ELKINS & G. ELLISON. June 21st.
8,744. "Means for controlling and regulating electric power." GEORGE L. COOPER. HANCOCK. Manufacturing Co., U.S.A. June 21st.
8,756. "Control of alternating electric current induction motors." W. BARKER. June 21st.
8,757. "Means for heating, freezing, sublimating, and liquefying human body." J. BERGONIE. June 22nd. (France, June 22nd, 1915.)
8,795. "Electrical systems for engines." W. A. CHRIST & C. F. KETTERING. June 22nd. (U.S.A., July 16th, 1914.)
8,796. "Controlling electric motors." BRITISH THOMPSON-HOUSTON CO. (General Electric Co., U.S.A.). June 22nd.
8,797. "Electric lamps." E. HOLDEN. June 22nd.
8,801. "Miners' electric safety lamps." O. OLDHAM. June 22nd.
8,811. "Battery lamp." N. KIRKS. June 22nd.
8,814. "Electrical influence machines." D. K. MORRIS. June 22nd.
8,815. "Electrical precipitation of solid and liquid particles." D. K. MORRIS. June 22nd.
8,818. "Device for straining or tensioning wires, cables, &c." A. L. REEDER. June 22nd.
8,821. "Means for controlling electric systems." H. J. HERINK & RELAY AUTOMATIC TELEPHONE CO. June 22nd.
8,831. "Electrically-welded wire fabric, &c." BRITISH REINFORCED CONCRETE ENGINEERING CO. & E. B. HALL. June 23rd.
8,845. "Electro-magnetic relays." C. B. BURDON (Siemens & Halske Akt. Ges.). June 23rd.
8,858. "Varying resistance of electric circuit." IGARIC ELECTRIC CO. CARL HANNOVER MANUFACTURING CO. June 23rd.

PUBLISHED SPECIFICATIONS.

1915.

- 8,689. STACKING PLUGS FOR INTERNAL-COMBUSTION MOTORS. Soc. Industriale de Delle. March 3rd. (May 8th, 1914.)
8,697. MOTOR-OPERATED GENERATING SYSTEMS. F. A. HOYS. (Neuland Magnets, Ltd.) June 3rd.
8,735. ELECTRICAL INSTRUMENTS OF THE MOVING COIL TYPE. E. S. HEURTEV. June 3rd.
8,825. ELECTRIC WELDING, BRAZING, AND SOLDERING, AND APPARATUS THEREFOR. BRITISH THOMPSON-HOUSTON CO. (General Electric Co., U.S.A.). June 4th.
8,812. ELECTRICAL HEATERS. E. C. R. MARKS (Siemens & Halske Akt. Ges.). June 8th.
8,772. DYNAMO-ELECTRIC MACHINES. A. H. NEULAND. June 10th.
8,762. REFRACTORY METAL TUBES. BRITISH THOMPSON-HOUSTON CO. (General Electric Co., U.S.A.). June 12th.
8,739. ELECTRIC APPARATUS FOR DRIVING CLOCKS. H. E. WARREN & WARREN CLOCK CO. June 14th.
8,829. ELECTRIC HEATING AND RESISTANCE DEVICES. A. F. BERRY. June 15th.
8,827. WIRELESS TELEGRAPH RECEIVERS. Marconi's Wireless Telegraph Co. and G. M. WRIGHT. June 17th.
9,720. WIRELESS SIGNALING SYSTEMS. BRITISH THOMPSON-HOUSTON CO. (General Electric Co., U.S.A.). July 3rd.
9,993. COMBINED LOCKING DEVICE AND SHADE SUPPORT FOR ELECTRIC INCANDESCENT LAMPS. W. C. CROCKETT. July 9th. (December 30th, 1915.)
10,769. CRYSTAL DETECTORS, PARTICULARLY FOR WIRELESS SIGNALING. Sterling Telephone & Electric Co., Ltd., and T. D. WARD-MILLER. July 24th.
12,017. METHODS OF MARKING GLASS. BRITISH THOMPSON-HOUSTON CO. (General Electric Co., U.S.A.). September 2nd.
14,330. ELECTROLYTIC PROCESS FOR REMOVING OXIDE FROM THE SURFACES OF ARTICLES OF IRON OR STEEL. P. MARINO. October 7th.
16,671. ELECTRO-DYNAMIC BRAKES FOR USE IN CONNECTION WITH PRINTING MACHINES. H. V. JAMES. November 25th. (Addition to 536/15.)
16,682. WINDING DRUMS FOR ELECTRIC WIRES, CABLES, AND THE LIKE. H. F. SMITHSON and Callender's Cable & Construction Co. November 24th.
17,946. AUTOMATIC SELECTORS FOR TELEPHONE SYSTEMS. SIEMENS & HALSKE AKT. GES. December 23rd. (April 20th, 1915. Addition to 23,336/13.)

1916.

- 3,234. DYNAMOMETERS. W. G. WALKER. March 3rd. Patent No. 100,556.

LIST OF BRITISH PATENTS EXPIRING DURING 1916.

(Continued from Vol. 78, page 748).

- 18,872. August 25th, 1902. H. W. Cox. Electric switches.
19,562. September 6th, 1902. H. H. Lake. Brakes and electric switches.
20,755. September 23rd, 1902. O. Imray. Electric controllers.
21,090. September 27th, 1902. J. Gell. Telegraphs.
21,914. October 8th, 1902. H. H. Lake. Dynamos.
23,712. October 18th, 1902. V. A. Fynn. Electric motors.
23,263. October 24th, 1902. A. Blondel. Electric lamps.
23,288. October 24th, 1902. G. Winter & F. Eichberg. Dynamos, electric transformers, electric motors.
24,770. November 11th, 1902. G. H. Hill. Electric motors.
25,025. November 14th, 1902. G. A. E. Kohler. Electric motors.
25,340. November 17th, 1902. E. Tyer, F. T. Hollins & F. W. Leake. Railway signals.
25,524. November 20th, 1902. Soc. G. et P. de Mestral. Electric lamps.
25,558. November 21st, 1902. Marconi's Wireless Telegraph Co. & C. S. Franklin. Wireless telegraphy.
26,395. November 29th, 1902. A. Artom. Wireless telegraphy.
26,552. December 2nd, 1902. R. A. Fessenden. Wireless signalling.
26,553. December 2nd, 1902. R. A. Fessenden. Wireless signalling.
26,568. December 5th, 1902. A. Wright. Measuring electricity; electrolysis.
27,769. December 16th, 1902. E. A. Carolan. Electric switches and cut-outs.
27,897. December 17th, 1902. M. Pognon. Internal-combustion engines.
28,167. December 20th, 1902. H. G. Brown. Railway signals.

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THE I.E.E. AND THE ELECTRICAL TRADES.

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As the June issue of the *Journal* of the Institution of Electrical Engineers reached our hands only on Thursday last week, we were unable to do more than insert a brief statement of the recommendations which the Council has authorised the President to submit to the Electrical Trades Committee of the Board of Trade, in our "Notes" columns. Incidentally, we may remark that none of our contemporaries referred to them at all, a fact which appears to bear out our comments in our leader of last week, with reference to the reticence of the Council regarding its proceedings—for evidently it did not occur to our colleagues that the "Institution Notes" appearing in the *Journal* were likely to contain anything of interest. On this occasion, we gladly admit, the Council has shown both energy in formulating a striking series of recommendations, and promptitude in publishing them in the *Journal*, and we tender our congratulations upon its activity.

The recommendations themselves are exceedingly interesting and important. They were based upon the conclusions reached by a Committee of the whole Council which for some time had "had under consideration certain matters affecting the electrical engineering profession," and had presented its report to the Council; on the announcement that the Board of Trade had decided to appoint Committees to consider the position of certain important British industries after the war, especially in relation to foreign competition, the Council urged the Board to appoint a separate Committee for the electrical trades, which was accordingly done, in April. The President having been invited to give evidence before this Committee, the Council resolved that the recommendations based upon the conclusions of its own Committee should be submitted by him on its behalf.

If we have felt it our duty, in the interests of the electrical industry, to reproach the Council in the past for its studied aloofness from all matters that could by any stretch of imagination be regarded as pertaining to trade, finance, and commerce, and for its deliberate decision to refrain from any participation in the development of electricity supply or of the electrical manufacturing industries, we are all the more ready, and indeed eager, to express our hearty appreciation of the policy of which it has now publicly proclaimed its adoption. It no longer shelters behind the advice of the B.E.A.M.A. to do nothing; it no longer adheres to the opinion "that no useful action on the part of the Institution appeared to be possible," and that "the continuance and expansion of British trade after the war will mainly depend on economic principles and on the commercial industry and initiative of British manufacturers." On the contrary, the Council has definitely thrown over these views; it has warmly adopted the cause of British trade, and puts forward a series of practical proposals, the majority of which, at all events, will be cordially welcomed not only by the members of the Institution, but also by all who wish well to the future of British industries.

In brief, the Council calls for "some combination of British electrical firms"; a Government Tribunal to control the electricity supply industry in this country, somewhat on the lines indicated by the recent discussions; the adoption of a protective

tariff to make it certain that the home market shall be secured to British manufacturers alone; a permanent Advisory Committee to ensure that raw materials and apparatus necessary to British trade shall be produced within the Empire; the improvement and development of the British Consular service; the adoption of British engineering standards throughout the Empire; and the compulsory adoption of the metric system. All these items relate entirely to British trade and industry, and they form a programme which reflects great credit on its framers.

In addition, the Council is endeavouring to promote the advancement of the profession, and the raising of the status of electrical engineers, by advocating the grant of a Charter to the Institution, the establishment of a Central Engineering Board to place the trained engineer on the same professional footing as a doctor or a solicitor, and improvement in the methods of training of such engineers—all objects which will command the support of every member of the profession.

As regards the first item, we are glad to note that excellent progress has been made in recent months towards the organisation of the British engineering industries to meet the coming trade war; up to the present the work has been largely confined to the broader aspects of combination, but this alone will not suffice. The highest efficiency of production can only be attained by proceeding from the general to the particular: it is most necessary that British manufacturers shall not, as in the past, be found in keen competition with one another in overseas markets, and this can only be avoided by the partition of the field either of manufacture or of exploitation. The tendency to add new lines of manufacture to an existing business is a weak point in our armour, for it increases the unit cost of each type of product; that it helps our competitors to offer lower prices and higher quality cannot be denied. That some individual sacrifices will be demanded for the common good we believe to be inevitable—but we also believe that they will be sacrifices of sentiment and opinion rather than of material advantage or personal profit, and this applies also to the second and third items. Again, however much we may object to any interference with economic laws, no shibboleths or maxims should blind us to the supreme and imperative necessity of excluding all goods of enemy origin from our markets for many years to come, and hence, if that object can be best attained or only attained by means of a protective tariff, we bow to the necessity. That patriotic sentiment alone cannot be depended upon to achieve the desired end, we fear, is certain; it will go a long way—but there is always the risk of unfair advantage being taken by others, the fear of which prompted the ill-fated proposal of the I.M.E.A. Council to oppose the restriction of public expenditure to British plant. Obviously, if a prohibitive tariff is set up, this objection will fall to the ground. The purpose of the Advisory Committee is naturally to promote Government action in order to make the British Empire self-contained and self-sufficing; the nation has had a sharp lesson, and will not readily forget the shortage of dyes, optical glass, and other indispensable commodities for which we have been almost wholly dependent upon Germany. We cordially welcome the inclusion of the metric system as a plank in the Institution platform; the movement in this direction is gaining strength, and we hope that this unique opportunity of effecting a long-delayed reform will be utilised by Parliament—it is more than ever urgent in view of the competitive effort which is being prepared by the United States, as well as that of Germany.

The professional aims of the I.E.E. Council are thoroughly commendable, but, with the exception of educational reforms, can hardly be regarded as of the first order of urgency. The immediate neces-

sity is to prepare for the return of peace, and we trust that the new policy of the Council of the Institution will be strenuously supported and brought to fruition by the efforts of a united profession and industry.

Copper.

The first downward reaction in copper, which was arrested at about the end of the third week in June, when the price of warrant metal dropped to £97 a ton, was followed by a rally up to £104 for near delivery in a sensitive market, due to an enormous fall from £146. The renewed break experienced since to about £84 is certainly indicative of another change in sentiment, which has been quite in keeping with the recent gratifying war developments. Obviously enough, events calculated to hasten the conclusion of the European struggle are bound to have an important bearing on the future of the metal, whose preposterously high price was brought about by the magnitude of the demand for the manufacture of munitions. The same applies to other so-called "war metals," the price of which, too, has lately come down rapidly, especially spelter. Market conditions now deserve careful watching, since demands for war purposes have been for the time being, at any rate, practically brought to a standstill, inasmuch as it is an open secret that requirements on the part of the Allies have been already well covered over the whole of this year, especially in the case of the red metal. It is true that the quantities actually consumed are as great as ever, with no possibility of their being curtailed for some time. At the same time, however, the outlook as regards future supplies has undergone a vast change in recent months, so much so that a good deal more metal is now being produced, under the stimulus of the very high prices, than is actually wanted, even allowing for the consumption to continue at the present huge rate for an indefinite period.

High-water mark having been, moreover, touched some months ago, it is only natural that a conservative policy is now in vogue under the new law of supply and demand. Market uncertainty is no longer connected with difficulties as to the filling of future needs, but it is chiefly a matter of gauging to what extent the price will be affected by the excess of supplies now quietly accumulating in first hands. It is, moreover, tolerably certain that considerable quantities of copper are held speculatively across the Atlantic, the digestion of which may be a slow process and must eventually assist another downward movement in prices, regardless of the indifference still professed by the copper magnates, whose position is at present still protected by the huge profits secured on their high-priced contracts entered into for deliveries into the end of this year. The big American manufacturers have apparently exceeded their needs to a considerable extent into the end of the first quarter of next year, which is not a healthy feature in a falling market. There has been no notable change in the European statistical position during the past month, the visible supply at 13,826 tons being pretty well where it stood at the end of May, while warehouse stocks remain very low. The latter fact, however, is no longer of any special significance, since shipping conditions have become easier and plentiful supplies are now available in the United States. Supplies from other sources, at the same time, tend to increase with rather freer competition for new orders, all of which should tend to cheapen the price. The trade demand lately, indeed, has been very slack, and the price of refined copper has been also affected by several pounds per ton. The usual statistics for June show a much freer movement of supplies, the total that came into sight on this side being 44,526 tons, against 32,126 tons in the same month last year. Prices are still much too high to induce a restriction of output.

LABOUR AND INDUSTRY.

(Continued from Vol. 78, page 704.)

THERE was a regrettable "dilution" strike on June 26th of about 5,500 engineers and allied tradesmen employed at Vickers, Ltd., Barrow-in-Furness, the alleged cause being the introduction, a few days before, of diluted labour on skilled men's work. According to the Ministry of Munitions report, the men took the matter out of the hands of the Joint Trades Committee, representing the various trade unions concerned. They refused any longer to recognize the Committee and elected a body of shop delegates in its place, the position taken up being that there should be no dilution of labour. The strike was repudiated by the Executive Council of the A.S.E., but disloyalty to union leadership is no new thing, and it was only under threat by the Government that the powers of the Defence of the Realm Act and the Munitions of War Acts against strikes and strikers would be brought into play, that the movement was broken, work being resumed on the following Saturday, after 5,000 working weeks or thereabouts had been thrown away. Only the strong hand of the State sufficed to incline these men to drop their differences and return to labour in the national cause, though the Jutland battle was in everybody's thought and the great advance on all fronts was impending! Truly the display of such utter disregard of the needs of the moment and such want of discipline, give one "furiously to think" in regard to the co-operation which may be expected from some British workmen when after-the-war industry engages our attention.

It is understood that Lord Haldane intends to call attention, in the House of Lords this week, to the question of the training of the nation and to the necessity of preparing for the future. Probably he will have something to say on the subject of scientific education upon which he addressed us appropriately enough 10 years and more ago, afterwards joining the Cabinet in which he had other things to think about, or in which, at any rate, judging by results, he was a voice crying in the wilderness. He long ago had ideas respecting the German system of meting out discipline with an iron hand to Labour, though as a legislator for the Democracy he doubtless recognised the impracticability of applying Prussian principles to a "Free" people. And if then—what now, when Labour is contributing to the defeat of the Common Enemy?

The Industrial Triple Alliance, already mentioned in this REVIEW, has asked Mr. Asquith to give hearing to a deputation which desires to discuss with him problems concerning demobilisation and Labour. This Alliance represents the miners, the railway men, and the transport workers. Mr. Asquith has signified his willingness to listen, but is too occupied at present. The time seems hardly ripe for giving more assurances, but the Premier will well know how to say nothing too strikingly committal if the hour of the interview is premature. Anything more in the way of war-time promises or assurances will be ill-advised save under stress of the utmost national emergency, and Labour, in its best and most representative parts, if we read correctly, is unwilling to be so unpatriotic as to hamper the Forces at the Front, and the cause of Justice and Freedom, at this very stirring and critical moment of the war. In closing a leading article on the Advance in the West, *The Times* truly says: "Did they but know it, the munition workers of this country hold in their hands during the next few months the fate of Europe and of civilization."

The Lord Mayor of Birmingham, Alderman Neville Chamberlain, who has in several utterances shown that in his opinion the interests of Labour must be adequately considered in connection with any new industrial efforts, delivered an interesting speech bearing on the point of "promises," last month. He was alluding to the co-operation of Capital and Labour for the successful prosecution of the war, and he added, according to a Birmingham report, "Labour had relaxed trade union rules, and the promise had been given that after the war those rights would be restored. He did not believe the promise could be kept, though he was quite certain that those who made it intended, and still intended, that it should be kept. To his mind, we could never revert to the exact conditions that prevailed before the war. The problem was to find some

substitute for the promise that had been given to the workmen—that it might be kept in the spirit, if not in the letter The present unequal distribution of wealth, which was to so many a stumbling block, could not be redressed in a day. If the whole wealth of the country were confiscated to-day, and divided so as to give every man an equal share, by to-morrow that equality would disappear. But it did seem to him that, if the men were ready to recognise that after the war of armies there was going to come an economic war, in which we should require all our energy in all parts of the nation, and were going to see that the best was got out of the machines, they were entitled to ask and receive from the employers a larger share of the profits which both contributed to make." Alderman Chamberlain put in a plea for consideration to be shown to organised Labour. Subject to certain restrictions, he would support a considerable extension of the minimum wage, so that every man should have the opportunity to live in decency and comfort. With unrestricted endeavour on the part of the workmen, and a larger remuneration paid by the employer, we should have no wallowing in the slough of depression after the war, but should enter upon a period of prosperity unexampled in history.

Shall we be excused if we remember at this interesting point the serious unwillingness of a section of Labour to do its best even in time of gravest national emergency? To Alderman Chamberlain's excellent bargain there must be two parties; and if the workmen fail in the fulfilment of their part, how can the industries of the nation be safeguarded—paying higher wages, and getting a half-hearted or limited output wherewith to raise them?

The Lord Mayor of Birmingham knows national industrial affairs, and he must see how necessary it will be for this part of the bargain to be most plainly understood by Labour. Among the regrettable pieces of slacking that one reads about in the newspapers in these days of well-paid labour are such reports as this:—"At a Munitions Court at Northampton, it was stated that 489 men employed by one firm had lost 11,281 hours in four weeks"—23 hours per man! And those men at Vickers's works must have lost in all at least 300,000 to 400,000 hours of useful national work!

The Chief Inspector of Mines in these days finds it necessary to receive a Trade Union deputation urging the establishment of an eight-hour shift for winding-engine men, but he has to reply that he fears it cannot be arranged during the war. The Bristol Annual Conference of the boot and shoe trades is advised by its president that the time is coming when Trade Unionists will have to insist that no orders shall be given by Government Departments to firms that do not employ at least 50 per cent. of Trade Unionists. Such is the deplorable atmosphere even in these perilous days of war!

Mr. A. D. Steel-Maitland, M.P., Under-Secretary for the Colonies, in speaking last month at Birmingham University on "The Labour Situation After the War," had no solution of the problem to offer, but suggested that the nation which could readjust itself quickest would have the best "look in." In putting an end to Prussianism between the nations we must see that it did not recrudescence in our own domestic life. He referred to the fatalistic feeling among large employers and secretaries of Trade Unions that we were "going to have an awful time in industry after the war." He thought that instead of allowing that feeling to exist, we ought to spread the idea that, as a community, we would not have it. When the war ended Government orders would mostly stop, and the Labour market, instead of being lightened by men taken off, would be depressed as they came back. Against that there were several factors all to the good. In the first place, there would be a great private demand for articles which, quite properly, had not been put forward during the war. This showed how important it was to postpone spending money now, reserving it for purchases after the war. Then there was the foreign trade, and it all depended how quickly we got to work again. Lastly, there was reconstruction work in Belgium and Serbia. In many cases departments were short-handed; in certain districts they had only 75 per cent. of the men they could use, and so many firms could take men without displacing anybody. On the other hand, where men and women had been drafted into districts the claims for rein-

statement that after the war would lead to displacements. These men, however, industries closed down for lack of business, it is not possible to find considerable employment for them when they came back. Of course, other industries would have to take them well. Everything should be done for the men who were so disabled that they could not return to their former occupations. There was some likelihood of men being stricken on the land, and that would greatly relieve the industrial situation. He did not think that with peace there should be an immediate cessation of Government orders; that might be a rather wise policy, as it was of greater disservice than it was worth. His feeling was that whether as a Government, a municipality, or as private individual, they should at once schedule the work that could be done, and be ready at the right time to give it out. This is a timely suggestion, and we believe that sheer necessity will compel municipal and other industrial undertakings to be prepared to place big contracts for work, plant, and maintenance now in arrears. Mr. Steel-Maitland said he thought there would have to be equal piece rates for the sexes. In this connection, we note that one of the Women's Labour Organisations was warned, at a meeting held in London last week, that there was a danger of a conflict between women now employed in industries and the men who would come back to those industries.

Mr. W. J. Davis (secretary to the Brassworkers' Society and treasurer to the Parliamentary Committee of Trade Union Congress), who presided over Mr. Steel-Maitland's meeting, said that the Labour Party had made, perhaps on speculation, sacrifices in their rules, such as the dilution of labour, and the giving up of rights and customs, to help the Government. They, therefore, expected statesmen to be as faithful to Labour as Labour had been faithful to them. "The Government," indeed? and what about the Nation, of which Labour is so large a part? Was not Prussian barbarism a menace to the Labour world and to the very existence of organised Labour?

A Reconstruction Committee of the Cabinet is sitting to consider and advise upon the problems that will arise on the conclusion of peace, and to co-ordinate work that has been done in this direction by various Government departments. Suggestions are being sent in which it is hoped will assist the Government in whatever after-the-war proposals it may develop. Apart from this Committee, we presume, steps have already been taken for bringing all trades engaged in the making of munitions and in other forms of war work, under the provisions of the National Insurance Act. The Bill, if it is passed, will come into force on September 4th.

The proposal is to bring under the provisions of Part II of the National Insurance Act and the amending statutes every workman (which, of course, includes women) who is engaged on or in connection with munitions work as defined by the Munitions of War Acts, except such classes of work as the Board of Trade may by order exclude, and every workman who is employed in the following trades:—

- The manufacture of ammunition, fireworks, and explosives.
- The manufacture of chemicals, including oils, lubricants, soap, candles, paints, colours, and varnish.
- The manufacture of metals and the manufacture or repair of metal goods.
- The manufacture of rubber and goods made therefrom.
- The manufacture of leather and leather goods.
- The manufacture of bricks, cement, and artificial stone, and 15 other artificial building materials, and
- Saw milling, including machine woodwork, and the manufacture of wooden cases.

The measure also applies the existing Acts to employers, while the Board of Trade will be given power under the new Bill to extend its provisions to any other trade or branch of a trade in which a substantial amount of munition or other war work is being carried on. So far as the measure imposes on employers and workmen a liability to pay contributions, it will cease to have effect at such date as the Board of Trade may by order determine, not being later than five years after the commencement of this Act, or three years after the termination of the present war, whichever of those dates may be the later; and, so far as it confers on workmen a right to receive benefit in respect of such contributions, it will cease to have effect at the expiration of six months from the date so determined, or at such later date as the Board may fix.

It is understood that about 1,500,000 additional persons will thus be insured against unemployment, and, according to Captain Pretymann, it is hoped that no liability to the State will arise, though if it does arise the State will be bound to meet it.

(To be continued.)

REVIEWS.

Wireless Transmission of Photographs. By M. J. MARTIN. London: Wireless Press, Ltd. Price 2s. 6d. net.

This book deals with a subject which is admittedly in its early experimental stages, but which is one of unusual fascination and importance. To have a photograph of an outbreak of fire in New York appearing in the London evening papers whilst the fire is yet raging on the other side of the Atlantic will be no mean accomplishment, and certainly one of journalistic importance. As yet it is impossible, but the author shows that the prospects of wireless transmission of photographs over long distances are very much more favourable than those of cable transmission. Difficulties will still have to be overcome, but they do not appear to be insuperable, and he would be a bold and foolish prophet who ventured to say that a wireless photo agency would not be at work within the next five or ten years. The author gives a very useful résumé of what has already been accomplished, and includes descriptions of ways and means which he has himself evolved by research in this field; the inclusion of this original and practical matter increases the value of the book to the reader who wishes to experiment on "radio-photography" (the term is the author's, but is not unexceptionable).

Whatever the details of the transmission system employed, the photo is transmitted and received in the form of a number of current impulses of varying duration and strength. These impulses are usually derived from analysis of the original picture into a number of lines or dots, and at the distant station the picture is reproduced by composition of similar lines or dots. The technique of this general process has so far advanced that satisfactory Press photographs (which are admittedly hardly studio pictures!) can be transmitted by wire between Paris and London. Where longer distances, and particularly where greater lengths of cable are concerned, the greater resistance, capacity, and inductance of the line much reduce the number of signals which can be recorded in a given time. A definite commercial limit is thus placed on the distance over which cable-transmission of photographs is practicable. Though other difficulties are encountered in wireless working, those of inductance and capacity limitations are absent, and it is in the field of long-distance transmission that radio-photography is most likely to be useful. After explaining these points, the author describes Bernocchi's and Knudsen's primitive systems for the wireless transmission of photographs, and then goes on to consider the requirements to be fulfilled by any system capable of being used in conjunction with existing wireless stations.

The only system of preparing prints which the author considers at all suitable for wireless transmission consists in photographing the original through a line screen and taking a print on zinc or lead foil by the bichromate process. It seems that a screen with 50 lines to the inch is about the first which can be used with present-day transmitting apparatus, and a 35-line screen is more suitable for experimental work. The author suggests several arrangements of style and table, &c., for use in obtaining current impulses in step with the gelatine lines on the prepared print. Here, as elsewhere, the author gives sufficient definite data to permit the reader to start his own experiments with a minimum of trial and error. The present limit of speed in transmitting a 5×4 in. picture, using a 50-line screen, is about 18 minutes, and this requires the style of the transmitter to make about 5,000 contacts per minute, and involves the use of very sensitive relays. It is not an easy problem to excite the aerial with definite, i.e., measured, signals at the speed implied by the above figures. The author states that a rotary spark-gap would be essential, and we believe he tends rather to under-estimate the difficulties which would arise in working with really heavy current.

The author describes various transmitting and receiving circuit connections, and gives notes bearing on the suitability of each for the present purpose; naturally, these notes are not very definite in the present state of knowledge. The chapter on receiving circuits and apparatus is particularly suggestive as a basis for experimental work, and is probably the best treatment extant on this branch of the subject. The reader is left to devise his own mechanical details in most respects, and this is just as well, because the system which finally emerges as best will depend largely for its success on perfection of mechanical detail. In considering the measure of success which the author has secured (and, really, he presents quite a mass of definite data), we notice a general omission to specify under what conditions and over what distances the results were achieved. Presumably the distances were quite small, though, of course, this does not detract from the value of many of his results.

A useful chapter is included on driving and synchronising methods as applied to the transmitting and recording photodiagrams. Unless this gear be very accurate in action, the received signals cannot be assembled intelligibly. Incidentally, the author considers this fact to add to the possible military uses of radio-photography; but it is still very doubtful what is the precise military value of wireless telegraphy, and it would certainly seem an easy matter for an enemy to "jam" his opponent's wireless photograph signals if he could not, by running through various recorder speeds, manage to receive them intelligibly. The last chapter of the book is

devoted to a description of the author's "telephotograph" system of radio-photography, which includes an improved method of transmitting and receiving and an ingenious arrangement for synchronising the two stations. Only one machine is required at each station, and it is claimed that isochronism is maintained with a limit of error of less than 1 in 800. The whole represents "an attempt to produce a system capable of working commercially over fairly long distances," but no information is given concerning the distance over which working is actually or probably practicable with this system.

The book concludes with appendices devoted to the characteristics and construction of selenium cells, and to the preparation of metal prints by the line-screen and bichromate process. In the later editions, which we feel confident will be demanded, it would be a welcome addition to find specimens of photographs which the author has transmitted wirelessly, by means and over distances which should be clearly specified.

Telegraph Engineering. By E. HAUSMANN. London: Constable & Co. Price 12s. 6d. net.

This treatise presents a useful treatment of the theory and practice of overland and submarine telegraphy, representative examples being given of the methods and equipment employed. The book should be equally useful to students and as a work of reference for practising engineers. Naturally, the work bears traces of its American origin, but the essentially American matter is a very small percentage of the total, and we do not hesitate to recommend the book to readers engaged in telegraph work in this country. Dealing first with simplex telegraphy, the author discusses the use of relays, closed and open-circuit working, instruments used, and so forth. In this chapter, too, there are examples of the author's clear correlation of theory and practice, as, for instance, in the application of theory to the determination of best windings for instruments and the calculation of limiting signalling speeds. Close and clear correlation between theory and practice is a strong feature of this book, but mathematics is not introduced unnecessarily. In places, as, for instance, in the chapter on current propagation in line conductors, advanced and cumbersome mathematical working is unavoidable if any quantitative treatment at all is to be given to the subject. In such cases, however, the author does his best for readers who are unable to follow every stage in the mathematical exposition, by setting forth clearly the main results and their practical applications. In this way, and by aid of problems appended to each chapter, the needs of the "practical man" are very well covered.

Differential, polar, and bridge duplex systems and the apparatus involved are dealt with in Chapter II, circuits and *modus operandi* being described in detail, and the special advantages and difficulties of each system clearly explained. Quadruplex telegraph systems, apparatus, and operation are next dealt with along similar lines; duplex-duplex working and the phantopex system are included. Chapter IV is devoted to automatic and printing telegraphy, and includes detailed explanations (well illustrated) of the Wheatstone system, of "ticker" tape machines, and of the Barclay page-printing system, as well as brief mention of other printing systems. Chapter V contains a great deal of valuable information which is not usually easily accessible, relating to telegraph office equipment and traffic-handling methods and classifications. The earlier portion of the chapter is devoted to switchboards (power and telegraph), instrument tables, protective devices, and so on. Types of messages, tariffs, and other commercial matters are then discussed, and though the examples given are American, they still form very instructive examples for English readers. It is not everyone who knows that, according to the latest available statistics, the average cost per telegram is least in Luxemburg and highest in the U.S.A., whilst the yearly telegrams per capita are highest in New Zealand and lowest in Russia; the telegraph development of New Zealand is phenomenally high.

Another interesting chapter is that on miscellaneous telegraphs, in which the author deals with multiplex systems, the Murray telegraph, the Pollak-Virag high-speed system, telewriters, telephotography and television, as well as military induction telegraphs (U.S. Army equipment). Chapter VII, on municipal telegraphs, relates chiefly to fire alarm telegraphy; various systems are dealt with and some interesting statistics are presented, but a number of half-tone illustrations in the chapter do not convey much to the reader. (How is it, by the way, that half-tones are wretchedly poor in so many otherwise splendidly produced American books?) Railway signalling systems deserve, and receive, a chapter to themselves, but a good deal of the matter in this chapter is not directly applicable to this country, though it is distinctly within the field with which the British engineer should be *au fait*. The same remark applies, to some extent, to Chapter IX on telegraph lines and cables, wherein there are some useful tables and some very instructive notes on wire span and economical span length, earth returns, elimination of inductive interference, and simultaneous use of lines for telegraphy and telephony.

The theory of current propagation in line conductors and submarine cables inevitably involves difficulties in treatment, but the author has prepared an excellent exposition on the subject, and readers acquainted with the calculus will find

Chapter X and the beginning of Chapter XI in this book particularly helpful. The later portion of Chapter XI is devoted to the methods and equipment of submarine telegraphy. The Picard system and the Gott method of signalling are described, and there are useful notes on duplex cable telegraphy and sine-wave signalling. Two other sections which deserve special mention are the analytical treatments of signalling speed on cables and the design of submarine cables. The notes on types of cable service and tariffs are uniform with those previously given for land lines. Tables of pertinent mathematical data are given in the appendix, and altogether this volume constitutes a sound, modern treatise quite justifying and realising the aims of its author.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY do not appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

60-cycle Transformers on 25-cycle Systems.

Having written my letter in haste, I failed to mention that, when the primaries are divided into two parts and put in parallel, three transformers are necessary. By connecting the primaries in series across the supply, each transformer receives 333 per cent. of the supply voltage, or, in other words, 66.6 per cent. of the voltage the transformer is connected up for. Although the voltage in this case is only reduced 33.3 per cent. against 50 per cent. reduced frequency, it will be found that almost all 60-cycle transformers will operate quite well on 25 cycles, it used in this way. Regarding the output of the transformers, two-thirds full load will be a good average, but in some cases full load will be possible.

Middlebrough, July 8th, 1916.

W. D. Lovell.

"Electric Wiremen's Work" Examinations.

We notice that at the annual general meeting of the Electrical Contractors' Association, Mr. W. R. Rawlings referred to his appointment as Examiner in "Electric Wiremen's Work" for the City and Guilds of London Institute, and to the fact that at present no more than 25 per cent. of the enrolled students attend the examinations.

We do not think this is so much the fault of the examinations as of lack of proper tuition and of facilities for the same. There is proof of this in the fact that—compared with the electrical engineering subjects—a mere handful of people take up electric wiring. The reverse ought, of course, to be the case.

Whatever views one may have on the scope of past examination papers, it must not be forgotten that the inclusion of the subject "Electric Wiremen's Work" in the C. G. Syllabus was largely due to the efforts of the resigning examiner—Mr. Frank Broadbent; and the profession and trade are heavily indebted to him for that, and for his subsequent work.

We gather from the report of the meeting that Mr. Rawlings is going to give us something fresh in the way of examination questions, and that the latter will tend more to the practical than to the theoretical side of the subject.

While that is good news, we should like to point out that unless the methods of tuition are radically overhauled beforehand, there will not be any more grist for the mill than there has been hitherto.

As the Electrical Contractors' Association are so closely concerned with the matter, they should certainly make themselves and their wants known to those in charge at our technical institutes all over the country, some of whom hardly recognise the existence of the subject of "Electric Wiremen's Work."

London, N., July 5th, 1916.

A. P. Lundberg & Sons.

Electric Fans for Military Hospitals.

In this world-war France is to most of us the chief centre of interest, and we are apt to overlook the fact that we are fighting in other and much worse climates than France.

This has been brought to my notice very strongly by a lady, with an intimate knowledge of the East, who wished to send some electric fans to Bassora, on the Persian Gulf, for hospital use, and the need of these will be well understood when it is stated that the temperature rises to 120°, with a still, steamy heat. Unfortunately, she had not been informed what the pressure was, nor whether the supply was continuous or alternating. At first I advised her that the best thing would be to send 100-volt continuous, but afterwards we came to the conclusion that, seeing that most of the supplies are sent from Bombay, it would be much safer for her to send her money there and have the fans sent on. This has, therefore, been done.

This lady was connected with the nursing profession, and informed me that at Alexandria and several other places which are subject to great heat, the supply of fans is totally inadequate for hospital use, and seeing that the weather in this country is more fitted for radiators than fans, it occurs to me that there must be a great many fans in this country belonging to firms in the electrical trade who would be glad to give these to relieve the discomfort of our brave men in hospital in tropical climates.

Before doing anything, however, some knowledge would have to be gained respecting the different systems of supplies at different places. I understand, on inquiring from several manufacturers of fans, that there is no particular shortage in the country and one can hardly think but that the military authorities would ask for whatever they wanted in this line. Whether they do or not, the fact still remains that I have a customer who is making a present of fans to a hospital, and alleges a very serious shortage of these, so the sooner this is looked into the better, as I understand the extremely hot season will be on about the end of July and the beginning of August—this referring, of course, to the Persian Gulf.

My object in writing this letter is, first of all, to see if any information can be gained regarding the different electricity pressures at hospitals in these tropical climates; and, secondly, to see if the only reason for the lack of supply is because they have to be paid for, whether it is not possible to have suitable fans donated by different electrical engineers throughout the country. I personally have several in stock that I have no use for, and would gladly give, but the business is to find out whether they are any use at any place, as it is obviously no use sending a hospital supplied with 100-volt continuous current a 200-volt alternating-current induction fan.

Trusting this letter will elicit some information of service

R. FALSHAW.

Harrogate, July 10th, 1916.

Decimal Coinage.

Mr. Bridges and the writer of last week are both right. The centime is not now to be seen in France except in Government cash departments, where it is, perhaps, used for accuracy, but more out of old custom than anything else.

To the ordinary Frenchman the centime is "an imaginary coin." He counts it, and pays it in multiple, but never sees it.

I have not seen one in France for 40 years. I believe they have long ceased to be minted.

C. L. VIENT

(Francois de Paris).

London, S.W., July 8th, 1916.

Will you permit me to again encroach on your valuable space, that I may thank Monsieur le Secrétaire de la Compagnie des Câbles Sud-Américains for his information re the French centime?

I am quite familiar with the French coinage system, and for several years have made up my accounts to a centime. But never in England or in France have I had the good fortune to set eyes on one of these coins.

Monsieur le Secrétaire will notice that my reference was to modern currency. I was careful to avoid stating that the centime piece had never existed.

I am indebted to Monsieur le Secrétaire for his note: will he further honour me with a personal communication—either in French, English, or Esperanto—with a view to my securing a specimen of this coin from the Government offices ere they disappear? We, too, once had our Spade guinea, Lion shilling, four-penny piece, and half farthing; but while these are still legal tender, they are fast gravitating into the hands of avid collectors.

Alfred Bridges.

London W., July 5th, 1916.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Electric Hammer.

Fig. 1 shows an electric hammer manufactured by the ELECTRO-MAGNETIC TOOL CO., LTD., and sold in Canada by R. E. T. Pringle, Ltd.; the hammer delivers from 1,000 to 3,000 blows per minute.

It is equipped with a Universal motor to operate on D.C. or A.C. (any cycle from 25 to 60), and supplied for either 110 or 220 volts. It weighs 27 lb. *Gen. Electrical News.*

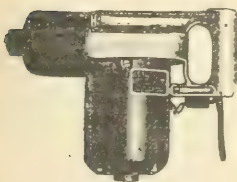


FIG. 1.—ELECTRICALLY-OPERATED HAMMER.

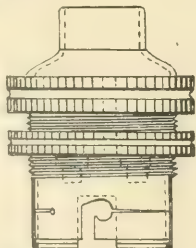


FIG. 2.—"ECONOMY" ANTI-VIBRATION LAMPHOLDER.

Anti-Vibration Lampholder.

A new type of anti-vibration holder for metal-filament lamps used on ships, trains, tramway cars, and where there is considerable vibration, has been brought out by Mr. J. H. Collis, and is being put on the market by MESSRS. EDISON & SWAN, MCGEOCH & CO., and VERITYS LTD. The arrangement is shown in fig. 2.

From the supporting sides of the slots in the ordinary socket, circumferential slits extended partly round the barrel, thus allowing a certain amount of springiness in the support.

A brass ferrule is fitted over the barrel to mechanically protect the spring part of the holder, and the arrangement is claimed to allow the lamp to roll slightly in any direction, and thus take up vibrations which would otherwise be transmitted to the filament.

G.E.C. Turbo-Alternator-Converter Installation.

In order to avoid the difficulties incidental to the construction of high-speed direct-current turbo-generators, Mr. H. M. Hobart advocated the installation of turbo-alternators driving rotary converters coupled direct electrically.

The GENERAL ELECTRIC CO., LTD., of London, has installed plant of this type at the works of Messrs. Fraser & Chalmers, Ltd., of Erith, at very short notice. The installation consists of a 1,500-kw. generating set, composed of a Fraser & Chalmers turbine, running at 3,000 R.P.M., and driving a "Witton" six-phase turbo-alternator, generating three-phase power at 325/370 volts 50 cycles. This unit is coupled electrically to two 750-kw. "Witton" rotary converters, running at a speed of 500 R.P.M. and generating continuous current at 440 volts, which is controlled by a "Witton" switchboard.

The two rotary converters operate in parallel from one winding of the turbo-alternator, and, as is well known, unless precautions be taken in such cases, trouble is met through the two converters being connected in parallel on both the A.C. and the D.C. sides. In the early days of rotary-converter operation, it was found impracticable to run two rotary converters off the same transformer.

Where transformers are used, they may be provided with two or more separate windings, each supplying one rotary converter. The same solution may be adopted in the case of generators, but it is

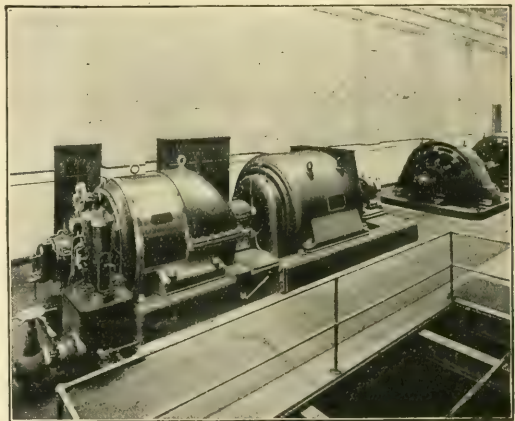


FIG. 3.—1,500-KW. "WITTON" TURBO-ALTERNATOR AND "WITTON" ROTARY CONVERTERS.

not always desirable to split up the generator winding into two or more parts. The two windings have been eliminated in a method (Patent No. 11,905/13) introduced by the General Electric Co., Ltd., and the present installation operates on this principle. Differentially wound balancing transformers are installed in the low-pressure A.C. leads of the rotary converter, as shown in fig. 5. These balancing transformers are inserted in each of three of the leads from the converter, as shown in the diagram. They consist of two oppositely-wound windings on the same cores. The alternating current supplying one phase of one converter is passed through one coil of the transformer, while that of the same phase for the other converter is passed through the second coil. Consequently, when the currents are equal, their effects cancel out, but should one converter attempt to take more than its share of the load, the excess current magnetises the core and induces an electromotive force in the other winding, which assists the current flowing therein, and tends to cause it to increase until the two currents flowing are again equal. In this way the loads taken by the rotary converters are equalised.

Any number of rotary converters can be coupled to the generator and run in parallel on this principle, and, if necessary, it is possible to take part of the generator output in the form of alternating current, for transforming up and distribution at a suitable pressure to outlying districts. In the present installation, as in others on this principle installed by the General Electric Co., Ltd., the rotary converters are started up with the turbo-alternator, and run up to speed with the machine. No synchronising is therefore required. The arrangement offers a completely satisfactory solution to the

problem of generating continuous current at a low power cost by means of turbines.

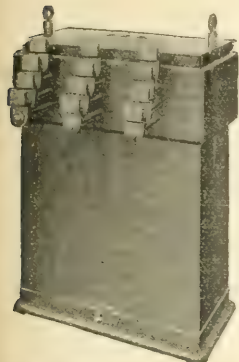


FIG. 4.—ONE OF THE BALANCING COILS.

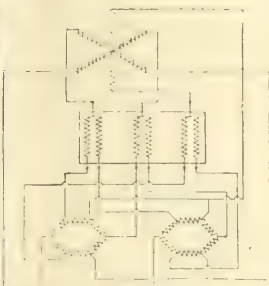
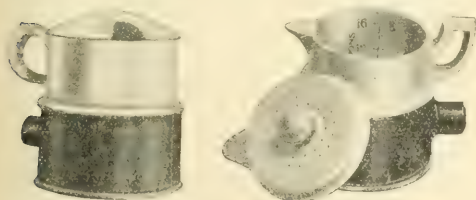


FIG. 5.—ARRANGEMENT OF BALANCING COILS IN THE ROTARY CONVERTER LEADS TO PREVENT CROSS CURRENTS.

The complete electrical installation was supplied by the General Electric Co., Ltd., of London and Witton, Birmingham.

Ediswan Hosgood Utensils.

The EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., of Ponder's End, is manufacturing a range of Hosgood stoneware electric utensils at Ponder's End. These devices are inexpensive and adaptable to many purposes: the essential principle of their construction is that the lower part of the vessel is surrounded with a



FIGS. 6 AND 7.—EDISWAN HOSGOOD BOILING MUG AND FOOD WARMER.

heating element protected by a metal jacket, and fitted with a plug-like cap of a glow lamp, which can be mated with a lampholder on a flexible cord. We select for illustration a one-pint, one-heat boiling mug, and a food warmer holding half a pint, with a graduated scale of tablespoons and fluid ounces inside, from a list of nine utensils. Being self-contained, these devices are very handy and can be used wherever there is a lighting circuit.

LEGAL.

MUNITIONS CASES.

THE Manchester Munitions Court on Friday last heard a case in which a parcel messenger boy, employed by the tramway department, complained that a leaving certificate which he desired had been unreasonably withheld. He said that he would be 16 years of age in December, and he desired to become a fitter's apprentice in a munition works.

Mr. J. M. McELROY (general manager of the tramways) said the tramways were certified as a munition works, and the parcel department was an important branch of the concern, largely used for the transport of small parts of munitions. The parcel department had to be run almost entirely by boys now, as practically all the adult male staff had joined the Forces. This case was in the nature of a test case, and if the application succeeded other boys would leave the service.

The CHAIRMAN suggested that the boy should be allowed to leave in November, when possibly his services in the tramway department would not be needed so much as now, and when it would still not be too late for him to become an apprentice to a trade.

Mr. McELROY agreed to this, and the claim was formally withdrawn.

At Oldham Munitions Court, last week, a switch fitter and maker of electric starters applied for a leaving certificate, and said he could get more profitable employment nearer his home.

The CHAIRMAN said the youth had made out no case, and the application would be refused. As an apprentice he was receiving a fair wage for the work he did.

Another man, aged 30, employed by the same firm, asked for a leaving certificate, and declared that when he started for the firm he was told he would be taught acetylene welding, and would be getting two guineas a week at the end of six months. At the end of two months he was put on general labouring at 27s. a week.

A representative of the firm said the Union men on acetylene welding refused to teach anyone else the work.

The Tribunal held that the agreement entered into by the firm had not been carried out, through no fault of the firm, owing to certain difficulties, and under the circumstances they decided to grant a leaving certificate.

WM. BATES, SONS & CO. v. W. & R. K. REE, LTD.

In the Chancery Division, on July 7th, Mr. Justice Neville concluded the hearing of an action by plaintiffs, manufacturers of cloth-finishing machinery, of Sowerby Bridge Mills, against defendants, of Manchester, for an injunction to restrain the defendants from obstructing the flow of the River Calder and for damages. Plaintiffs' case was that Messrs. Ree, by their new works at Lock Hall Mills, Sowerby Bridge, had obstructed the flow of the Calder, and thus reduced the power obtainable by the plaintiffs' electrical plant and materially reducing their output. It was alleged by the defendants that the rise in the river complained of was not due to defendants' works, but to debris from buildings destroyed by fire which had fallen into the river.

His LORDSHIP said he was not satisfied by the evidence that the obstruction complained of was due to the defendants' works, and dismissed the action, with costs.

ALBERT LEE & CO. v. SWINDEN & CO.

In the Chancery Division, Mr. Justice Petersen heard a summons in this action to determine whether the defendant company were or were not partners with one Albert H. Davies in a venture known as the Essex Battery & Manufacturing Co.

It appeared from the statement of counsel that Davies was in possession of a secret process for the manufacture of dry-cell batteries, and he approached the defendants with a view to putting the batteries on the market. They agreed to finance him to the extent of £200, with which he was to start in business at Ilford, or some other suitable place. The business was to be carried on as the Essex Battery & Manufacturing Co., Ltd., and was to be for the manufacture of batteries in accordance with the secret process, and other electrical appliances and accessories as the parties might from time to time agree. The business was, however, not to be extended without the defendant company's consent, and by the agreement under which they lent the money, it was to be paid into a bank and all cheques were to have the signature of one of their officers. The money was to be a first charge on the business, but the agreement expressly stated that it was not to constitute a partnership. The sole question on the present summons was whether such an agreement constituted a partnership so as to make Swinden & Co. liable for the debts of the Essex Battery Co.

His LORDSHIP held that the agreement did not constitute a partnership, and made a declaration to that effect, dismissing the summons, with costs.

PRITCHETT & GOLD & ELECTRICAL POWER STORAGE CO., LTD., v. THE HAMBLE RIVER LUKE CO., LTD.

The Court of Appeal (the Master of the Rolls and Lords Justices Pickford and Warrington) heard an appeal by the liquidator of the defendant company from a judgment of Mr. Justice Sargent concerning the property in a storage battery. The case has been reported in our pages.

Mr. MARK ROMER, K.C., who appeared in support of the appeal, said that the result of Mr. Justice Sargent's decision was that the plaintiffs would be paid in full, and would not have to prove in the liquidation in competition with the other creditors of the defendant company, which he (counsel) submitted was their only right.

Mr. GRANT, K.C., in support of the judgment of the Court below, contended that the property in the battery passed on delivery at the place where the work was to be done.

The hearing concluded on Saturday, July 8th, when their Lordships allowed the appeal, and reversed the judgment of the Court below.

Petrol for Stationary Motors.—Although the Petroleum Supplies Committee of the Board of Trade is introducing a system of permits or tickets for the supply of petrol for use in motor vehicles, we learn that no permits will be required as regards the spirit necessary for stationary engines, such as are used for lighting purposes.

ADJUSTABLE-SPEED POLYPHASE INDUCTION MOTORS.

One of the chief difficulties still remaining in the application of a squirrel-cage induction motor, more particularly in the case of polyphase machines of considerable size. To meet this difficulty a new type of variable-pole machine has been developed, in which every polarity can be used, thus rendering available a number of different speeds which is ample for almost all purposes.

The new motor, which is built under Mr. F. Creedy's patents, is identical in construction with the squirrel-cage induction motor, but has a drum-wound stator or primary, which is divided into a number of sections which can be connected in either "mesh" or "star." From each section a terminal is brought out, which connects through a suitable controller to a phase converter, consisting of a specially wound three-phase squirrel-cage motor, the function of which is to convert from the 2- or

tripled, and the motor will operate with 6 poles, and so on. In all cases, if the number of sections is properly chosen, one converter terminal goes to one, and one only, of the motor terminals, so that all terminals of both apparatus are in use on every polarity. By the use of a machine operating on these principles the following advantages are secured:—

1. Variable-speed machines can be supplied in all sizes up to the very largest without incurring commutating troubles, and, in fact, without departing from standard induction-motor practice.

2. The well-known advantages of the standard induction motor are retained.

3. Although more terminals and wiring are used than in single-speed 3-phase motors, the wiring is correspondingly reduced in section, so that the total cross section of copper in the wiring is exactly the same as in a standard machine, and thus has only half the section required for a 2-speed machine, with 2 separate windings.

4. The whole of the stator winding is always in use, so that there is no dead copper on the stator, as in the 2-speed motor just mentioned.

5. It is possible to offer a large number of steps in speed,

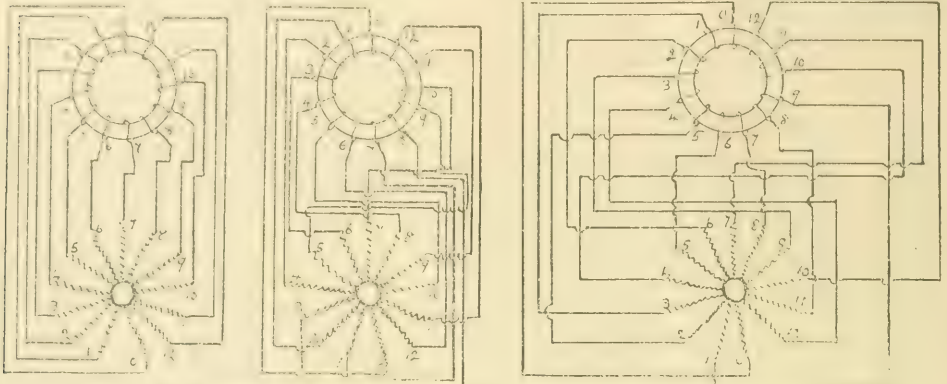


FIG. 1.—CONNECTIONS OF CREEDY MOTOR AND PHASE-CONVERTER FOR 2, 4, OR 6 POLES.

3-phase line current, to a number of phases equal to that of the sections in the motor winding. By the use of this phase converter and a suitable controller, it is possible to vary the phase difference between adjacent sections of the stator winding in such a way as to produce any desired polarity. In fig. 1 is shown such a winding, having 13 terminals connected to a phase converter, giving 13 phases, in such a manner as to give 2, 4, or 6 poles. If every terminal of the motor is connected in order to the corresponding terminal of the phase converter, the phase difference between the adjacent sections of the motor will be the same as that of adjacent sections of the phase converter (that is, 360 divided by 13 in the case shown), when the motor will operate as a bi-polar machine. If the motor terminals, starting from a given point, are connected to every second converter terminal, the phase

difference between the sections will be doubled, and the motor will operate with 4 poles. Similarly, if the motor terminals are connected to every third phase-converter terminal, the phase difference between adjacent sections will be

tripled, and the motor will operate with 6 poles, and so on.

In all cases, if the number of sections is properly chosen, one converter terminal goes to one, and one only, of the motor terminals, so that all terminals of both apparatus are in use on every polarity. By the use of a machine operating on these principles the following advantages are secured:—

1. The difficulty as regards starting squirrel-cage motors is completely overcome, so that 3-to-1 speed range machines, of the squirrel-cage type, can be guaranteed to start at full-load torque, with not exceeding twice full-load current.

2. As compared with D.C. variable-speed interpole shunt motors, the motor is capable of giving the same torque at all speeds, and consequently power proportional to the speed, whereas a D.C. motor can only give its full torque on the lowest speeds, since at all speeds above this the field has to be weakened. As a result of this, the D.C. motor will give no more power at the highest speed than it will at the lowest, whereas the characteristic of almost every type of industrial apparatus is such as to require a constant torque at all speeds, and therefore a power proportional to the speed. It will be seen, therefore, that the natural characteristics of the motor correspond much more closely with those of ordinary industrial machinery than do the characteristics of D.C. motors.

In an equipment recently completed, the motor, which is shown in fig. 2, has a massive cast-iron frame, which forms the base, supports the bearing brackets, and holds the stator punchings, which are hydraulically pressed in and keyed on.

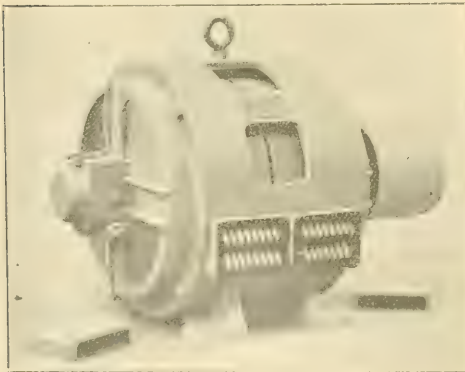


FIG. 2.—CREEDY ADJUSTABLE-SPEED POLYPHASE INDUCTION MOTOR.

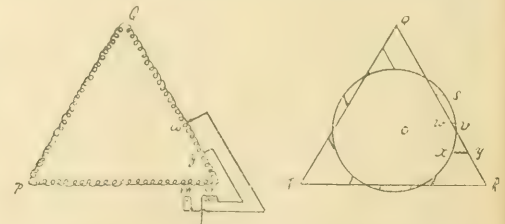


FIG. 3.—DIAGRAM OF PHASE-CONVERTER.

difference between the sections will be doubled, and the motor will operate with 4 poles. Similarly, if the motor terminals are connected to every third phase-converter terminal, the phase difference between adjacent sections will be

tripled, and the motor will operate with 6 poles, and so on. In all cases, if the number of sections is properly chosen, one converter terminal goes to one, and one only, of the motor terminals, so that all terminals of both apparatus are in use on every polarity. By the use of a machine operating on these principles the following advantages are secured:—

exactly similar sections, there being in the case described two coils per section. One end of each of these sections is brought to a common star point, while the other is taken to a terminal mounted on the stator frame. The rotor consists of laminated steel disks, mounted on a spider, exactly as in a standard machine, and carrying a squirrel-cage winding of normal type. The bearings are of the journal type, lubricated by oil rings. Thus it will be seen that the motor differs from a standard induction machine in no respect except in the terminal block and the connections thereto. In fact, comparing the 6-speed machine we are describing with a standard drum-wound 3-phase machine, having, say, 10 poles, thus giving a speed midway between the highest and lowest speeds of a variable-pole motor, we see that such a machine will have 30 sections or groups in its stator winding, as against 31 in the variable-speed motor, these sections being interconnected

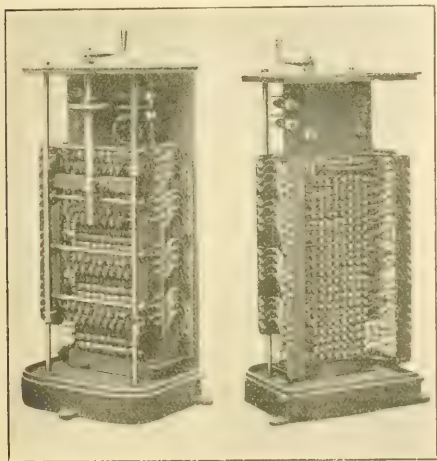


FIG. 4. FRONT AND BACK VIEWS OF PHASE CONVERTER. COVER REMOVED.

among themselves, so that only 3 or 6 terminals need be brought out, while in the variable-speed motor no such interconnections exist, but each section of the winding is brought out to a separate terminal.

The phase converter consists of a mesh-connected 3-limbed 3-phase auto-transformer, the coils lying on each limb being tapped at a number of points and connected to a secondary wound on another limb, in the manner shown diagrammatically in fig. 3, where, for instance, wy is a section of the main 3-phase winding of the converter, while wv and xy are secondaries, the manner in which they are connected being more clearly shown on the left. Fig. 3, of course, shows a 3 to 13-phase transformation, but in the case of the 3 to 31-phase transformation that we are discussing, two of the coils on the 3-limbed transformer are divided into 10 sections each,

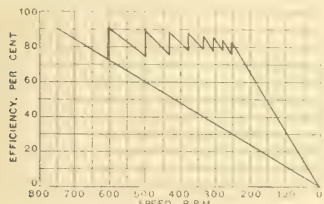


FIG. 5.

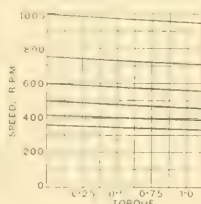


FIG. 6.

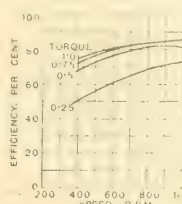


FIG. 7.

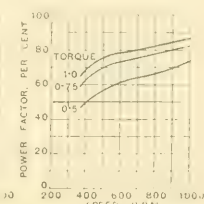


FIG. 8.

TEST CURVES OF CREDDY ADJUSTABLE-SPEED MOTOR.

while the third has 11 sections. Each of these sections is wound and insulated separately, so that in the event of a fault occurring, only one section will need repair. Each section consists of a primary or thick wire portion, part of the mesh-connected 3-phase winding, and a secondary of thin wire, and very few turns, which will be one of the coils marked xy in the figure. Thus far it will be seen that the phase-converter is identical with a standard 3-phase transformer, since these are also, as a rule, sectionalised for the purpose of minimising self-induction. The terminals are arranged in three rows mounted on three cross bars, one situated above and parallel to each of the limbs. These terminals are connected alternately to such tapings as w and y , together with one end of the secondary coil, or to such terminals as v or x . These three cross-bars and the terminals mounted on them form the only special part of the phase-

converter. The size of the apparatus is about equal to that of a normal transformer to deal with 25 per cent. to 30 per cent. of the motor input. It is supported in a cast-iron oil tank, from which the wiring is carried by means of tubing.

Great attention has been paid to the design of the controller, which is claimed to have resulted in producing an article representing the very highest class of switchgear practice, and accomplishing its object with a maximum of simplicity and compactness. Externally, the controller (fig. 4) is arranged in the form of a standard drum-type controller, 36 in. high by about 15 in. square, with sheet-steel cover, mounted in the usual way. When the cover is removed, the controller is seen to consist of a rectangular piece of $\frac{1}{4}$ in. steel plate bolted to the C.I. head and base of the controller. On this plate are mounted a number of rows of studs, 8 in a row, insulated from the plate by porcelain bushes, $\frac{1}{4}$ in. long, each tested to 2,000 volts. By this construction, an ample creepage surface of at least $1\frac{1}{4}$ in. is ensured between adjacent studs, although they are only $\frac{1}{4}$ in. apart from metal to metal. Mounted vertically above, and parallel to the plate, are two circular polished steel rods or guides, which support the sliding carriage to which the controller brushes are attached. This carriage consists of two vertical steel angle pieces to which are attached the sliding bearings which surround the guides, and on which are mounted four horizontal brush-holder arms. These arms are parallel to the rows of eight contact studs mentioned above, and consist of round steel rods, insulated with mica, and mounted so as to be readily detachable for inspection or adjustment. On each of these rods are mounted eight cast-brass brush-holders, each carrying a phosphor-bronze brush, which is pressed into contact with the stud below by a spiral spring with screw and nut adjustment.

To each of the vertical supports which carry the brush-holder arms is attached a strip of insulating material, drilled for a number of bolts and nuts.

The brush-holder carriage is actuated by a vertical lead screw and nut, the nut being carried on a cross-bar parallel to the brush-holder rods, while the lead screw is turned by a crank handle on the top of the controller. It will be noted that two of the studs may be connected to different transformer sections, and hence a short circuit between them, such as might be formed when the brush moves from one to the other, would form a short circuit on the transformer, and therefore have very serious consequences. To avoid this, a special switch, known as a spark-diverter switch, is fitted above the main field contacts of the controller. This is actuated by a cam wheel, mounted on the lead screw, which also serves for "notching" purposes. These switches, which are arranged to break two out of the three line phases, consist of standard clapper switches, with circular carbon fixed contact, and copper moving contact, the fixed contacts being mounted by means of porcelain bushes on the steel plate described above. A notch is provided on the cam wheel, which engages with a roller attached to the two switches. When this roller lies in the notch, the switches are held in contact by means of a pair of spiral springs, and the motor is in operation. When it is desired to change from one speed to the next, the handle is turned, and this causes the roller to be forced out of the notch, which has the effect of lifting the two clapper switches and breaking the main circuit. A further motion of the handle moves the brushes from one set of studs to the next, and when a complete revolution of the lead screw has been made the roller falls into its notch again, thereby making the circuit, and the motor will operate on a different speed. An indicating arrangement, consisting of a

star wheel engaging with a pin on the lead screw, is also fitted.

The machine, as mentioned above, is a constant-torque machine, giving a power directly proportional to the speed, and operating at all speeds with a constant field strength; owing to this, the apparatus will absorb a constant magnetising current, whether running at high or at low speeds, and this is the main fact to be borne in mind in endeavouring to understand how the power factor varies with the speed. With constant power input, the power factor will be approximately the same, no matter what the number of poles. Ignoring small differences due to variations in efficiency, the power factor depends only on the load, and not on the speed. At low speeds, of course, it is impossible to obtain a high power factor, but this is due to the small output.

The machines absorb a constant amount of wattless cur-

ment and this is not greater than that absorbed by a standard motor having the same rating.

On every stop of the controller the speed is independent of the load, as with a shunt control D.C. motor. The efficiency is greatly improved, as compared with any other means of obtaining variable speed, on A.C. circuits. In fig. 5 is shown a diagram of efficiencies, in which a 9-speed motor is compared with a single-speed motor, controlled by rotor resistance; in machines controlled by rotor resistance, in spite of the reduction in the power taken by an apparatus at low speeds, there is no reduction in the power taken by the motor, the difference being wasted in the resistance, whereas in the variable-speed motor just described, the power taken by the motor is reduced in practically the same proportion as that taken by the apparatus.

The equipment has been very fully tested. Fig. 6 shows the torque plotted against the speed for all six settings of the controller, and illustrates graphically the wide range of speed and the close speed regulation between no load and full load.

Figs. 7 and 8 show efficiency and power-factor curves plotted against speed for cases in which the motor operates at full, three-quarter and half full-load torque. The full-load power factor varies from 85 per cent. at 1,000 r.p.m. to 70 per cent. at 425, and 63 per cent. at 375. Simultaneously, the efficiency varies from 85 per cent. at 1,000 to 76 per cent. at 425, and 72 per cent. at 375 r.p.m. The overload capacity varies from three times full load on the top speed to one and a half times full load on the lowest speed.

The machines, which are claimed to mark a great advance in induction-motor practice, are being manufactured and placed on the market by Messrs. F. Parkinson & Co., of Leeds.

WAR ITEMS.

Enemy Concerns Now and After the War.—In the course of a recent discussion in the House of Commons, a question was asked as to whether the Government intended to enforce the liquidation of the Deutsche Bank, the Dresdner Bank, the Direction der Discounts-Gesellschaft, and similar alien financial institutions shortly after the declaration of Peace, and to take steps to prevent such alien enemy financial institutions or their direct or indirect agents from carrying on any business in this country in future. Mr. Harcourt, who replied on behalf of Mr. Runciman, who is still away from the House, said that the institutions referred to in the question were at present prohibited under the law relating to alien enemies from carrying on any banking business in this country, except the completion of transactions entered into before the outbreak of war, so far as these transactions would, in ordinary course, have been carried through or with their London establishments. It would be premature to make any statement at the present moment as to whether and, if so, under what conditions, they would be allowed to resume business after the conclusion of peace.

Major Hunt asked why about 400 German firms were still allowed to do business in this country? Mr. Harcourt, in reply, said that the work of eliminating enemy interests in businesses carried on in this country was proceeding with all possible rapidity. It was proposed shortly to issue a statement showing the nature and extent of the work of the Board of Trade's Advisory Committee in this matter. Each case must necessarily receive close investigation in order that the injury to British interests might be minimised. In the meantime all the more important businesses not dealt with in the above manner had been placed under supervision, and steps were being taken to extend supervision to the remainder.

According to the *Times*, Sir J. Harwood-Banner asked in the House of Commons whether all British ministers in neutral countries had been instructed to notify British traders in those countries that the Government's policy of commercial reprisals against alien enemies in neutral countries, as formulated in the Trading with the Enemy (Extension) Act, was to be regarded as continuous and would not terminate on the declaration of peace. Sir E. Grey, in reply, said that the question would receive careful consideration in connection with the recommendations made by the Paris Conference.

In reply to a House of Commons question, Mr. L. Harcourt (according to the *Times*) said that the Advisory Committee appointed under the Trading With the Enemy Amendment Act, 1916, had investigated the businesses of 415 companies and firms, and it was anticipated that there might be somewhat over 200 additional cases for their consideration. Most of the important cases had already been considered by the Committee, and in view of the progress which had been made and the desirability of uniformity of treatment, he did not think it was necessary to appoint any further committee.

Trade Debts of Alien Enemies.—More than a year ago we called attention to the rather inchoate policy of the Government with regard to the very important question of the recovery of private British claims against, and pre-war debts from, subjects of enemy countries after the war. A manifesto now in circulation from the Employers' Parliamentary Association reminds us that, as regards trade book-debts in

particular, the position is still unsatisfactory. An answer given by the President of the Board of Trade only last month seems to indicate that British traders are merely expected after peace is made to pursue their own claims for themselves in the foreign law courts, regardless of the bankruptcies that may occur there. The Employers' Parliamentary Association urgently claims that the Government should make itself responsible for recovering what is due, and that no British debts to alien enemies should be allowed to be liquidated till the interests of British creditors have been adequately safeguarded. Since the Public Trustee now holds, as custodian, enemy property here to the amount of £131,000,000, while the total British property, including debts, in enemy countries is estimated at £200,000,000, our position is apparently a strong one. There can be no doubt that British traders have some ground for dissatisfaction at the indefinite character of the Government policy, so far as it has been yet disclosed on this point.—*The Times*.

After the War Trade in India.—At a meeting of the Indian Economic Society, Prof. V. G. Kale, of the Ferguson College, Bombay, opened a discussion on the subject of "Indian Trade after the War." In the course of the lecture he said: "Every scheme of Imperial preference that will be adumbrated for our benefit will have to be closely scrutinised and its weak points exposed. He submitted for consideration: (1) The volume of opinion, which is growing stronger every day in England and the Colonies as also in the Allied countries, seems likely to lead to a modification of the present Free Trade policy of Great Britain; (2) while imports coming from enemy countries will be penalised, those hailing from the component parts of the Empire will be encouraged; (3) the Allied nations will be treated favourably; (4) what are called the key industries of Great Britain will be supported by the State; (5) India and the Colonies will be called upon to give preferential treatment to British and Allied imports; (6) in the matter of exports, also, similar concession will have to be made; (7) as the bulk of our imports are British, there is no scope for further encouragement; (8) preferential trade will entail heavy loss of revenue to India; (9) our indigenous industries are not likely to benefit; (10) inter-Imperial free trade, therefore, is not a business proposition; (11) every scheme must therefore be closely examined and tested before it is accepted.—*Indian Industries and Power*.

A Reuter dispatch from Simla stated recently that the Government of India had promulgated an ordinance dealing with the liquidation of hostile firms, and the property of hostile persons, bringing legislation in India into close accord with the present state of English law. The ordinance follows the English Act closely with such modifications as local circumstances require.

The Engineering Trade After the War.—The Board of Trade announce that, in view of the wide range of the industries included within the scope of the Committee appointed to deal with the position of the iron, steel, and engineering trades after the war, and in order to expedite the inquiry, the President has decided to sub-divide the work of the Committee between two committees, dealing with the engineering trades and the iron and steel trades respectively. He has accordingly appointed the two following Committees:—

For the Engineering Trades.—Sir Clarendon Hyde (chairman), Mr. Arthur Balfour (Sheffield), Mr. A. J. Hobson, Mr. W. B. Lang, Sir Hallowell Rogers, Mr. H. B. Rowell, and Mr. Douglas Vickers; Mr. A. F. Ilsey, secretary.

For the Iron and Steel Trades.—Mr. G. Scoby Smith (chairman), Sir Hugh Bell, Bt., Mr. Archibald Colville, Mr. James Cox, Mr. James Gavin, Mr. George Mure Ritchie, Mr. Henry Simmers, and Mr. Benjamin Talbot; Mr. C. R. Woods, secretary.

Exemption Applications.—According to the "North Mail" (Newcastle-on-Tyne), at the Newcastle Military Tribunal three employes of the A.E.G. Electric Co. were applied for by the general manager, who stated that an official of the Board of Trade was now controlling the company. [It has since been ordered to be wound up.—Ed.] The business, which had its headquarters in London, was carried on solely in the national interest. "But you are a German firm," said Coun. Johnstone Wallace. This was not quite correct, said the general manager. The company was composed of British directors, and they had an entirely British staff. The only thing that might be against them was that the capital was provided by Germans a good many years ago. Mr. Wallace said he understood that 300 employes had left the firm. He wished to know where they were gone. A considerable number had joined other firms, and over 50 had gone into the Army, was the reply. Some had gone back to Germany, but not since the war broke out. They might have had a hint; they simply left the firm. Badges had been applied for, but were refused on the ground that the firm was not doing Government work. It was working for Government contractors, however, many of whom depended on the A.E.G. plant. The superintendent engineer was given conditional exemption, one was given two months, and the other was ordered to join up. The first-named was stated to be receiving £350 a year.

At the Doncaster Military Tribunal, a teacher of mechanical and electrical engineering at the Doncaster Technical School, and a member of the Society of Friends, was granted exemption till August 14th, after which date he must find work of national importance.

Before the Devon Appeal Court, an appeal by Chris. W. Cochran, electrical wireman with Messrs. Garnish, Leman and Co., of Barnstaple, was crossed out, he having been badged by the Minister of Munitions.

At Canterbury, Mr. Blaschek, city electrical engineer, appealed for F. Tapshfield, motor fitter and engineer, who has just joined the staff from Swansea. Mr. Blaschek said it would be absolutely impossible to get an older man to replace Tapshfield. Four months were allowed.

Coventry Tribunal has given conditional exemption to S. P. Golland, motor-man on the Corporation tramways, on the ground that he is in a certified occupation.

At Chester-le-Street, Mr. T. Taylor applied for a further three months' exemption for his electrician, aged 30, to enable him to complete contract work in hand, he being the only man left. The appeal was refused.

Hitchin Tribunal, on July 3rd, granted one month's exemption to A. B. Heyes (36), electrical engineer at a local cinematograph theatre.

At Herne Bay, renewed exemption was sought by Mr. A. E. J. Cressay, manufacturer of electric switchboards. He urged that he was engaged in work of national utility, but the appeal was dismissed.

At Dover, on July 5th, the Town Clerk applied for conditional exemption for Mr. E. D. Oxford (25), acting chief clerk of the electricity department. The two senior members of the staff are serving, and six months were recommended by the Advisory Committee. The Town Clerk said that Mr. Oxford was indispensable, and there were 1,500 consumers' accounts and 150 special ones to deal with, besides correspondence, interviewing new consumers, and dealing with complaints. The six months were allowed, with leave to renew the appeal if necessary.

Mr. E. E. Beaven, of Dartford, appealed for his electrical engineer, Mr. S. G. Wenham (23), whom, he said, he could not replace. Conditional exemption was conceded.

Two months have been allowed at Coalville to an electrician at a local cinematograph hall, who is doing Government work in the daytime.

At Warrington, Mr. H. Rogers, electrical engineer and contractor, appealed for an employé, aged 26, engaged in maintaining electrical plant at various works. The man had been starved, but this had been cancelled. A final month was allowed.

At Walton-on-Thames, Messrs. R. J. Rodd, Ltd., electricians, secured conditional exemption for two skilled employes.

Mr. A. Sheppard, electrical engineer, of Hertford, who holds a munition badge, has been totally exempted.

At Barnes (Surrey), Mr. F. H. Fiford, electrician, applying for exemption, said that if he had to serve he would have to close down the business and lose his book debts. He consented to join the Special Constabulary, and was given four months' exemption.

Conditional exemption has been given by Watford Tribunal to Mr. J. Ginger, accountant, and Mr. H. Pollard, collector of the electric light accounts, with the Urban Council.

Before the Herts. County Appeal Court, exemption was claimed by Mr. T. B. Daniels (21), electrical engineer, of Hertford, who possesses a munition certificate. Exemption was allowed so long as appellant remains in his present occupation.

Appellants at Woking included Mr. R. Staples, electrical engineer, who sought exemption for his son, Mr. A. R. Staples (30), the only one left to assist in the business, and who acts as medical electrician for Woking Nursing Home. The appeal was refused, and notice of appeal was allowed.

At Guildford, Mr. A. S. Massey (27), electrical engineer, of Ripley, asked for a month's exemption, as he was going on probation for that period in the Royal Flying Corps. As his partner was also serving, he appealed for his foreman, H. C. Hersey (31), to look after the business whilst he and his partner were serving. Both appeals were allowed.

At Leatherhead, conditional exemption was sought by Mr. A. H. Morris (32), electrical engineer, and local manager for Messrs. Buchanan & Curwen. He said that they had large contracts with the War Office, and were training several juniors in skilled work. He was exempted until the end of July.

Stowmarket Tribunal has given conditional exemption to an electrician and clerk (34) with a private electric light and power company, but refused appeals from an engine-driver (24) and an electrician (23).

Dalston (Cumberland) Tribunal have conditionally exempted I. Pattinson (40), electrical plant superintendent with Messrs. Jacob Cowe & Sons.

Maidenhead Tribunal has given exemption until October 1st to Mr. W. L. Chubb, assistant engineer and deputy manager for the Corporation electricity works, and Mr. W. H. Vevers, jun. (26), electrical engineer. Both are to join the Volunteer Training Corps.

Chatham Tribunal has given conditional exemption to 28 members of the staff of the Tramways Co., after military consultation with the manager, Mr. W. Jensen.

Southend-on-Sea Tribunal has refused exemption to an electrical engineer in business in Helygate Avenue, who stated that he had done much work for the military for lighting at Salisbury Plain and Waltham Abbey.

Conditional exemption has been granted to Mr. E. O.

Saxby, who has charge of the electric light plant at Belmont, near Faversham, the seat of Lord Harris.

Littleborough Tribunal has granted exemption until July 31st to H. Thomason (36), electrician at a local cinematograph theatre.

At Hyde, H. Dobson, electrician, employed by Messrs. E. Hibbert & Co., was granted conditional exemption last week. Taunton Tribunal have conditionally exempted Mr. A. A. Clements (36), electrician, whose entire capital is invested in his business.

At Weymouth, exemption was claimed for an apprenticed electrical wireman with Messrs. Brooking & Co. Appellant has two years more to serve under his indentures. Exemption refused.

The Bacup Tribunal, on Thursday last week, granted conditional exemption to an electrical engineer, aged 37, who is a widower with three children.

At Middleton (Lancs.), conditional exemption was granted to the chief storekeeper and clerk of the Middleton Electric Traction Co., who was stated to be responsible for the payment of wages and the receipt of money, and handled £25,000 per annum.

At Ashton, Herbert Underwood (31), electrician, of Minerva Road, said he was prepared to give three days a week to work of national importance. The Chairman jocularly remarked that the applicant might get good wages by laying telephone wires in front-line trenches. The appeal was disallowed, but applicant is not to be called up before August 31st.

At Stalybridge, last week, Mr. R. Blackmore appeared on behalf of the Joint Tramways & Electricity Board to appeal for exemption for 23 employes engaged as motor-men, car fitters, machine drillers, and car repairers. He said the average hours worked by all the tramway employes were 68 per week, and they were running the cars with 25 or 30 per cent. fewer men by using the car-shed staff. There was only one route in the district on which women car drivers could be employed, and although they had endeavoured to get women drivers they had not succeeded. They were running a winter service because they could not get sufficient men to run a summer service. Conditional exemption granted.

The Worsley Tribunal last week granted temporary exemption until August 31st to the principal clerk in the electrical department, and to an electrician, both employed at the Earl of Ellesmere's collieries.

At Southport, exemption until October 1st was granted to Mr. E. M. Lowe, electrician, of Birkdale.

At Pudsey (Yorks.), Mr. E. G. Beerman, electrical engineer, aged 26, who was born in the township and of naturalised parents, declared his sympathies to be with England, and was put back finally to September 1st.

The last remaining blacksmith of the Morley Electrical Engineering Co. was given conditional exemption until October 1st.

At Leeds, the appeal of an incandescent electric lamp company for a skilled engineer and fitter, on the ground that he was engaged importantly in developing a trade here which had previously been almost a German monopoly, was not allowed.

The electrician at Lunly Hall, Wetherby, responsible for the lighting and pumping plant, and the last man employed at the Hall, was exempted until September 1st.

At Shipley, the appeal of an electrical engineer, who pleaded that he was working under the Corporation in the construction of a military hospital, was postponed until October 1st.

At Todmorden, W. H. Gatley, electrical engineer, claimed that he should be left in the national interests, as he was the only practical man employed in this business in the town. His staff now consisted of one man over military age, two youths of 18, and a boy and a girl in the office. Formerly they had as many as ten men. Exemption granted.

An appeal was made at Winchester for an assistant mechanical electrician at the municipal electricity works, and the manager (Mr. Ayton) said that he could not guarantee to carry on the undertaking without his help. He took over all the boilers and attended to the economiser. The Military opposed, but the Tribunal gave exemption, holding that the man was in a certified occupation.

The Barford Electric Supply Co. appealed to the Warwick Tribunal for a fitter, considered to be indispensable. The Military considered that the man was only necessary to the convenience of a very few people, and that he was the very man needed for military work. Exemption was given until August 1st.

Graham Tribunal has given conditional exemption to seven employes of the Urban Electric Light Co.

Absolute exemption has been granted at Stockton-on-Tees to the treasurer and pay clerk of the Imperial Tramways Co., who have liberated 383 employes, seven of whom have been killed.

The Ross Electric Light Co. appealed to the Herefordshire Tribunal for Mr. C. E. Ray, resident engineer, and Mr. W. Maddy, engineer and electrical assistant. Both had been granted until October 1st, and the Court decided that an appeal should be made again to the Ross Tribunal before the period of exemption expires.

Beaconsfield Tribunal, on July 4th, granted two months' exemption to Mr. J. C. Bridger, electrical engineer.

Eastbourne Tribunal, on Monday, gave six weeks' final exemption to the chief electrician at Devonshire Park.

Bedford.—**LOAN APPLICATION.**—The T.C. has applied to the L.G.B. for sanction to loans of £2,390 for excess expenditure; £1,210 to cover the cost of extensions; and £1,300 for extensions to the works of Messrs. W. H. Allen, Son, and Co., Ltd., the latter firm paying a rental of £200 a year for the mains, &c., until required for public lighting, when the amount will be adjusted by agreement. An arrangement has also been made whereby the cost of an automatic pressure regulator at the works of Messrs. W. H. Robertson & Co., Ltd., will be met by the firm, and repurchased by the Council when the contract for which it is intended is concluded, at a depreciation of 25 per cent. per annum.

Bradford.—**YEAR'S WORKING.**—It has been announced in the T.C. that the net profit on the Corporation electricity undertaking for the past year was £159,899, as against £189,265 in the previous year. The total income was £167,022, and the gross profit £79,958. The cost of coal showed an increase of £12,055, but the other works costs, in total, were less, in spite of an increased output of 5,000,000 units.

Bristol.—**NEW PLANT.**—The Electrical Committee reports that it has reluctantly adopted the suggestion of the L.G.B. that, in view of the desirability of spending as little money as possible during the present crisis, a 3,000-kw. turbo-alternator should be put down for present time, instead of a 6,000-kw. machine suggested by the Committee, and agreed to by the Council in April, 1915.

Burnley.—**YEAR'S WORKING.**—The report of Mr. Starkie, the borough electrical engineer, on the last year's working of the electricity undertaking, shows an output sold of 5,158,074 units, a decrease of 36,000 on the previous year; power and heating increased by 31 per cent., but considerable reductions occurred in other directions, and notably in tramway supply. The maximum load was 2,561 kw., and the load factor 23 per cent. Altogether 570 motors, of 2,068 h.p., were connected to the supply. The net income from all sources was £33,190; the gross profit amounted to £14,315, and after meeting financial charges, the net profit was £4,472 against £6,022 in the previous year, the falling off being accounted for by increased works costs and financial charges.

Canada.—The Shawinigan Water and Power Co. is issuing new capital, which it is stated will be used for the construction of a transmission line to Quebec consequent on the acquisition of the Dorchester plant, the purchase of the Gres Falls water power, and extensions of companies dealing with carbide and electro-metals, in which the Shawinigan Co. is interested.

The Vancouver (B.C.) City Council has approved a new three-year contract with the B.C. Electric Railway, under which the existing arc lamps will be replaced by nitrogen-filled tungsten lamps. These new lamps will be in 600, 400, and 250-c.p. sizes, and the saving by their use is estimated at \$6,000 per year. The rates to be charged—viz., \$38, \$35, and \$33 per annum respectively for the three sizes—are considered very low. About 2,000 arc lamps will be replaced.

Colchester.—**YEAR'S WORKING.**—During the year ended March 31st last, the electricity department made a gross profit of £6,087, and, after meeting customary financial charges, a net deficit of £881 remained. It is proposed to slightly advance the price of electricity.

Coventry.—**REVISED PRICES.**—The T.C. has decided to regulate the price of current for power by the average price of coal; increased charges will be made, varying from 2 per cent., with coal at 13s. 6d. to 14s. 6d. per ton, to 16 per cent., with coal at 20s. 6d. to 21s. 6d. per ton.

Dawlish.—**STREET LIGHTING.**—The U.D.C. has accepted the following offer made by the Electric Light Co. in respect of restricted lighting:—Contract prices for all lamps lighted: £1 15s. per annum for each 200-c.p. lamp unit, 17s. 6d. for each 100-c.p. lamp unit, and 8s. 9d. for each 50-c.p. lamp unit.

Derby.—The T.C. has empowered the E.L. Committee to arrange for the supply of current to new works to be erected in Osmaston Park Road, the estimated cost of the scheme being £1,500.

Edinburgh.—**YEAR'S WORKING.**—The Electric Lighting Committee has reported that the deficiency on the account for the year is £8,075. This amount will have to be made good from the reserve fund.

Exeter.—**PUMPING PLANT.**—Last week new waterworks pumping plant was started up on the occasion of the annual inspection of the Waterworks Committee. The plant consists of a Rees-Roturbu pump, coupled to a 63-B.H.P. two-phase motor, supplied by the B.T.H. Co. The pump has a capacity of 25,000 gallons an hour against a head of 325 ft., and the plant is supplied through a transformer, from the Corporation electrical system.

Gillingham (Kent).—In reply to a suggestion from the B. of T., the T.C. has replied that it is impracticable to enter into a scheme for taking current either from the Kent Electric Power Co. or the Chatham and District Light Railways Co.

Glasgow.—A preliminary statement shows that the Corporation electricity undertaking had a revenue, for the year ended May 31st, of £530,720, as against £405,372 in the preceding year, an increase of £125,348 in the year.

Grantham.—**PRICE INCREASE.**—The Urban Electric Supply Co. has informed the T.C. of the necessity of advancing the charges for current by another 10 per cent. from the date of the June quarterly meter readings, making a total increase during the war of 20 per cent.

Halifax.—**PRICE INCREASE.**—The Corporation has given notice that, owing to the increased cost of coal, the charges for electricity for motor power are to be increased by 17½ per cent. from October 1st next.

Haslingden.—**BULK SUPPLY.**—Under a pre-war arrangement the Haslingden T.C. has been supplied in bulk exclusively by Accrington. The increased demand for energy in both towns has made it difficult for Accrington to keep pace with the double

requirement, and, in the circumstances, the latter has concurred in Haslingden entering into an arrangement to obtain a supplementary supply from Rawtenstall, and the final negotiations have been concluded by the L.G.B. sanctioning an expenditure by Haslingden of nearly £2,000 for cables and switchgear, the charges upon which will, however, be largely borne by Rawtenstall. In case of need, Haslingden will thus be able to pass on a supplementary supply of current to Accrington.

YEAR'S WORKING.—In the electricity undertaking for the year ended March 31st, 1916, the gross income was £4,897; and the gross profit £1,179, against £661 in the previous year. Interest and redemption absorb £784. Bulk supply purchased from the Accrington Corporation amounted to 890,686 units, at an average price per unit of 0.71d.; the amount paid by the Accrington Corporation to cover the annual charges on the cable from Accrington boundary to the Prinny Hill distributing station was £221, equal to 0.06d. per unit supplied, leaving the net cost of this supply 0.65d.

Hastings.—**YEAR'S WORKING.**—The Corporation electric light accounts for the last year show that the total capital expenditure on the undertaking amounts to £188,149, of which £99,276 had been repaid up to March 31st last. The income for the 12 months was £18,015, a decrease of £7,210 as compared with the preceding year, of which £4,765 was due to decreased public lighting. The expenditure (£12,732) was a decrease of £451. The gross profit was £5,734, as compared with £12,493. After making allowance for sinking fund and interest, &c., there was an adverse balance of £5,785, which has been met by £2,142 out of surplus standing to the credit of this account and £2,929 drawn from district rate account, with a balance of £714 provided for out of reserve fund.

Hereford.—**LOAN SANCTION.**—The L.G.B. has informed the T.C. that it is prepared to sanction a loan of £18,000 for a scheme for supplying current to a new factory to be erected at Rotherwas, when tenders are accepted for the plant, &c.

Hinckley.—The R.D.C. has decided to take no action relative to an application by the Leicestershire and Warwickshire Electric Power Co. for consent to lay cables from Brockley to Barwell.

Kirkcaldy.—**YEAR'S WORKING.**—The returns of the electricity undertaking for the year ended May 15th last, show a total income of £14,506, gross profit amounting to £5,026, and, after meeting financial charges, a net surplus of £621, being roughly £100 more than in the preceding year. The total output sold, 1,944,220 units, included 983,556 units for power, and showed an increase, due entirely to the latter, over the previous year; the average price being also increased, the total revenue was £2,300 better than in 1914-15. Expenditure also increased by about £2,000, mainly due to increased coal cost, which amounted to 62.8d. per unit as compared with 32d. in the previous year. The maximum load was 950 kw., and load factor 23.3 per cent.; the motors connected totalled 1,944 h.p. The report contains a recommendation that a new power-station site be obtained near the sea and railway.

London.—**BATTERSEA.**—In view of the representations of the Board of Trade in regard to linking-up, the Council has agreed to reopen negotiations with the Hammersmith B.C., as to the joint scheme for linking-up Hammersmith, Fulham and Battersea, in regard to which H.M. Treasury last year only sanctioned the linking-up of the last two boroughs. The E.L. Committee has now arranged for the installation of a 350-kw. Peebles converter and B.T.H. switchgear, with a view to increasing the supply in the Nine Elms district.

Luton.—**YEAR'S WORKING.**—In our last issue we gave the financial particulars of the last year's working of this progressive undertaking. Further information shows that 12,254,529 units were sold or nearly 4,000,000 more than in the previous year. The motors connected equalled 6,632 h.p. and heating apparatus 1,576 kw.; the maximum load was 4,208 kw., and the number of consumers 1,914. In spite of the price of coal increasing 40 per cent., the total works cost per unit remained at 74d., while the average price received was 86d. per unit. The net profit of £6,227 was after reserving £700 for excess profits duty.

Middleton.—**YEAR'S WORKING.**—It was stated at a meeting of the T.C., on the 5th inst., that the loss on the electricity undertaking during the past year was £1,066; Alderman Bentley (chairman of the E.C.) said they had spent £1,000 more in coal, and he thought they had not increased the price of current as much as they ought to have done.

Rathmines (Co. Dublin).—**PRICE INCREASE.**—The U.D.C. has decided to increase the charges for electricity for private lighting from 4½d. to 5d. per unit; for the lighting of places of worship, &c., and business premises, from 4d. to 4½d. per unit; and for power and heat from 1½d. to 1¾d. per unit, these charges to be in addition to the 5 per cent. added in 1913, and to date as from July 1st.

Sheffield.—**SUGGESTED PRICE REVISION.**—The general manager of the electricity undertaking (Mr. S. E. Felden) has submitted to his Committee a report upon the advisability of revising the existing charges for the supply of current. The manager states in this report that he feels grave anxiety both as regards the financial stability of the department and for its ability to supply cheap units in the future, if the charges generally are so fixed as to yield a very small available surplus. Whilst the undertaking was complying with legal requirements as regards repayment of loans in

Glasgow.—**FEMALE LABOUR.**—In the course of the annual report of the T.C. tramway department, the financial and passenger side of which has already been published in the REVIEW, it is pointed out that the number of women conductors at present employed by the department is 1,107, and since March 1st of this year, when the Committee decided to experiment with women drivers, 106 women have been introduced to the front platform of the cars. At several depôts women were also employed in connection with the cleaning of the cars. When war was declared 633 male members of the staff who were Reservists and Territorials were called up, and since then the number of employés who had joined the Colours was 2,811. Of this number the Committee regretted to report the deaths of 113.

Haslingden.—**YEAR'S WORKING.**—For the year ended March 31st last, the tramways show a gross income of £8,464 against £8,217; a gross expenditure of £5,272 against £5,540, a gross profit of £3,192 against £2,376; and a net profit of £1,021 against £160. The total mileage was 150,676. The rate aid given to the department since its inauguration amounts to a total of £3,395.

Hull.—**YEAR'S WORKING.**—The accounts of the Corporation tramway undertaking for the year ended March 31st last show that 53,734,387 passengers were carried, of which nearly 24 million were 4d. fares, and the remainder 1d. fares. The total was much in excess of the previous year, although the car-mileage, 4,072,342, was roughly 500,000 less than in 1914-15. The total revenue amounted to £162,927, while working expenses totalled £108,670 and war allowances £8,759, leaving a balance to net revenue of £45,498. After meeting the usual financial charges, £12,469 was transferred to the appropriation account, bringing the latter to £22,469, and enabling £10,000 to be transferred to rate relief, a similar amount being reserved for future relief, and the balance of £2,469 being allocated to reserve. The reserve fund in hand amounts to £112,000.

London.—**SOUTHWARK.**—**ELECTRIC VEHICLE REPORT.** A curious report on the use of electric vehicles has been presented by the borough engineer to the Works Committee. From this we gather that he has taken quite a paternal interest in the subject of power-driven vehicles for some years, though, unfortunately, it would appear from what follows, that his interest has not led to an accurate appreciation of the merits of the electric vehicle, either in itself or in relation to the electric supply industry. He says: "No doubt electricity will become adaptable for our general use in five or 10 years, but the charges of one or two vehicles would be of no assistance to the Council's electricity works, and working them would be more expensive than petrol plant." It is difficult to understand these remarks in view of the number of cases in which electric vehicles are being adopted for municipal work, because of their low cost of operation and general efficiency, but apparently the borough engineer is prejudiced by the knowledge that electric vehicles represent but a small percentage of the municipal motor vehicles in use. Again, it is obvious that unless the Southwark Council provides charging facilities, it cannot expect to benefit from electric vehicle charging and the charging of "one or two vehicles," in view of the huge possibilities in front of the electric, may be of the greatest assistance to the Council's electricity undertaking. The fact that 740 electric vehicles are in use, or on order in this country, as compared with 150 in the previous year is evidence that some people are appreciating the advantages of the electric vehicle, although this is not the case with the Southwark Works Committee, which endorsed its engineer's views.

Kirkcaldy.—**YEAR'S WORKING.**—During the year ended May 15th, the Corporation tramways carried 5,403,000 passengers, or about 90,000 less than in 1914-15; nearly 50 per cent were 4d. fares. The car-miles run, at 439,000, were 9,400 less than in the previous year, but the average revenue, 9.3d. per car-mile, showed an increase. The total revenue amounted to £17,433, and the gross profit to £5,649, while after meeting financial charges, including £413 depreciation, the net surplus remaining was £137. The report draws attention to the probable heavy expenditure on permanent way in a few years' time, and suggests that measures should be taken to increase the revenue in order to meet these charges; one suggestion is the abolition of 4d. fares.

Manchester.—A collision between a tramcar and a taxi-cab in Moss Side, last week, resulted in the death of a lady passenger in the cab and serious injuries to the motorman.

The new double tramway track in Cross Street, between King Street and Albert Square—in the busiest part of the city—is now completed. The laying of the second line, which will be a great boon, has been made possible through the demolition of some property and the widening of the thoroughfare.

Wallasey.—**WAGES.**—A special meeting of the Tramways Committee was to consider the demand of car drivers and conductors for an increase of wages. The men threaten to cease work to-morrow (Saturday), unless they receive a favourable reply to their demand.

Rotherham.—The Corporation has been recommended to take up the tramway track in a portion of Westgate, and put down a double line of rails. The borough engineer has been instructed to arrange for the immediate purchase from Messrs. Steel, Peech and Tozer, Ltd., of 40 tons of rails at £16 10s. per ton.

Tasmania.—The result of the year's working of the Launceston city tramways to June 30th was a total revenue of £19,317 and a net surplus of £508. The passengers carried numbered 2,385,860 and the car-miles were 355,421.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—The Government telegraphic system at the end of 1914 comprised 38,674 km. of line and 93,129 km. of wire, with 908 offices; 147 million messages were handled during the year. The telephone system, in the hands of seven companies, consisted of 96,390 km. of line and 385,633 km. of wire, with 69,667 subscribers. *Journal Télégraphique.*

France. The publication of *Annales des Postes, Télégraphes et Téléphones*, which had been suspended owing to the war, has been resumed.

Spain. Since May 2nd a radiotelegraphic service has been established between Spain and Germany, the tariff being 0.25 peseta per word. The Spanish station is situated at Aranjuez. *Journal Télégraphique.*

Tahiti.—A wireless station has been erected by the French Government near Papeete, in Tahiti, placing the island in communication, *via* Samoa and Awanui (New Zealand) with the world's submarine cable network.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—August 16th. P.M.G. Distilling apparatus (Schedule 502), telegraph and measuring instruments (Schedule 498). See "Official Notices" June 16th.

MELBOURNE.—August 8th. Deputy P.M.G. Standard battery material:—Porous pots, jars, zinc and carbon rods, and chemicals. Schedule 1,327. High Commissioner's Office, 72, Victoria Street, S.W.

SYDNEY.—August 17th. Portable internal-combustion engine and dynamo (2½ kw.) for the Departmental Stores, Sydney, for P.M.G.*

August 24th. P.M.G. Automatic switchboard and apparatus for North Sydney Exchange. Schedule No. 511.*

Dublin.—July 20th. Corporation. A.C. slot meters. See "Official Notices" to-day.

Hull.—July 20th. Machinery oils for the Corporation Electricity Department. Mr. J. F. Magoris, Acting Electrical Engineer.

New Zealand.—**INVERCARGILL.**—September 28th. Borough Council. Steam turbo-alternator, condensing plant, and switchgear. Specifications from the Tramway Office. Contract No. 40.*

Plymouth.—July 20th. Corporation. Rotary steam boiler feed pump for the Electricity Department. See "Official Notices" June 30th.

Walthamstow.—July 26th. Council. 500-KW. rotary or motor converter. L.H.F. switchgear; L.F. switchgear. See "Official Notices" to-day.

York.—Corporation. Coal (14,000 tons of either unscreened beans, pea slack, rough slack, or small peas quality) for the electricity works for nine months. Mr. J. W. Harris, Engineer and Manager.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Argentina.—The *Times* states that the largest contract for iron placed since the beginning of the war by Argentina has been secured by the Staveley Coal and Iron Co., Ltd. It is for 26,000 tons of c.i. piping for about £262,500, and the whole is to be delivered before the end of the current year.

Australia.—The Sydney City Council has been recommended by the Electric Lighting Committee to accept the following tenders:—

Induction regulators, £1,549.—Aust. General Electric Co.
10,000 ft. of 1½ in. gauge welded conduit, £280.—Lawrence & Hanson, Electrical Co., Ltd.

Melbourne City Council has accepted the following tenders:—

Five 30-hp. 3-phase oil switches with transformers, £114.—British Westinghouse Electric and Manufacturing Co., Ltd.
Two Erith Riley stokers with fans and hydraulic controls, £1,296 f.o.b. (total estimated cost, including freight, insurance and erection, being £2,000, for installation in two of the oldest boilers at the supply station.—Erith Engineering Co., Ltd.

P.M.G.'s Department, South Australia:—

Increasing the capacity of storage batteries, Central Exchange, Adelaide, £512.—T. Knight Seanes.
£3,230 yd. paper-insulated lead-covered cable, 400 pairs, £1,510 per mile; 1,060 yd. ditto, 300 pairs, £1,201 per mile; 1½ miles ditto, 400 pairs, £785 per mile; 3½ ditto, 100 pairs, £440 per mile; 1 mile ditto, 25 pairs, £138 per mile; 770 yd. silk and cotton insulated, lead-covered switchboard cable (various), £461.—Western Electric Co. (Aust.), Ltd.
—*Australian Mining Standard.*

Bristol.—Electrical Committee. Accepted tender:—

Derby, T. O. *Crustacean zoogeography*. D. McCarthy (ed.). M. J. Walker. Deutscher Verlag, 1981. Brookhouse, 1981. 200 pp. Pp. 1-100.

Glasgow. The Clyde Navigation Trustees. Electrical stores: Ross & Co., and the Liverpool Electric Cable Co., Ltd.

Alex. Hawkins & Sons	.. .. .	accepted	\$71
Allen Mfg. Co.	.. .. .	" "	78
H. L. C. & Co., Ltd.	.. .. .	" "	620
W. C. Little & Co., Ltd.	.. .. .	" "	671
Harvey & Co.	.. .. .	" "	867

British Thomson-Houston Co., Ltd.—Motor-converter switchgear, £329.

W. & T. Avery, Ltd.—Coal-weighing machines, £340.
Harris-Anderson Patent Feed Water Filter Co.—Water softener, £495.
Hayward, Tyler & Co.—Rotary feed pump, £258.

Sheffield.—Electricity Committee :—

Steel Barrel Co. - Petrol storage installation, £195.
 Vickers, Rotherham - Streeted a 10 ft. long to provide a single lane.
 W. & A. P. - Repairing and building loading platform, £283.

Stafford. Town Council, 500-kw, general hydro-generators and condensing plant, aggregating £5,230. Part of the plant is to be supplied by Messrs. Siemens. In reply to questions regarding that firm, it was stated that the concern was Government-controlled, and there was not the slightest suspicion as to the propriety of the works being carried on: if they were stopped, it would be the greatest disaster that could befall Stafford.

J. Thompson & Co.—Creosoted troughing, collars and bends.
Jones Bros.—Tiles.
Norfolk Engineering Co.—Brush-holders.

Wimbledon.—Coal for the Electric Lighting Committee :
Foster & Co.—4,500 tons Kingsbury small nuts, 23s. 3d. per ton ; 1,000 tons ditto nutty slack, 22s. 3d. per ton ; 2,000 tons Fostock double-screened nuts, 24s. 9d. per ton ; 1,500 tons ditto slack, 17s. 9d. per ton ; 2,000 tons S. Leicester nutty slack, 21s. 4d. per ton.

Wolverhampton. Electricity Committee. 10,000 tons of slack coal. W. H. Boswell Ltd.

There are many interesting and novel features in the report, which deserves the close attention not only of educationists, but also, and perhaps still more, of manufacturing engineers. A clear distinction is drawn between the two great classes—manual workers and thinkers—and the comparative failure to solve the problem of providing the best system of education for each of these classes is ascribed partly to confusion of one with the other. Emphasis is laid upon the importance of training the workman not merely as a skilled man, but also as a good citizen. The nature and functions of the junior technical school are explained, and it is recommended that boys should enter it from the public elementary school at the age of 12, leaving it to enter works as apprentices at 15. Special attention is devoted to the nature of the instruction to be given during the trade apprenticeship course concurrently with the workshop training. Boys aiming at the higher positions should receive whole-time education up to the age of 18, and then enter upon a University course; if this is not possible, they should leave the secondary school at 16 and enter a senior technical school for two years. University entrance scholarships should be increased in number and value until it is no longer possible for a boy to be prevented from entering a university by reason of want of money. The previous system of training, if his native ability and previous education fitted him to derive from this training so much benefit that the increased value of his services to the community will repay the cost.

A very significant passage deals with the excellent quality of modern engineering text-books, which are so good that they diminish the necessity of lectures, which should be directed rather to guiding the student and stimulating his interest in the subject studied. The greater part of the university time should be spent by the student in working out problems of the kind that he will meet in practice.

Works training before the college course is deprecated, unless it can be effected during vacations without interruption to the academic work. The six-months' sandwich system is not recommended in connection with English Universities, though it is less objected to in Scotland, where the sessions are shorter. Finally, the immense importance of research work, at the colleges, the works, and in special institutions, is vigorously driven home, and intimate co-operation between engineering firms and colleges is advocated. The report is worthy of the most careful consideration.

NOTES.

Electricity on Canadian Farms.—The British Columbia Electric Railway is energetically pushing the use of electricity amongst farmers in the Fraser Valley, which is covered with a network of power lines. The farmers are stated to be keenly interested in the matter, and at their request meetings are being held, at one of which a number of interesting kinematograph and other views of electrically-worked farms were shown.

Nitrate Plant for U.S.A. Government.—The Army Reorganisation Bill as finally enacted authorises the President to make an investigation to determine the best process "for the production of nitrates and other products for munitions of war and useful in the manufacture of fertilisers and other useful products." He is further authorised to select a water-power site or other site and to construct a plant for the manufacture of such product. The products of the plant are to be used for military and naval purposes to such extent as the President may deem necessary, and any surplus may be sold under such regulations as he may prescribe. The Bill does not specify the capacity of the plant, but \$20,000,000 is appropriated for its construction. A provision is inserted that the plant must be operated "solely by the Government and not in conjunction with any other industry or enterprise carried on by private capital." *American Machinist.*

ENGINEERING EDUCATION AND RESEARCH.

The report of the Subcommittee on "Engineering Education and Research," appointed by the Council for Organising British Engineering Industry, and composed of Mr. A. P. M. Fleming, Prof. J. C. M. Garnett, and Prof. Miles Walker, was issued last week. The following are the principal recommendations:

The organisation of British engineering industry by the federation of British manufacturing engineers for purposes

The co-ordination of existing means for educating engineers, and particularly the provision of an adequate and more uniform system of scholarships.

Inquiries. Markets of electrolytic materials.

Foreign Trade.—THE JUNE FIGURES.—The following figures for imports and exports during the month of June, 1916, are given in the following tables for electrical and electromotive goods.

IMPORTS	1916	1915	%
Electrical goods, all	£14,991	£1,004	148.8
Machinery	87,007	30,000	290.0
EXPORTS:—			
Electrical goods, all	£1,004	£14,991	1.5
Machinery	177,881	81,921	217.1

Educational Notes.—UNIVERSITY COLLEGE, LONDON.

At an assembly of the College, Professors of the various departments, the Provost stated that the "Pro Patria" contained the names of 1,476 members of the College who were serving in the war; 101 distinctions had been gained, and 73 had laid down their lives. The College had rendered many important services to the Government, of which particulars could not at present be given. Dr. G. Carey Foster, formerly Professor of Physics and Principal, delivered an address to the students.

MIDDLESBROUGH TECHNICAL COLLEGE.—The fund for the erection of a Technical College at Middlesbrough, for the furtherance of iron and shipbuilding industries, now stands at £73,700. The Cleveland and Durham Electric Power Co. has offered to supply as an annual donation £100 worth of electrical power per annum.

Patents and Alien Enemies.—Application has been made to the Board of Trade for the avoidance or suspension of Patent No. 11,693/10, for the electrolysis of liquids, granted to Billiter, by Mr. E. J. Smith, of Willesden, N.W.

Japan and Electrical Export Trade. According to Japanese papers, Japan is about to make a special effort to develop the electrical market in China. The *Asahi*, which is the leading paper, says is regarded in Tokyo as the organ of the Government, credits an authority in the Department of Agriculture and Commerce with the following statement:—"Japan's electrical industry has recently undergone a marked development. Efforts should be made to further national interests by promoting the export of the various products of the industry. The Government is, therefore, considering means to encourage the export of electrical apparatus to China, India, and other accessible places. A new item of expenditure is to be provided in the next Budget for the purpose of subsidizing the export. The scheme, however, has not yet been considered by the Cabinet in detail. In order to secure a large market for electrical apparatus in China or anywhere else, it is necessary that the general electrical industry there should be developed. In this respect much depends upon the activity of Japanese capitalists. The war has stopped European competition, and the present is the best opportunity for consolidating the foundation of Japan's business and industrial potentialities abroad. To attain this object an immediate loss should be ignored with an eye to an ultimate gain."

H. R. Merton & Co., Ltd.—According to the *Times*, a circular has been issued by the above company, stating that the shares in the company which were hitherto held by German firms have now all been acquired by British subjects. The negotiations to that end, which were started in July, 1915, only came to a successful conclusion in February, 1916. "The terms of the transaction were submitted to the Board of Trade and the High Court of Justice for their approval, which was granted. The company has altered its Articles of Association, which now contain very stringent provisions, by virtue of which the company is now, and will always remain, under exclusively British control." The *Times* understands, as a result of its inquiries, that the result of the transaction is that the proportion of the capital in British hands is increased from 55 per cent. to 85 per cent., the remaining 15 per cent. being held in allied and neutral countries. Should any of these countries ever become involved in war with Great Britain, the holders resident therein may be compelled to dispose of their holdings. No shares may be sold to foreigners, or to British subjects having foreign connections.

Institution and Lecture Notes.—Verband Deutscher Elektrotechniker.—The annual meeting of the V.D.E., which should have been held last year, was abandoned owing to the war; but this year a meeting was held in Frankfurt-on-Main, at the beginning of June. About 750 members and visitors attended. On June 2nd the meeting considered the report prepared by G. Dettmar (secretary), from which it appears that there are now 22 associations in the union, and that, in spite of the war, the number of members remains practically constant at 6,000 (a fact which is possibly due largely to those on active service being retained automatically on the membership roll). During the period covered by the report, the chief activity of the committees has been directed to examining the applicability of the various rules and recommendations to war conditions, and to devising special war rules to meet the abnormal conditions of labour and material supply in Germany. On the evening of June 2nd, members and visitors were received in the historic town hall of Frankfurt as guests of the city. The large number of public officials attending this year brought back to mind (says E. T. Z.) the international electro-technical exhibition held at the same place 25 years ago, when the first high-pressure alternating-current power transmission from Lauffen to Frankfurt was inspected by members, including such

pioneers as Oscar von Miller, Dolivo-Dobrowolsky, and Kittler. A retrospect of this brilliant period of electrotechnical development formed the subject of an historical appreciation delivered by Prof. Epstein on the second day of the meeting. Prof. Klingenberg delivered an address on "Large-scale Electric Administration with State Co-operation," and in the afternoon G. Dettmar read a paper on substitutes for various electrotechnical materials. "A successful exhibition of substitute-materials and of products made therefrom bore witness to the high degree of independence of German industry with regard to foreign supplies, and also disclosed technical and scientific advances which will be of great importance after the war, as well as now."

Electrical Association of Australia (Victorian Section).—At the meeting held at Melbourne, on May 25th, Mr. C. F. Lindblade read a paper on "Decay of Timber in its Relation to Electric Light Undertakings."

Volunteer Notes.—1st LONDON PATENT ARMED VOLUNTEERS.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Saturday, July 15th.—Parade, 3.0 sharp. Golden's Green Station. Uniform.

Monday, July 17th. Technical for Platoon No. 9, 46, Regency Street, S.W. Squad and Platoon Drill, Platoon No. 10. Signalling Class and Recruits.

Tuesday, July 18th.—Officers' Instructional Class, 6-7. Recruits, 7-8. Lecture, 7.15, "The Mechanism of the Service Rifle," Lieut. Scott Moore.

Wednesday, July 19th.—Platoon Drill for No. 1 Platoon.

Thursday, July 20th.—Platoon Drill, No. 5 Platoon. Recruits, 5.45-7.15. Instructional Class, 5.45.

Friday, July 21st.—Technical for No. 14 Platoon, 46, Regency Street, S.W. Squad and Platoon Drill, No. 9 Platoon.

Saturday, July 22nd.—Instruction Parade, 2.30, Company Commander Fleming.

Sunday, July 23rd.—Entrenching duties. Parade, Victoria (S.E. and C. Railway Booking Office), 8.35 a.m.

1st BATT. OLD BASS CENTRAL LONDON VOLUNTEERS.—Battalion Orders by Capt. R. J. C. Eastwood (Commandant). Thursday, July 13th, 1916:—

Week-End Parades.—**Saturday.**—The Battalion will Parade at Wembley Park, at 3 p.m., for Drill.

Entrenching.—**Saturday.** Parade at Liverpool Street station (Low Level entrance), at 8.40 a.m.

Sunday.—Parade at Liverpool Street Station (Low-Level entrance, at 9.30, for Entrenching duties.

Wednesday, July 12th.—Parade at Wembley Park, at 3 p.m., for Drill. Saturday, 15th inst., but it is arranged to commence on Saturday, 22nd inst. Names must reach the Adjutant not later than Wednesday.

Saturday will report at 9.20 a.m., at No. 8 Platform, Waterloo Station; those shooting on Sunday, at 9.15 a.m.

Signalling Practice in future will take place at Queen's Club on Mondays, Wednesdays, and Fridays, at 6 p.m.

Recruits will Parade at Wembley Park on Saturday at 3 p.m., and Sunday at 11 a.m.

Decimal Coinage and the Metric System.—At a meeting of the City Corporation on Thursday last week, Mr. Sandle moved that, in view of the advantages which would accrue to British commerce in foreign markets by the use of the decimal system of coinage and weights and measures, it was desirable that steps should be taken for its immediate introduction, so that it might be in operation at the end of the war. The subject was referred to the County Purposes Committee for consideration.

German Substitutes.—We have had a report occurred in our article on German substitutes for copper conductors (Vol. LXXVIII, No. 2,013, p. 718), in that the specific resistance of zinc per sq. mm. per metre at 20° C. was given as 0.0067, instead of 0.0607 ohm.

Mechanics for the R.N.A.S.—An appeal is made by the R.N.A.S., 17, Brook Green Road, Hammersmith, W., for skilled engineers, carpenters, and electrical fitters. The age limits are 18 to 45. All will be put on "deferred entry," which means that they will be liable to be called up at a fortnight's notice, when required.

Copper Output of Spain.—According to the Government's *Boletín Comercial*, Spain produces yearly about 3 million tons of copper, of a value of 63,000,000 pesetas. The district yielding most copper in Spain is the Province of Huelva, and next to it comes Seville. There also exist in Spain large areas of unproductive ground allocated to copper production by concessions whose proprietors are, for the most part, unable to work them owing to the lack of capital; if this ground were to be made productive, and to yield, say, 9,000,000 tons of copper, the value of Spain's output yearly would be augmented by 189,000,000 pesetas. In view of the increased price of copper owing to the war, the *Boletín* urges Spanish capitalists to invest their capital in the production of native copper.

Southampton. A DAY OF IT.—A firm of local wine merchants, asks in the Review, "What is the best of the season's wine?" In these days of expensive wines and when the price of the best is so high, it is not surprising that the wine of the season is the one that is the most popular. The wine of the season is the one that is the most popular. The wine of the season is the one that is the most popular.

On Wednesday last, a most perfect weather, a party of about 100 persons, of whom the Metropolitan Association of Electric Tramway Managers and friends, made Southampton the scene of their day's outing.

On their arrival in the town, the visitors were received at the tramway station from whence a special car conveyed them to the South-Western Hotel, where they were entertained to lunch by the Mayor, who gave them a most hearty welcome.

Mr. W. C. Thompson, general manager, East Ham Corporation Tramways, proposing a vote of thanks, voiced the feelings of the entire party in saying that they were greatly surprised and very much impressed by the beauty of the town.

Alderman Littler, late chairman West Ham Tramways Committee, also paid a great tribute to the town, and spoke of the indebtedness of the entire nation to Southampton for the wonderful work it was doing in connection with the war.

The Mayor and Alderman Dunford replied the latter remarking that although the local tramway system was not particularly large, yet it was one of the most complete and successful undertakings in the country. In Mr. Robson they had a manager who was sometimes a revelation of the Committee, which was perhaps a good thing.

During the afternoon the visitors made a tour of the tramway system, and were impressed by the Avenue and the Common, which many of them said made the most charming tramway route they had ever seen. The chief glory of Southampton is the Common, a great area of natural forest land a portion of the Royal Forest of Bere, and it is impossible to over-praise the beauty of this great natural park of 348 acres, all of it finely wooded with stately trees and picturesque thickets. A visit was paid to Portsmouth car depot, where they saw the electric vehicles which have entirely taken the place of horses, and the new 2-ton electric tipping wagon to be used by the permanent way department, and for general carting work. Much interest was shown in a method of repairing defective rail joints, adopted in Southampton for the first time on any large scale. The arrangements also included a trip down Southampton Water to Southsea and back, during the course of which the party were entertained to tea by Alderman Dunford.

The trip occupied just three hours; and as the shores are beautifully wooded, and are nearly a mile apart, nothing could have been more delightful, both from the picturesque point of view and as a relief to the ever-present thoughts of the deplorable struggle which, there is reason to hope, will shortly give way to an early and sudden peace.

To the Mayor and to the Chairman of the Tramways Committee for their hospitality, to Mr. Robson, and Mr. Goodyer, the popular hon. sec. of the M.A.E.T.M., for their admirable arrangements throughout the day, we add our thanks to those of Mr. Littler, who spoke for the visitors, and to the Clerk of the Weather we offer our heartfelt gratitude.

We must not omit to mention that, after the water trip, the party had the privilege of inspecting the newly-erected cable works of Messrs. Pirelli, on the invitation of Mr. Bevis, when the Mayor took the opportunity of wishing "Success to the Firm."

Union of Technical Associations in Germany.—A German "Verband" of technical-industrial associations has been formed, comprising the Institution of German Engineers, the Institution of German Architects, the Association of Blast Furnacemen, the German Chemical Society, the Institution of German Electrical Engineers and the Association of Shipbuilding Engineers. The headquarters are in Berlin. The Verband will thus represent 60,000 members of the different professions involved. One of the principal results which is looked for from the combination is the furtherance of the work of finding substitutes for the raw material hitherto obtained outside Germany. *Times Trade Supplement.*

Performance of British Westinghouse Turbines.—Excellent records have recently been made in regular performance by turbines of British Westinghouse manufacture. A turbine installed in the Port Dundas power station of the Glasgow Corporation, of the Westinghouse-Rateau high-pressure impulse type, is rated at 6,000 K.W., and runs at a speed of 1,500 R.P.M. The alternator generates three-phase current at 25 cycles, 6,600 volts, and has an overload capacity of 25 per cent. for two hours, and 50 per cent. for half-an-hour. This set is provided with a direct-coupled exciter. At the present moment there is in course of manufacture another 6,000-K.W. set with surface condensing plant, which will be, to all intents and purposes, a duplicate of the set above mentioned.

This set ran from July 24th, 1914, to October 31st, 1915, a period of 15 months, during which it was in operation for 9,595 hours out of a possible 11,520 hours or 83 per cent.; the average load was 5,510 K.W., and the total output was 53 million units, or 62 per cent. of the total output of the whole station during that period, and 78 per cent. of the possible output of the turbine at full load for the whole running time, the average load being 5,510 K.W.

A 3,000-K.W. D.C. turbine, which is also in service in the Glasgow district of the Westinghouse-Rateau mixed-pressure impulse type, is rated at 300 K.W., and runs at 3,000 R.P.M. The generator develops full load at 460 volts; and is of the three-wire type. The commutator is of the well-known radial type, the design of which enables sparkless commutation to be obtained at all loads at high speeds. The condensing plant is of the multiple-jet type, working in conjunction with a natural-draught cooling-tower.

This set was in operation from July, 1910, to December, 1915, a total period of 18,204 hours, and was on load during that period for 47,023 hours, or 97.5 per cent. of the possible running time in 54 years. The maximum load grew from 150 to 273 K.W., and the mean load from 80 to 207 K.W.; as the spare plant consisted of two belt-driven dynamos of a total output of 100 K.W., it will be seen that the reliability of the turbine was a very important matter. These records are certainly admirable.

Naval Electricians. The rank of Lieutenant (Electrical) has just been created in the Royal Naval Volunteer Reserve and such officers gazetted are to be assistants to Lieutenants (T), and to have charge of the repair and maintenance of the ordinary electrical equipment of the ship, this leaving the Lieutenant (T) free for torpedo work. This new departure rather hits the warrant electrician who up to the present was entrusted with that class of work and did it well.

OUR PERSONAL COLUMN.

The Editors only electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramways and railway officials to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—An Australian exchange states that Mr. W. G. T. GOODMAN, chief engineer and general manager of the Adelaide Municipal Tramways Trust, has two sons enlisted for active service. Up to date, 195 of the Trust's employees have enlisted for active service.

Bexhill-on-Sea T.C. has, by a re-arrangement of the electricity staff, appointed Mr. R. C. CARTER as mains assistant. Faversham T.C. has increased the salary of the electrical engineer (Mr. G. SOMERVILLE) from £200 to £210 per annum.

Torquay T.C. has increased the salary of Mr. J. L. MEDWAY, assistant electrical engineer at the generating station.

General.—The assistant surveyor of Bournemouth. (Mr. F. P. DODD) has been appointed borough surveyor, in succession to the late Mr. Lacey.

Mr. S. HOWARD HALL, who has been with Messrs. Mather and Platt, Ltd., Park Works, Manchester, for the past six years, has just been granted a commission as lieutenant in the Royal Naval Volunteer Reserve, and is to undertake electrical duties.

At the recent Degree Day at the Manchester University, the degree of M.Sc.Tech. was conferred in *absentia* on Lieutenant BERTRAM HOYLE, of the R.N.V.R., now on active service, who, in civil life, is an assistant lecturer and demonstrator in electrical engineering at the Manchester Municipal School of Technology.

London Gazette notice.—Territorial Force. Royal Engineers. *Type Electrical Engineers*.—Lieutenant (temporary Captain) C. M. FORSTER is seconded.

At Wesley Church, Burnley, on June 28th, the marriage took place of Mr. THOS. H. NUTTALL, assistant electrical engineer to the Burnley Town Council, and Miss Clara Haythornthwaite.

Roll of Honour.—Captain J. S. DAVIDSON, Royal Irish Rifles (1st County Down Volunteers), who has been killed in action, was the only surviving son of Mr. S. C. Davidson, founder and managing director of the Sirocco Engineering Works, Belfast, of which firm Captain Davidson was himself a director, and for many years, prior to the outbreak of war, acted as general manager. He proved a keen and able officer. His knowledge of practical engineering was soon discovered, and he was appointed to the machine gun section, subsequently being advanced to the position of brigade-captain of the 108th Infantry Brigade, Ulster Division, in which capacity he was serving in charge of the Machine Gun Company at the time of his death. Captain Davidson's death has caused sincere grief amongst a wide circle of friends and acquaintances, and particularly in the Sirocco Works, where he was greatly loved. He was 38 years of age and unmarried. He was a member of the Institution of Mechanical Engineers. In a letter from headquarters to Mr. S. C. Davidson, it is stated that the deceased officer "fell after gallantry which deserved the Victoria Cross."

Sergeant SAWDREY, of the Lancashire Fusiliers, who has been wounded by shrapnel, was engaged at the works of the British Westinghouse Co., Trafford Park, before the war.

Sergeant R. A. WALTON, of the Stockport Territorials, who was an electrician in Stockport prior to the war, has been recommended for the Military Medal.

Sergeant DOUGLAS HARTLEY, of the Royal Engineers, who has been killed in action, was 19 years of age, and, prior to the war, was employed at Ashton as an electrician.

Gunner A. E. GARTON, of Crewe, who was employed in the electrical department at the Crewe Railway Works, and who saw active service at Gallipoli, has died of disease.

Captain ALFRED LEE WOOD, of the Lancashire Fusiliers, formerly with the Lancashire Dynamo & Motor Co., Trafford Park, and, prior to the war, their representative in India, was killed in action last week. He was 30 years of age, obtained his commission two months after the war started, and went to France in November last.

Able Seaman ARTHUR MULCOCK, whose loss on board H.M.S. Torpedo Boat Destroyer *Turbulent* during the North Sea

Battle is now reported, was formerly with Messrs. Elliott Bros., Ltd., electrical engineers.

Lance-Corporal J. FAICHER, of the Oxon and Bucks Light Infantry, who was, before his enlistment, engaged at Rugby with the British Thomson-Houston Co., Ltd., has been wounded in action.

Private WILFRED KNIGHT, of the Cheshire Regiment, who has died of wounds received in action, was formerly engaged at the works of the British Insulated & Helsby Cables, Ltd.

Corporal ARTHUR PLANT, of the King's Royal Rifles, who was, when he enlisted, engaged at the Rugby works of the British Thomson-Houston Co., Ltd., has been awarded the Military Medal for gallant conduct on the field at Ypres, where he was wounded.

Corporal H. W. BRAY, of the 1st Herts. Regiment, who has died of wounds received in action, was, before the war, assistant electrician to his father, Mr. A. Bray, at Lord Salisbury's residence at Hatfield House, Welwyn. He was wounded in fighting at La Bassée.

The *Times* states that Second-Lieutenant C. S. COOMBS, of the Queen's Own Royal West Kent Regiment, who died in hospital on July 6th from wounds received on July 3rd, was educated at the City of London School and the City and Guilds Technical College, Finsbury, and was a Student Member of the Institution of Electrical Engineers.

Corporal W. HUTCHINSON, West Yorkshire Regiment, who has been wounded by shrapnel, and is in hospital, was an assistant engineer at the Batley Corporation electricity works.

Private JOSEPH GENT, of the Border Regiment, who died at Netley Hospital last Friday from wounds, was 21 years of age, and was formerly employed by the Lancashire Dynamo and Motor Co., Ltd., Trafford Park. He had previously been wounded at Gallipoli. Another employé of the same firm, Private F. J. MOSS, of the Manchester Regiment, aged 20, has also died of wounds.

Private THOMAS YATES, of the Northants Regiment, who has been wounded, was an employé of Messrs. W. T. Glover and Co., Trafford Park.

Private FRED YOUNG, of the Durham Light Infantry, and formerly in the electrical department of Messrs. Duxford and Sons, Ltd., Sunderland, has died from wounds sustained in action.

Private C. H. LONG, who went to the war from the Bradford electricity works, was wounded in the Somme advance.

Sergeant-Major HARRY GILL, formerly electrical engineer at the Leeds Slate and Marble Works, has died from wounds received in the battle of the Somme.

Obituary.—MR. SYDNEY DOBSON.—We deeply regret to read the announcement of the death of Mr. Sydney Thornton Dobson, which occurred through accidental drowning in Poole Harbour on July 3rd. The late Mr. Dobson, who was 50 years of age, had been chief engineer of the St. James's and Pall Mall Electric Light Co., Ltd., almost as long as we can remember the company, indeed, his connection with that concern began in 1889, and he has been responsible for its technical engineering developments all the way along. For the past 16 years he has been associated with Sir Alex. Kennedy as joint engineer of the Central Electric Supply Co., which gives bulk supply to the Westminster and St. James's undertakings. Mr. Dobson was educated partly at King's College School, and at the School of Electrical Engineers, in Hanover Square, and part of his technical training consisted of an apprenticeship served with the firm of R. E. Crompton & Co.; later he acted as second engineer of the firm in their electrical works at the Tilbury Docks. His change over to the St. James's Co. was preceded by a couple of years' central station experience at Vienna on the electrical staff of the Imperial Continental Gas Association. Mr. Dobson was not a man to care for the glamour of the foot-lights. In the main, he appears to have devoted himself with assiduity to the operation of the electricity supply concern which had such a run of prosperity as has fallen to few electricity supply companies in the Metropolitan area. He was a member of the Institutions of Civil, Electrical, and Mechanical Engineers.

Mr. F. TAYLOR.—The death took place, in London, on Monday, of Lieutenant-Colonel Frederick William Taylor, D.L., of Chelmsford, a director of Messrs. Christy Bros. & Co., Ltd., electrical engineers. Deceased, who was 50 years of age, was for many years associated with the Volunteer movement, was a prominent Churchman, and for a long period had served on the Chelmsford Board of Guardians and Rural Council.

NEW COMPANIES REGISTERED.

Kilmallock Electric Light & Power Co., Ltd. (1,361).—This company was registered in Dublin on July 10th, with a capital of £2,700, in 41 shares, £65 each, the business indicated by the title. The subscribers are: D. Clery, Kilmallock, Co. Limerick, draper, 100 shares; T. J. Griffith, "Lisa Corra," Kilmallock, J.P., 50 shares; T. Hannan, Wolf Tone Street, Kilmallock, merchant, 50 shares; J. W. Joyce, Sheares, Kilmallock, clerk of works, 50 shares; W. H. Madden, Kilmallock, auctioneer, 50 shares; P. D. Clery, Kilmallock, auctioneer, 50 shares; J. O'Rourke, Kilmallock, victualler, 50 shares; T. W. W. Bennett, Ardunell, Kilmallock, farmer, 25 shares; T. J. Carroll, Kilmallock, chemist, 25 shares; P. P. Heelan, Kilmallock, draper, 25 shares. Private company. The first directors to number not less than five or more than 10) are the above subscribers. Qualification, £25. Secretary, D. Casson, Registered in London & Sons, Ltd., 16, 17, Chancery Lane, W.C. Registered office, Kilmallock, Co. Limerick.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Orford Electric Light & Power Co., Ltd.—Particulars of £750 debts., created June 5th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £650. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Vickers, Ltd.—Mortgage dated June 15th, 1916, to secure £74,299 5s. 3d., charged on certain land and premises in Barrow-in-Furness. Holder, H.M. Secretaries of State for War.

Douglas Southern Electric Tramways, Ltd.—Particulars of £3,000 debts., created June 7th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Edmundsons' Electricity Corporation, Ltd. For the year ended March 31st, 1916, the net profit, after providing for mortgage and debenture stock interest and redemption, amounts to £13,259, plus £3,366 brought forward. After deducting the interim half-yearly dividend, paid last January, on the cum. pref. shares, the balance is £20,625, of which £6,000 is required for the final dividend on the preference shares, and £4,625 is carried forward. We extract the following particulars from the schedule, showing gross profits of subsidiary and other companies for the years 1914 and 1915—

	gross profit before providing for capital charges and depreciation.	1915.	1914.	Lamps connected & require 33-watts.
Alderley	£3,000	£3,118	35,099	31,830
Bromley	11,067	12,755	128,298	122,671
Folkestone	17,064	19,487	153,451	145,943
Guersey	5,797	5,830	116,957	135,471
Isle of Wight	10,493	12,946	154,434	146,794
Ilfracombe	816	1,151	22,451	22,550
Lynton	1,438	1,899	22,134	21,085
Milton Mowbray	2,475	2,727	29,770	26,152
Newmarket	1,970	2,318	31,322	30,749
North of Scotland	7,038	6,937	102,741	95,089
Ramsgate	3,075	3,391	45,432	44,459
Seaboard Trans	1,722	208		
Salisbury	6,670	5,896	46,881	44,576
Urban Co.	70,001	70,229	920,555	886,519
Weymouth	6,881	6,337	72,499	68,336
Cromer	368	822	18,448	17,806
Dorking	2,605	2,853	26,183	26,085
Frome	1,405	2,063	53,839	51,820
Hamilton	4,528	4,300	84,809	78,898
Swinton	12,369	9,598	152,297	149,943
	£157,396	£169,605	2,145,220	1,994,396

* Figures for year ended March 31st, 1915.

† Figures for nine months ended December 31st, 1915.

The total capital expenditure increased during 1915 from £3,182,877 to £3,230,912. Annual meeting: July 20th.

The report for 1915 states that the gross earnings were £316,554 and expenses £89,626, leaving a credit balance of £226,927, which was insufficient to meet the interest on the first mortgage bonds, while interest on the refunding mortgage bonds and interest payable on current account were not earned. The loans to the company secured by its first mortgage bonds and the other net current liabilities amount to nearly £550,000. The company will require, in addition, £100,000 to instal the third generating unit. In June, 1915, the company sought permission of the British Treasury to make a public issue of securities in London, but this request was refused. Unsuccessful efforts were then made to effect a compromise with the committee representing the holders of the first mortgage bonds. Subsequently a Noteholders' Protective Committee, representing the holders of the notes, which are secured by the refunding mortgage bonds, was able to effect a compromise with the committee representing the holders of the first mortgage bonds. In order to carry out the terms of this compromise and to avoid the sale of the properties in foreclosure proceedings, it is necessary that the holders of the £2,495,000 par value of the shares, now issued to the public, should subscribe for a sufficient number of the proposed new issue of preferred shares to realise £374,240 in cash. It is, therefore, proposed, at the ensuing annual meeting, to enact by-laws reducing the paid-up capital from £5,000,000 to £1,000,000, and to issue to each shareholder one fully-paid share for each of his five fully-paid shares now held by him. The Noteholders' Protective Committee have procured the formation in New York of a syndicate which will underwrite an issue of at least \$50,000 of preferred shares, and the Noteholders' Protective Committee will offer these preferred shares to noteholders and to the shareholders at the price of \$80 per share. Each shareholder is requested for each five shares now held by him, to subscribe for at least two new preferred shares of the par value of \$100 each, and to pay therefor \$80 per share in cash, and upon such payment being made each shareholder, in addition, will, in case the issue of preferred shares is not

Committee, the directors of the company have for every two preferred shares allotted to him. Subscriptions on the first mortgage bonds paid until January 1st, 1918, and the company is now in a position to complete the in-crease of its capital and to carry on its business.

French Electrical Companies.

The financial statement of the *Société Industrielle d'Electricité* for profits and losses for the year ended March 31, 1915, shows a net profit of £48,000 for 1915. After allowing for depreciation, the balance has been carried forward.

The accounts of the *Compagnie Industrielle de l'Est (Jeumont)* show net profits and balance forward amounting to £15,000 for 1915. A dividend at the rate of £1 4s. per share has been declared, and the sum of £7,800 has been carried forward.

The directors of the *Chemin de Fer Electrique Souterrain Nord-Sud, of Paris*, state that the mileage working in 1915 was the same as in each of the two preceding years, and after a period of 11 months of depression in the traffic from the beginning of the war, a marked improvement took place in the second half of the year. The net profit for 1915, as compared with the net profit of £48,000 in 1914, was £15,000. The net profit for 1914 and £48,000 in 1915, whilst the net profit of £15,000 brought forward from 1914 declined to £15,000 last year, which sum has been transferred to the contingency fund. It is mentioned that the work of extending the line "A" from the Place Jules Joffre to the Porte de la Chapelle was resumed in the course of 1915, although the construction is proceeding slowly.

The report for 1915 of the *Ateliers de Constructions Electriques du Nord et de l'Est (Jeumont)* recalled the fact, as was mentioned a year ago, that the company's workshops were situated in the district occupied by the enemy, and it had, therefore, been impossible to balance the accounts for 1914. It was still impossible to furnish complete information. According to news upon which it was believed reliance could be placed, the directors knew that a limited personnel had been kept, and was occupied on the maintenance of the plant and the completion of certain manufactures in hand, in order to provide means of existence for the workmen who were deprived of any resources. As a result of the requisitions made, and for which certificates appeared to have been regularly given by the German authorities, the machine tools, manufactures, and raw materials had been removed from the works. As soon as the enemy troops had evacuated the district the directors would proceed to value the material damages caused under the conditions provided for by the French Decree of February 4th, 1915, in order to safeguard their rights in any eventuality. During the year the company had collected several important accounts, which brought the sum available in cash and at the banks to over £180,000. The plant at the works at Saint Ouen had been increased, and satisfactory results obtained. The various works of the subsidiary company, the *Electricité de Gaz du Nord*, were occupied by the enemy; the gas works had not been damaged, nor had the Jeumont central station, but no information was procurable regarding the Lomme station, near Lille. At the recent general meeting, and in reply to questions, the chairman stated that most of the machinery at the Jeumont works had been removed and carried away; the value was considerable, and was known from the books. At the Saint Ouen works operations had been resumed as soon as possible, and two advantages had been derived therefrom. In the first place, the directors had got the men to work, and secondly, they had the possibility of acquiring a certain quantity of new plant which would permit of the immediate re-equipment of certain of the shops at Jeumont as soon as the enemy had quitted that region.

For the year ended March 1916, the net profits were £196,275, plus £36,701 brought forward, making £232,976. After deducting debenture interest and depreciation amounting to £27,260, there is an available balance of £205,716. A dividend of 6 per cent. on the preference shares required £42,000; managing director's and employés' bonus amounted to £12,701; a dividend of 10 per cent. on the ordinary shares £50,000; to reserve account £40,000 is added; grants to dependents of men on active service amount to £12,962; and there is to be carried forward £12,962.

The result of the past year has been generally satisfactory. All the company's works have been fully occupied throughout the year, and have been mainly employed in the production of material essential for the purposes of war. Although the demands on the company were mostly confined to the electrical field, many requisitions were made for appliances of all kinds, and the company had to overcome. Some 1,500 experienced members of the staff and workpeople now serving at the Front had to be replaced by untrained substitutes. New workshops had to be erected for special work. The scarcity of labour, the difficulty of obtaining new machinery, and of adapting existing

plant to the production of new articles, and the occasional dearth of raw material caused temporary delay and disorganisation. If the present results are satisfactory, they are entirely due to the unselfish devotion, initiative and unremitting energy of the staff and workpeople. The capital expenditure on new works at Witton during the year amounted to approximately £70,000. The extensions planned and referred to in previous reports have been suspended until the advent of a more favourable moment for carrying out such constructional work. For the same reasons, no further progress has been made with the Kingsway building. The various selling branches of the company have all done well. In spite of the reduced output of the works available for private and ordinary industrial purposes, the company's large reserve stocks have been helpful in the past to make good the deficiency. The export business of the company records very large inquiries, but, owing to well-known causes common to all exporters in this country at the present moment, only a small proportion of the demand could be filled.

The directors draw attention to the increasing investment account. The company's investments may be sub-divided as follows:

(a) *Manufacturing Companies*: Peel Conner Telephone Works, Ltd.; Robertson Electric Lamps, Ltd.; Salford Electrical Instruments, Ltd.; Steel Conduit Co., Ltd.

The company is also subscribing as proxy for a number of the output of these works, and thus the company has to financial interest and management. The company is also a shareholder in a manufacturing company in which the General Electric Co. holds at present half the capital, the other half being held by Messrs. Pirelli & Co., of Milan. No profit has yet been made, nor was it anticipated, as the works have only been running for a short time. The works, both in construction and equipment, are most complete and up-to-date, and the directors are well satisfied with the progress made under prevailing conditions.

(b) *Trading Companies*: Anglo-Argentine General Electric Co., Ltd.; British General Electric Co., Ltd., Australia; British General Electric Co., Ltd., South Africa; General Electric Co. (of Belgium), Ltd.; General Electric Co. of China, Ltd.; General Electric de France, Ltd.; General Electric Co. (India), Ltd.

The object of these companies is to sell in their respective territories the products of the British works.

(c) *Electricity Supply Companies*: Bogotá Telephone Co., Ltd.; Barbadoes Electricity Supply Corporation, Ltd.; Dacca Electric Supply Co., Ltd.; The Electricity Co. of Macclesfield, Ltd.; Frinton-on-Sea and District Electric Light and Power Co., Ltd.; Madeira Electric Lighting Co. (1909), Ltd.; Northwood Electric Light & Power Co., Ltd.

The above investments with the exception of Northwood and Barbadoes, are principally owned and managed by this company, and all have arrived at a profit-earning stage.

(d) *Sundry Investments*: In addition to the above, there are sundry industrial investments largely composed of a temporary character and, whilst those under headings (a), (b) and (c) are practically permanent, that is, required for the conduct of the General Electric business, those under heading (d) are constantly changing.

Any shares allotted to the company for consideration other than cash are not included in the figures of the balance sheet.

Mr. Montagu F. Armstrong, Mr. George H. Ide, and Mr. Maurice Solomon have joined the board. Annual meeting: Monday, July 17th.

We give below the comparable figures from the reports for the three years ended March 1911, 1915 and 1916.

	1914.	1915.	1916.
Net trading profit and income from investments...	£157,894	£161,877	£196,275
Depreciation and debenture interest	32,328	26,855	27,260
Pre-l. dividend	21,000	38,684	42,000
	(6%)	(6%)	(6%)
Available balance	133,896	136,081	163,716
Managing directors and employees' bonus	10,156	9,934	12,701
Expenses of new issue of shares	14,000	13,822	
Staff benevolence	3,000		
War grants		7,182	12,962
Ordinary dividend	10,000	18,142	50,000
	(10%)	(10%)	(10%)
To reserve account	30,000	20,000	40,000
Balance carried forward	36,710	36,701	48,053
Reserve fund total	200,000	220,000	260,000

The A.E.G.—Union *Elektricitäts Gesellschaft, of Vienna*, proposes to pay a dividend of 6 per cent. for 1915, as compared with 4 per cent. in the preceding year.

The net profits amounted to £46,000, as contrasted with £27,000 in 1914. At the same time, the ordinary share capital is to be increased from £600,000 to £850,000.

The *Ver. Glühlampen und Elektricitäts Gesellschaft, of Budapest*, after setting aside £15,000 for depreciation in 1915, as compared with £14,000 in the previous year, report net profits amounting to £75,000, as against £41,000 in 1914. The directors recommend the payment of a dividend of 12 per cent., as compared with 10 per cent. in 1914.

The directors of the *Gesellschaft für Elektrische Industrie of Vienna*, which is connected with the Austrian Railway Traffic Establishment, state that the work of reorganisation

Austrian Electrical Companies.

which was begun a few years ago, was completed in July, and working assumed a more profitable course; the net profits realised last year, after making provision for depreciation, amounted to £16,000, as compared with £8,000, and a dividend of 10 per cent. has been declared, as against 5 per cent. in 1914. An increase in the share capital recently took place, and a further augmentation to £333,000 is to be made at an appropriate time.

The report of the *Oes. Siemens-Schuckert Werke* states that the company's co-operation in meeting Army requirements in 1915 consisted not only in the establishment of numerous installations and works, but also in the invention and production of multifarious auxiliaries, of which information is withheld, and these were amplified by the manufacture of considerable quantities of munitions. On the other hand, the output of peace products was restricted to those which were absolutely necessary, and the economy practised in materials formerly obtained from abroad led to a more extended use of inland substitutes, which would also continue to some extent after the war. After allocating £67,000 to depreciation, as compared with £65,000 in 1914, the accounts show net profits of £118,000, as against £79,000, and a dividend of 7 per cent. is in contemplation, this contrasting with 5 per cent. in 1914.

German Electrical Companies.

The Deutsche Magneta, A.G. (Electric Clock Works), of Cologne, reports receipts of £5,400 from rents and royalties in 1915, as compared with £5,600 in 1914. The net profits were £940, as against £760, the disposal of the former not being specified.

The report of *Kortings Elektrizitäts Werke, of Berlin*, states that existing circumstances exercised an unfavourable influence on the receipts from the operation of the various works. The net profits reached £10,700, as compared with £11,000, and a dividend of 4 per cent., as in 1914, has been declared.

The Elektro-Nitrium, A.G., of Rhina, Baden, which company was formed by the Berlin Electricity Works Co. and the A.E.G., in conjunction with the Griesheim-Elektron Chemical Works, is engaged on the erection of nitrate works, and has just published provisional accounts for the initial period. Lignite is proposed as the station fuel, and for this purpose control has been secured over two lignite mines and lignite deposits in the neighbourhood of Bitterfeld.

The financial statement of the *Kabelwerk Duisburg, of Duisburg*, shows gross profits of £114,000 for 1915, as compared with £109,000 in the preceding year, the net profits being £31,000 and £56,000 in the two years respectively. At the recent general meeting a dividend at the rate of 18 per cent. was declared, together with a bonus of 12 per cent. as compared with a distribution of 18 per cent. in 1914.

The Elektro-Treuhand, A.G., of Berlin, which financial institution was jointly formed by the A.E.G. and the Siemens group, and which holds £750,000 in shares of the Hamburg Elevated Railway Co., has decided to pay a dividend of 5½ per cent. for 1915, as in the previous year, on the paid-up capital of £750,000. The amount of the dividend has had to be provided by the two manufacturing groups in question, according to guarantee.

The A.E.G. Schnellbahn, A.G., of Berlin, which has in course of construction an electric railway between the north and south of Berlin, reports that the continuance of the work in 1915 was prejudicially affected by the scarcity of transport vehicles and workmen. The accounts indicate receipts of £82,000 from interest, as against £74,000 in 1914, whereas £95,000 was paid to shareholders by way of interest during construction, and general expenses also absorbed £5,000. It is expected that, despite the war, the most difficult parts of the work of building this underground railway, which is to have a total length of 5½ miles, will be completed towards the end of 1918, as is provided for under the concession.

The Elektro-Salpeter Werke, A.G., of Zschonowitz, which was also formed by the Berlin Electricity Works Co. and allied undertakings (A.E.G.) to establish nitrate works in connection with the lignite fuel generating station of the Elektro Works of Golpa-Jessenitz, and near the Imperial Nitrate Works, has just published its accounts for the three months ended with December. After the Imperial Works had contracted with the Elektro Works for the supply of 500,000 kw.-hrs. per annum, the Elektro-Salpeter Works undertook to accept delivery of a further 250,000 kw.-hrs., and the full capacity of the Golpa-Jessenitz station has now been engaged. It is expected that operations at the Zschonowitz nitrate works will shortly be commenced.

Electric Light & Power Supply Corporation, Ltd. (Balmmain, Sydney).—The report for the half-year ended April 30th, states that the new consumers connected constitute a record, and that the total number is now 3,648. The lighting of the Parramatta Road has given satisfaction, and the streets served now total 116 miles, while for private consumers the street miles are 55. It is difficult to obtain supplies; fuel, stores, and wages cost more, and have augmented the working cost; and the coal conveyor has been delayed, but was expected to be completed in June. The revenue was, for the complete year, £47,844, and the expenditure £23,139. The dividend is 8 per cent.

Capital Reduction.—*Madras Electric Supply Corporation, Ltd.*—A petition for confirming the reduction of the capital from £500,000 to £380,000 is to be heard on July 18th.

Southern Brazil Electric Co., Ltd.—The report for the six months to December 31st says that owing to the period under review being exceptionally short, there is necessarily little of interest to add to what was stated in the last report. The improvement in Brazil then referred to continues to make steady progress, and the rate of exchange, which had at one time fallen to 11½d., has during the past two months shown a sensible recovery. In the State of Sao Paulo the outlook appears decidedly favourable; the staple crop, coffee, is selling at remunerative prices, and the yield of cereals and other produce promises to be unusually large, thus giving every prospect of a season of general prosperity. Abundant rains have fallen throughout the State, and the necessary water supply is amply assured for a considerable time to come. The balance to the credit of profit and loss account, after deduction of all charges in Brazil and London and of interest on debentures to January 1st last, is £946, plus £2,127 brought in, making £3,073, which the directors propose to carry forward.—*Financial News*.

Chili Telephone Co., Ltd.—The report shows that the aggregate number of subscribers at all centres at March 31st, 1916, was 13,307, an increase of 212. The gross revenue from all sources was £121,973, an increase of £9,612; the total expenditure was £72,388, an increase of £7,992; the net revenue was £49,585, an increase of £1,620. The balance to the credit of revenue account, including £4,339 brought forward, is £53,924, of which £2,644 has been expended on replacements, &c., of plant. An interim dividend of 3s. per share, free of income-tax, has already been paid, and after putting £18,577 to the general reserve and £2,000 to the reserve against loss on investments, a final dividend is proposed of 5s. per share, free of income-tax, leaving £4,302 to be carried forward. Shareholders are to be asked to approve the payment of directors' fees free of income-tax.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended May 26th, 1916, amounted to 1,955,288, compared with 1,893,700 in the corresponding four weeks of 1915.

Stock Exchange Notice.—The Committee has ordered the following securities to be quoted in the Official List:—

Adelaide Electric Supply Co., Ltd.—Further issue of 20,000 6 per cent. cumulative preference shares of £5 each, fully paid, Nos. 30,001 to 50,000.

Karachi Electric Supply Corporation, Ltd.—The directors have declared a dividend at the rate of 5 per cent. per annum as the result of the first complete year's working. At the meeting held on June 13th, the Hon. Mr. M. de P. Webb stated that the demands for electrical energy had exceeded all expectations. The directors propose to raise a further Rs. 2,00,000 of capital at an early date.—*Indian Engineering*.

Paignton Electric Light Co., Ltd.—Profit for 1915, £1,711. After putting £500 to depreciation and paying debenture interest, £894 is to be carried forward. Electricity sold produced £3,433, as against £3,400 for the previous year. Consumers number 296 (20,566 lamps), an increase of 33 consumers (1,494 lamps).

Northern Light, Power & Coal Co., Ltd.—At a meeting of the holders of the first mortgage gold bonds, a resolution providing for the immediate issue of prior lien bonds was approved.

National Gas Engine Co., Ltd.—Interim dividends for the half-year ended June, 1916: At the rate of 5 per cent. per annum on the preference shares, and 7½ per cent. per annum on the ordinary shares, both subject to income-tax.

Direct United States Cable Co., Ltd.—Interim dividend, 2s. per share, less income-tax at 5s. in the £, being at the rate of 4 per cent. per annum, for the quarter ended June 30th.

Anglo-American Telegraph Co., Ltd.—Interim dividends of 15s. on the ordinary stock and 30s. on the preferred stock, less income-tax at 5s. in the £, are declared.

Fraser & Chalmers, Ltd.—Interim dividend of 7½ per cent. on the preference shares, less income-tax.

Hadfields, Ltd.—Interim dividend, 1s. per share, free of tax, on the ordinary shares.

Bank Rate Change. The Bank Rate was yesterday raised from 5 per cent. to 6 per cent.

Copper Prices.—THE WEEK'S CHANGES.

F. Smith & Co. report, Wednesday, July 12th.—Electrolytic bars drop from £133 to £128; ditto sheets, from £151 to £150; ditto rods, from £140 to £135; ditto h.c. wire, from 1s 4½d. to 1s 4½d.

James & Shakespeare report, Wednesday, July 12th.—Copper bars, sheet and rod (best selected), drop from £152 to £148.

STOCKS AND SHARES.

THURSDAY, JULY 13, 1916.

THE forward push by the Allies on the various battle-fronts has its modest counterpart in the way that Stock Exchange prices move steadily upward. Each successive advance emphasises more clearly the determination on the part of stockholders to keep what they have. The demand of the buyer

goes so frequently unfulfilled that it is nothing unusual for a broker to open negotiations with a jobber with the direct question whether the latter has any stock for sale, instead of going through the ordinary preliminaries of asking for a price.

The Home Railway market is fairly getting into its stride. One of the features of the past few days has been a marked improvement in the 6 per cent. income bonds of the Underground Electric Railways of London. The price is 4 points up, standing now at 94. What to suggest now to those who took the hint to buy the bonds about 80, is a little difficult. There is an excellent profit, but how to replace the investment with anything yielding as well as these bonds do is something of a problem. The rise is quite likely to continue if markets remain in their present buoyant condition. The £10 shares have jumped to 2, and the "A" shares hardened to 6s. 9d.

The St. James' & Pall Mall Co. has declared an interim dividend at the rate of 5 per cent., as against 7 per cent. a year ago. For 1915 the company paid 8 per cent. to its ordinary proprietors, so the present reduction is taken as a possible caution that for 1916 the rate may be 6 per cent., as to which another six months will show. Various other reductions in dividend distributions are now spoken of as likely.

Instead of such considerations inducing sales of shares, the market is actually firmer than it has been for many months past. City Lights are $\frac{1}{2}$ up, so are Charing Cross, and London Electric, of the lower-priced shares, have 1/16 rise to their credit. The best-class preferences are almost as hard to get as debenture stocks in the front-rank companies.

Investment having now arrived at the stage when it asks for stocks and shares likely to appreciate after the war, immediate reductions in dividends, or temporary low yields, form no particular bar to the capitalist on the look-out for cheap and good security. Hence the inquiry for electric lighting shares. There may be another lean half-year or two to be compassed, but after that, the prospect of good business is a good deal brighter for electricity than for some of the industries enjoying phenomenal, if ephemeral, prosperity by reason of war orders.

British Westinghouse preference are once more close to 50s. General Electric preference have regained their par price of 10, on the issue of a very satisfactory report. Net profit rose to £193,000, an increase of £70,000, and the ordinary dividend is maintained at 10 per cent. Edison & Swan £3 paid shares have come in, and the price accordingly receded a few pence. The Telegraph manufacturing group exhibits pronounced strength. British Insulated are 15s. to the good. Henley's put on 5s. Callender's preference show an equal advance.

Attention is re-directed to affairs in Brazil in consequence of a gradual stiffening of the Rio rate of exchange. The country's Government and railway stocks have risen substantially. Brazilian Tractions at 63 are a point up, after 64 had been reached. There are a good many orders in the market to sell shares at 65, which was the making-up price on the eve of war's outbreak, July, 1914, and the knowledge of this may be holding back the price to some extent. Underground Incomes, it may be remarked, kept just below their making-up price of 87½ for some time; once the price was passed, showing the open stock to be all absorbed, further advance came rapidly. So it is likely to prove in the case of Brazilian Tractions.

Argentines also are a much better market, the railway stocks in particular. Anglo-Argentine Trams, however, are strong also. The first preference at 3½ are 3/16 up; the second preference remain at 3½, and the debenture stocks are very firm.

The Stock Exchange has made up its mind that the Mexican days of mis-rule are rapidly approaching their end, and that General Carranza's new-found pliability is the result of a real desire for peace. The utility companies' first mortgage bonds are, therefore, harder, although naturally the market in all the stocks is what the House calls *piano*. Fresh advances are scored by British Columbia Electric Rails, the 4½ per cent. debenture gaining 3 and the preference stocks 2 points. Canada draws more and more to the front of popular favour with every week, because of the remarkable evidence of her returning trade activity as shown by railway traffic and land sales. The shares of the Canadian & United States light and power undertakings keep very firm.

Marconis followed up their 6s. rise of last week with a jump of nearly as much before a slight reaction happened. The market in them is animated, and its appearance suggests mild gambling. The strength is due to the statements at the recent meeting, and to the hopes of a big bonus to come. American Marconis have touched 19s. 9d., Canadians 12s. 9d., and Spanish 14s. 3d., the top prices not being maintained. Canadians, at any rate, look dear at 12s. on the published information, but in the market they seem to expect that the shares will go still better.

The only decline in cable shares is £1 in Indo-Europeans. A feature is the strength of West India and Panama at 22s. 6d. Anglo-American preferred and ordinary are to receive their regular quarterly dividends. Globes are better, and in the Telephone group, United River Plates stand out with 3/16 rise. Chili Telephones are better to the same extent, keeping pace with River Plates. The Eastern group holds all its recent big improvement.

Rubber shares are a better market on the slight recovery in the price of the produce. On the other hand, copper shares have given way because of a heavy drop in the metal. The chemical shares are mostly good, while armaments keep steady without varying much in price.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend		Price	July 11, 1916.	Rise or fall this week.	Yield p.c.
	1914.	1915.				
Brompton Ordinary	10	10	62	—	47 18 2	
Charing Cross Ordinary ..	5	5	25	—	6 18 0	
do. do. 4½ Pref.	4½	4½	94	—	6 18 6	
Chelsea	5	5	8	—	6 18 4	
City of London	9	8	124	—	6 10 8	
do. do. 6 per cent. Pref. ..	6	6	104	—	6 11 3	
County of London	7	7	7	—	6 11 9	
do. do. 6 per cent. Pref. ..	6	6	104	—	6 15 8	
Kensington Ordinary	9	7	54	—	6 16 7	
London Electric	4	4	12	—	7 5 5	
do. do. 6 per cent. Pref. ..	6	6	44	—	6 18 4	
Metropolitan	34	9	18	—	6 6 1	
do. do. 4½ per cent. Pref. ..	4½	4½	8	—	7 10 0	
St. James' and Pall Mall ..	10	6	8	—	6 13 4	
South London	5	6	92	—	6 18 10	
South Metropolitan Pref. ..	7	7	14	—	8 4 6	
Westminster Ordinary	9	7	14	—	6 14 3	

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	6	6	1054	—	5 18 9	
do. Def.	30½	33½	28	—	7 10 9	
Chile Telephone	8	8	418	—	5 17 5	
Cuba Sub. Ord.	6	6	75	—	6 17 9	
Eastern Extension	7	8	—	—	5 6 8	
Eastern Tel. Ord.	7	8	150	—	5 6 8	
Globe Tel. and T. Ord.	6	7	184	—	5 7 8	
do. do. 10 per cent. Pref. ..	6	6	44	—	6 15 1	
Great Northern Tel.	22	32	38	—	6 18 0	
Indo-European	13	13	48	—	6 12 8	
Marconi	10	10	84	—	3 2 0	
New York Tel. 4½	4½	4½	1024	—	4 7 10	
Oriental Telephone Ord. ..	10	10	2	—	5 0 0	
United R. Plate Tel.	8	8	64	—	5 17 5	
West India and Pan.	1	—	18	—	—	
Western Telegraph	7	8	15 1/2	—	5 6 8	

HOME RAILS.

Central London, Ord. Assented	4	4	73	—	5 9 7	
Metropolitan	14	1	174	—	8 12 9	
do. District	Nil	Nil	194	—	Nil	
Underground Electric Ordinary	Nil	Nil	2	—	Nil	
do. do. A	Nil	Nil	694	—	Nil	
do. do. Income	6	6	94	—	6 11 2	

FOREIGN TRAMS, &c.

Adelaide Sup. 6 per cent. Pref.	6	6	5	—	6 0 0	
Anglo-Arg. Trams, First Pref.	54	54	94 1/2	—	7 2 0	
do. do. 2nd Pref.	54	54	34	—	8 9 2	
do. do. 5 Deb.	5	5	774	—	6 9 0	
Brazil Tractions	4	4	65	—	6 7 0	
Bombay Electric Pref.	6	6	163	—	6 18 4	
British Columbia Elec. Rly. Pice.	5	6	62	—	Nil	
do. do. Preferred	Nil	Nil	40	—	Nil	
do. do. Deferred	Nil	Nil	35	—	Nil	
do. do. fully paid	44	44	65	—	6 10 9	
Mexico Trams 5 per cent. Bonds	Nil	Nil	44	—	Nil	
do. do. 6 per cent. Bonds ..	Nil	Nil	54	—	Nil	
Mexican Light Common	Nil	Nil	30	—	Nil	
do. do. Pref.	Nil	Nil	88	—	Nil	
do. do. 1st Bonds	Nil	Nil	42	—	Nil	

MANUFACTURING COMPANIES.

Balcock & Wilcox	14	15	3	—	5 0 0	
British Aluminium Ord. ..	6	7	204	—	6 7 8	
British Insulated Ord. ..	15	174	114	—	7 17 0	
British Westinghouse Pref. ..	74	74	494	—	6 2 5	
Callenders	15	20	124	—	8 0 0	
do. 5 Pref.	5	6	4	—	5 11 1	
Castner-Kellner	30	—	—	—	5 6 8	
Edison & Swan, £3 paid ..	Nil	—	103	—	Nil	
do. do. fully paid	Nil	—	14	—	Nil	
do. do. 5 per cent. Deb. ..	5	5	57	—	8 16 8	
Electric Construction	6	74	15/3	—	9 16 8	
Gen. Elec. Pref.	6	6	10	—	8 0 0	
Honley	20	25	154	—	8 4 0	
do. 4½ Pref.	44	44	4	—	6 12 6	
India Rubber	10	10	124	—	8 3 4	
Telegraph Con.	30	30	89	—	6 4 0	

* Dividends paid free of Income-tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of passengers.	Total to date.		Route miles open.
		£	£		£	£	
Blackpool-Fleetw'd ..	June 24	3,760	931	25	12,629	4,924	8 ..
Bristol (Trams)	" 30	20,041	680	26	121,717	2,194	30 5/8 ..
Cork	" 29	2,201	41	28	12,416	217	9 5/8 ..
Dublin	" 30	26,813	183	26	145,671	9,302	54 2/3 ..
Hastings	" 30	4,026	29	—	—	318	19 5/8 ..
Lancashire United ..	" 28	7,550	68	26	44,355	1,468	42 ..
Llandudno-Col. Bay ..	" 30	1,784	354	304	7,864	293	6 5/8 ..
Anglo-Argentine	July 1	193,888	4,772	24	1,826,059	6,632	—
Auckland	June 2	21,154	642	48	253,058	4,949	26 5/8 ..
Calcutta	July 1	17,618	169	26	—	5,749	20 5/8 ..
Kalgoorlie, W.A.	June 2	2,479	—	13	6,903	—	—
Madras	June 30	8,969	300	26	24,689	1,888	—
Montevideo	June 2	25,800	1,034	34	241,068	14,876	—
Dublin-Lucan Rly. ..	June 30	722	56	26	3,407	311	7 ..

NATIONAL ECONOMY IN FUEL.

THE USE OF GAS COKE FOR STEAM RAISING.

OUR great national treasure, diligently sought for, mightily fought for, and carefully invested in all parts of the world with so much forethought by our fathers long ago, has been let loose in a veritable Niagara of shot, shell and munitions of war during the past two years; and, although we have yet resources sufficient to meet our needs, it requires only a little thought to realise the extent of the task before those engineers who, in every industrial walk in life, will be left to face it—the task of re-erecting by economy and thrift, in co-operation with scientists, bankers and inventors, the great awning of credit, under whose shelter only is it possible for the nation to take its proper place again in history.

Economy and thrift cannot be exercised better than in the use of coal, our greatest source, perhaps, of wealth. Many, and competent, writers and speakers have in the past rightly urged the importance of this matter, with little effect, but the common need of the Allies for fuel, and the loss of men and merchantmen, has resulted in unheard-of prices, and raised an immediate and insistent demand for the stoppage of all kinds of waste.

The Board of Trade, in its letter dated May 25th last, has drawn attention very properly to the need for great care during the coming winter, and engineers are casting about for means to meet the crisis, without much, if any, additional expenditure in machinery.

It is of little use thinking just now of dispensing with the boiler house and erecting gas engines, or of using the force of the tides. We have to look rather to smaller things, including greater skill and care in burning what fuel we can obtain in the boilers as they stand.

With the present high prices of coal of all grades, it may, according to conditions and locality, pay to use lower-grade fuels; but even here high draught and special furnace brickwork settings are essential to success.

Mr. E. W. L. Nicol's recent paper on "Coke Fuel for Steam Boilers," read before the Junior Institution of Gas Engineers, is full of useful suggestions; but the difficulties met with in dealing with this class of fuel are not, naturally enough, emphasised. It is the purpose of these notes to indicate some of its advantages, and to point out the more important difficulties to be overcome.

Coke and coke breeze are the residuals of gas coal after the latter has been roasted in retorts, and the volatile matter driven off in the process of manufacturing gas. They are essentially by-products, and can be sold at a low price without greatly affecting the profits of the gas company, with the consequence that the cost is usually sensitively subject to variations in demand.

Both coke and breeze consist of "fixed" carbon adulterated with ash and moisture in varying quantities. A fair sample of gas coke may contain 10 per cent. to 12 per cent. of ash and 5 per cent. to 8 per cent. of moisture, with, perhaps, 1 per cent. or 2 per cent. of volatile matter; while coke breeze has usually 18 per cent. to 25 per cent. of ash, about 10 per cent. of moisture, and the same amount of volatile matter. As fixed carbon has a calorific value of approximately 14,500 British thermal units per lb., and the heating value is directly lessened by the proportion of ash and moisture, it is a simple matter to calculate within practical limits the calorific value of coke as varying from 12,400 to 11,740, and that of coke breeze from 10,700 to 9,800 British thermal units per lb.

Now, from the point of view of national economy, it would appear a most attractive and highly-desirable proposition, first of all, to extract from coal all those valuable products which more often than not go up the chimney unconsumed, and are dissipated in uncontrolled freedom and smoke, and then to burn the fixed carbon for steam raising. The supply of coke and breeze is as continuous as the making of gas, and the commodity is, for want sometimes of better use, burnt to make "water gas" to mix with coal gas, or shipped abroad.

The difficulties attending the use of this fuel are many and varied, and, no doubt, give an explanation of its

restricted use. At the outset, one is faced with its large bulk, weight for weight, as compared with coal. For the same thermal capacity, coke may be taken to occupy 35 per cent. more space than coal, even when broken. This difficulty raises the question of storage accommodation, the size of the railway wagons, and the capacity of the conveying gear. Then the higher amount of ash calls for greater expenditure in its disposal.

The calorific value as shown of, say, coke, is considerably less than that of good coal, and 10 per cent. or more, according to circumstances, may possibly have to be added to its price when considering relative values.

When we come to the actual burning on the grate, we find, as might be expected, from experiments on our own hearths, that it requires a considerable exercise of patience to ignite, and then calls for high draught to keep it alight.

To burn it successfully on a chain-grate stoker, the conditions of draught (preferably a combination of "forced" and "induced," or "forced" and "chimney") must be studied and carefully supervised, and the brickwork setting must be so disposed as to give early ignition and well-sustained reflected heat on the body of the fuel as it travels to its temporary home in the ashpit.

These conditions being met on a grate having a sufficient area to allow for a low rate of fuel consumption—approximating 18 or 20 lb. per sq. ft.—it will be found that a high CO_2 , and consequent high furnace temperature, is obtained, and will give a somewhat more efficient evaporation than coal.

It is for the engineer to consider whether all these difficulties can be met, and the full output of his boilers obtained, while the prices of coal and coke maintain their present relation. It may be that a judicious mixture of a cheap coal, high in volatile matter, with coke or coke breeze, will result in an acceptable strengthening of both his employers' and the nation's resources.—K. D.

THE TRADE OF NEW ZEALAND.

A REPORT on New Zealand trade during 1915, prepared by H.M. Trade Commissioner, has lately been issued by the Board of Trade. It will repay study by everyone concerned in the business affairs of this flourishing British Dominion. The Report (Cd. 8,268) may be purchased from Messrs. Wyman & Son, Ltd., price 3d. Those of H.M. Trade Commissioner's remarks which it is thought will interest the electrical and allied industries are extracted below:—

Position of Trade.—Imports from the United Kingdom have declined somewhat seriously. In the early days of the war the primary difficulty experienced was in securing the shipment of goods, owing to congestion on the British railways and at the docks. With the gradual organisation of munition making, prohibition of export, and increase of prices in the United Kingdom, the decline has become more and more pronounced. Imports from Germany in previous years have been about £1,000,000, and from this source, as well as from Austria-Hungary, Turkey, and also from our French allies, practically nothing has reached New Zealand during 1915. On the other hand, the war has effectively stimulated trade with America and Japan. From the former, travellers in search of business and offering new agencies have come in unusual numbers. Scarcity of freight, high prices, and, towards the end of the year, the serious blocking of the Panama Canal, have tended to check business. On the other hand, the total or partial stopping of supplies such as structural steel, corrugated iron, wire, tubes and pipes, motor cars and cycles, glass, &c., has forced importers to look for new sources of supply, and even to go to America in quest. Almost all orders for electrical machinery from public bodies and Government have, during the year, gone to America. A large part of the trade in motor cycles, hitherto an entirely British preserve, has gone across the Pacific, while all orders for motor cars which would have gone to the United Kingdom or other parts of Europe have similarly been shared by makers on the American continent. Japan also was early in the field, and an official commercial mission visited New Zealand during the year. Electric torches, basket and brush ware, glassware, and bottles, buttons and haberdashery, stationery and fancy leather goods, are a few of the lines in which Japanese competition will have to be expected.

Safeguarding the Future.—So far as British manufacturers are at present precluded from competition, we have merely to face the facts of the situation as they present themselves and do the best we can to minimise the future loss. The facts, however, must be faced, and, so far as possible, made known. Some importers have transferred their custom, to

foreign countries in a purely commercial spirit, buying their requirements from the most obvious and cheapest available source. Others, again, have done so from sheer necessity, and with the utmost reluctance. In either case they have made the mistake of buying competitors, and have at least temporarily secured a glut of imports and substituted new ones. The leeway which will have to be made up after the war before the British manufacturers can get back even to their normal pre-war share of the trade in the Dominion will be serious, and it behoves them to do all in their power now to minimise this. The Commissioner lays particular emphasis on the following points:—

1. Those firms who are occupied entirely with munition making and are entirely precluded from exporting should, so far as possible, make this fact known to their customers in New Zealand, not only to importers, but to consumers.

2. Those whose goods are still available, but whose prices are seriously enhanced, should take care to give ample explanation of the reasons. Unreasonable buyers and trade rivals between them have done ample mischief already in explaining advances in prices as "extortion," "trading on the patriotism of the Dominion," &c., and it is a matter of importance that manufacturers should give the actual facts in as much detail as possible, e.g., the actual advance in price of raw material, number of staff enlisted, increased freights, war taxation, and so on. Buyers do not always realise without being told the connection between, say, war prices of spelter, fencing, wire, copper tube, brass, &c., and the prices of the manufactured article which they import. And, further, few people not directly connected with military supplies realise in the least the multiplicity and variety of things required for the Army and Navy.

3. All firms who are partly or entirely cut off from their market must realise that, if they wish to save themselves future effort, they must spend more, rather than less, in keeping their name before the public by way of advertisement.

Necessity for Trade Catalogues.—At least two-thirds of the manufacturers who are doing direct trade with the Dominion have never troubled to send their catalogues to the Commissioner's office.

It is entirely unnecessary that any manufacturer who has an accessible agent in the Dominion should give his prices to the Trade Commissioner. But, on the other hand, it is essential that he should give the Trade Commissioner full particulars of what goods he does make in order that these may be indexed for reference in case of inquiries; and, further, the name of the agent should be given in order that the Trade Commissioner may refer inquiries to him. Firms not represented by local agents should give full information with their catalogues if they wish them to be of use. It may be explained, further, that visitors to this office have not direct access to the catalogue files, and that catalogues are only shown to *bona-fide* inquirers, not to merely curious competitors.

Suggested Industrial and Commercial Department.—A section of the public have claimed that the high prices in New Zealand of both locally produced and imported commodities, whether due to arbitrary fixing of rates by rings or to other causes, are sufficiently serious to necessitate the existence of a permanent Board of Inquiry. Another section, consisting chiefly of local manufacturers, want a Board of Trade or an authoritative body which they can brief with their case for increased tariff protection. Others, again, feel that the commerce and industries of New Zealand have now gone to a scale more than sufficient to justify the existence of an independent Government department.

At the very end of the 1915 Session Sir Joseph Ward brought in a Bill to establish a Board of Trade, the Board to consist of the Minister and three specially-selected members, whose duty would be to investigate all matters connected with prices and cost of living. The fact was emphasised that they are not by any means to be confined to reporting and advising, but are to have considerable power of initiative. In what directions exactly this embryo department will develop it is too early to say, but there is undoubtedly room for its activities in many directions.

Prospective Industries.—Among functions which such a department might, and probably will, perform with advantage is that of looking for directions in which new capital and enterprise might be employed. It is an admittedly unfortunate fact that attempts have been made in the past to start industries and enterprises which were unnecessary and economically unsuitable, and that the public has been taxed in order to foster these, while many others which would obviously benefit the Dominion have never been initiated. Industries in the former category are such as consist in working-up imported semi-manufactured goods, what might be called secondary, if not tertiary, industries, such as making galvanised corrugated sheets from imported sheet iron, and spelter, manufactures from imported wire, tin plate, &c.

The manufacture of acid from local sulphur deposits, if these could be developed, would lead to local manufacture of superphosphates; there seems a reasonable possibility of utilising water power, as Norway is doing, for making carbide, nitrates, wood pulp, &c. Similarly, while the Department of Mines and Geological Survey locates beds or deposits of minerals, it would be of practical utility to the Dominion to have reliable facts as to the practicability of working them.

and it would tend to draw capital from overseas for exploiting them.

Public Works.—No new work of special note has been put in hand, but a fair number of small contracts for electrical enterprises have been placed. The electricity from Lake Coleridge has been carried into Christchurch, and the demand from that city and elsewhere has already justified extending the power plant. The Railway Department, while holding back the major part of its £5,000,000 reorganisation and development scheme, is carrying out minor parts of it, including re-arrangement, expansion, and electrification of shops, besides a normal programme of railway construction and locomotive and rolling stock building.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION, 1916.—IV.

The Generation of Electricity.

By HARRY S. ELLIS.

(Abstract.)

It is the object of this paper to deal with the suggestion of Mr. R. A. Chaddock, that "until there is some scheme of centralisation it is extremely unlikely that there will be any marked reduction in the cost of producing and distributing electrical energy below that obtained in the large power stations now operating in this country" (address to the Association at Birmingham, 1914).

Mr. Ferranti read a short paper before the Association in 1913, and said "Electricity is being produced on a larger scale every day, and it appears certain that to obtain the full benefits of electric working the current must be produced in large stations supplying extensive areas embracing all classes of demand."

In his inaugural address to the Institution of Electrical Engineers, the President, Sir John Snell, said: "There is no doubt, were we beginning anew, that instead of each small local authority putting down an independent power station, considerable waste of money and fuel would be avoided by establishing one large system for several adjacent areas supplying energy to each smaller area for local distribution. Even in some cases where there are existing small power stations, some of them unfavourably situated for cheap generating costs, it would probably pay to extend one of the better placed stations only and to supply the others therefrom rather than to extend each local station from time to time."

"There is, however, another side to the question. It may be generally said that once a small station is built and the expenditure has been incurred, then, and so long as the system is kept within defined limits of extension, the extra operating cost of an addition to the local power station is often cheaper than any commercially feasible bulk supply."

The author has prepared tables with a view to showing definitely the effect of load factor and load on all the items which go to make up what are commonly termed working costs. In almost every instance the costs decrease as the load factor increases, and they also decrease as the load increases. The effect of load and load factor on "total working

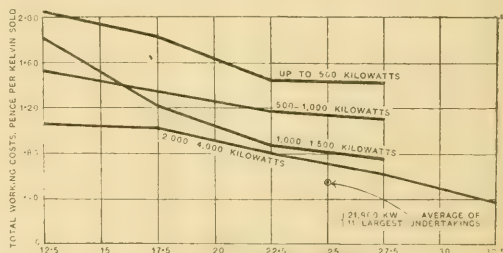


FIG. 1.—TOTAL WORKING COSTS PER KELVIN SOLD.

costs" is shown in fig. 1; all the other items are affected in like manner.

These figures are the result of averaging the costs of several undertakings in each group; and it may be generally conceded that the larger undertakings can generate more cheaply than can the smaller ones. Fig. 2 shows the combined effect of load and load factor on the various items which go to make up the "total working costs," based on *units sold* and not *units generated*. The item "repairs and maintenance" includes outlay in connection with the distributing system.

The load factor in no case exceeds an average of 25 per cent., so that it would appear as if the larger undertakings had gained very little; compared with the smaller undertakings, by increased load as far as load factor is concerned.

The best way to improve the load factor of a system is to increase the number of different industries connected thereto.

This, however, is not always possible, especially in the case of a municipal undertaking; the large electrical power companies are very much better off in this respect owing to the fact that they embrace very large areas; on the other hand, the power companies have to cover a much greater area to secure the same income as would be obtained within the boundaries of a great town, with the result that anything saved owing to improved load factor is to a great extent swallowed up by the excessive capital charges on the distribution system.

The Newcastle-on-Tyne Electric Supply Co. and its affiliated companies operate over an area of more than 1,400 square miles.

Some years ago the above company tried to persuade the South Shields Corporation to take their supply from the company instead of extending their own plant, but the engineer at that time (the late Mr. J. H. Cawthra), assisted by Mr.

ing of current in bulk at low prices* so long as their coal costs remain in the region of .25d. per kelvin sold?

The steady all-round increase in the price of coal during the past 10 or 15 years has to a great extent neutralised the increased efficiency of steam-raising and electrical generating plant, and the lower costs obtained have been due largely to the effect of the improved load factor on the other items which go to make up the total works costs.

One of the chief reasons for the steady increase in the price of coal for electricity works is without doubt the wider market which is opening out for the use of small coal and "duff."

There is no doubt that in many cases, what might be called phenomenally low costs are accounted for by a mere accident, such as the proximity of the generating station to a coal mine supplying screened coal for household purposes, in which case small coal can be bought for an almost nominal sum per ton.

It does not always follow, of course, that the proximity of the generating station to the coal mine will result in low costs. The author's experience during the past four years in South Shields has been quite the reverse.

Up to this point (the purchasing of coal) the larger undertakings have little (if any) advantage over the smaller ones. The same type of boilers, economisers, &c., can be purchased and installed by a comparatively small undertaking as well as by the larger ones, and for equal load factors it is doubtful whether there is much difference in the relative efficiencies of the large and smaller plants; but the smaller station, working with, say, two boilers on load, will require a third (equal to 50 per cent. of the total) as standby; whereas the larger station, working with, say, 10 boilers, can run without any standby boiler at all, since in the event of any boiler giving trouble the remaining nine can be overloaded until another boiler is got away. It is evident, therefore, that the smaller generating station has a greater percentage of standby losses.

Large boilers have very little (if any) advantage over smaller ones from the point of view of efficiency. Under normal test conditions 78 per cent. is an average efficiency for the boiler and superheater, with about 85 per cent. for the boiler, superheater, and economiser.

There is a rapid relative decrease in steam consumption per kelvin of modern high-speed turbine plant from sizes of 500 kw. to 2,000 kw., and a remarkably slight fall between sizes of 2,000 kw. and 10,000 kw. The larger sizes of plants have a gain over the smaller sizes of from 5 per cent. to 15 per cent. Where the conditions as regards steam and vacuum are similar the larger stations have had the advantage over the smaller ones as far as the electrical generating plant is concerned, but from a careful study of results obtained of the very latest type of turbine, e.g., the "Brush Ljungström," it would appear that the difference in efficiency of large and small turbines is diminishing. It is almost impossible to get the steam consumption, even of the very largest sets, much below 12 lb. per kelvin, while the Ljungström turbine of 1,000 kw. is capable of developing its full rated output with a steam consumption of only 12.75 lb. per kelvin.

The 25,000-kw. set supplied by Messrs. C. A. Parsons to the Chicago Edison Co., has the remarkably low steam consumption of 11.65 lb. per kelvin at full load.

The field for modern high-speed reciprocating engines, not only at present, but in the immediate future, appears to be among the smaller generating stations where the largest unit is in the region of 750 to 1,000 kw. In such cases a steam engine set capable of developing 1,000 kw. at a speed of, say, 250 R.P.M., will consume at full load about 15.85 lb. of steam per kelvin when running condensing (26 in. vacuum) and with steam at 180 lb. per sq. in., superheated to 550 deg. F., which figure compares very favourably with those obtained from most steam turbines of similar output and under similar conditions. The figures for the smaller sets under similar running conditions are briefly as follows: 16, 16.4, and 19.3 lb. per kelvin, for sizes of 750, 500, and 250 kw. capacity respectively. The results at half and three-quarter load exceed the above figures by about 5 per cent. and 10 per cent. respectively.

In order to obtain reliable figures for total working costs per kelvin generated further investigation had to be made.

When due allowance is made for repairs and maintenance in connection with the distribution system, and for distribution losses (approximately 15 per cent.) the following figures are obtained:—

COSTS PER KELVIN GENERATED.

Load in kilowatts.	Works costs.	Relative works costs.	Total working costs.	Relative total working costs.	Load factor.
	Pence.		Pence.		Per cent.
Up to 500	1.60	100	1.43	100	About 15
500-1,000	.75	75	.996	70	.. 15
1,000-1,500	.64	64	.846	59	.. 20
1,500-2,000	.60	60	.845	59	.. 20
2,000-4,000	.51	51	.668	47	.. 20
4,000-7,000	.42	42	.566	40	.. 25
7,000-10,000	.39	39	.518	36	.. 25
10,000 and upwards	.333	33.3	.450	31	.. 25

* Say 375 per kelvin for supplies of about 1,000 kw., maximum demand at 28 per cent. load factor, energy to be measured on the primary side of the transformer.

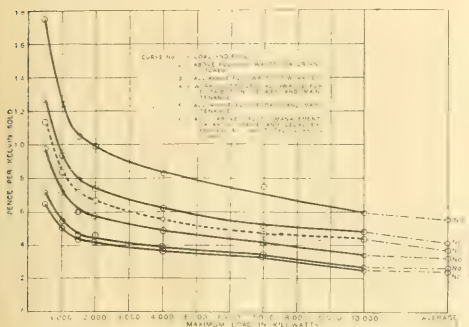


FIG. 2.—WORKING COSTS PER KELVIN SOLD.

(now Sir) John Snell, appeared to have satisfied not only his Committee and the Town Council, but also the Local Government Board, that by the time proper allowance was made to cover the interest and sinking-fund charges on plant already installed—plus the cost of converting current supply to direct current and single-phase alternating current—there would be no saving whatever. The Corporation proceeded with their extensions and the results have been entirely satisfactory.

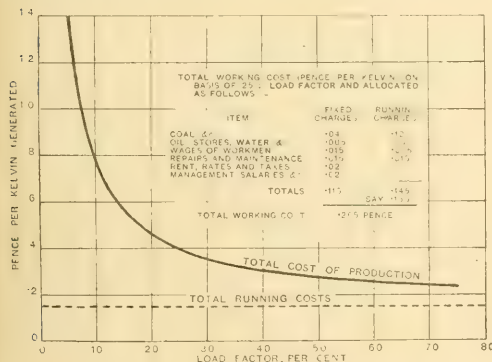


FIG. 3.—ESTIMATED COST OF PRODUCTION PER KELVIN GENERATED.

Plant installed of 100,000 kw. Load = 80,000 kw. Cost of plant £1,000,000. Interest and sinking fund £100,000.

Since that time the author has installed and set to work further modern electrical, and also steam generating, plant, with the result that still further economies are being effected, and there is every indication that the undertaking will be in a position to cope satisfactorily with any business that is likely to come along in the future.

The most important item is undoubtedly coal, which alone accounts in many cases for about half, and in most cases for at least one-third, of the total working costs. Much time and thought is given by engineers to the question of saving $\frac{1}{2}$ lb. of steam per kelvin, and yet practically nothing is done collectively to reduce the price of the coal delivered. If Mr. Ferranti's dream of a national scheme for electric supply is ever to be realised, there will have to be some sort of national control over this item of cost.

How are the large undertakings going to justify the supply-

A summary of the figures gives the following result (approximately only), which indicates the tremendous amount of waste which is going on in connection with the generation of electricity.

Kelvin generated.	Cost per kw.	Total working costs.
1,300,000,000	£1,438,000 265d. per kelvin	£3,363,516 62d. per kelvin.

Had it been possible to deal with electricity generated by electric supply companies, private individuals, railways, &c., which probably exceeds many times that indicated above, it might not have been a difficult matter to show how by means of centralisation of supply it might be possible to reduce the above figure, 265d., by, say, 25 per cent. (not to mention the total costs figure, 62d.), and so effect a saving of upwards of £1,000,000 on coal alone.

For capital costs reference has been made to the figures appearing in *Garcke's Manual*. The results obtained are as follows:—

COST PER KW. INSTALLED OF GENERATING PLANT, LAND, BUILDINGS, &c.

(Nothing is included for anything outside the generating station.)

Load in kilowatts.	Cost per kw. of generating plant installed.
	£ s. d.
Up to 500	40 0 0
500-1,000	27 0 0
1,000-1,500	25 0 0
2,000-4,000	22 10 0
10,000 and upwards	20 0 0

The impression created on glancing at the above figures is that the smallest undertakings have not been able to benefit by the low costs per kilowatt of turbine plant.

The steam-engine set holds its own against its competitor in the sizes from about 750 kw. downwards. There is nothing gained, as far as the cost per kw. of turbine plant is concerned, by adopting the larger sizes, since owing to the reduced speed of the larger sets (1,500 R.P.M. as against 3,000 R.P.M.) there is quite an appreciable increase in the cost per kw. Hence, in the case of South Shields, it was possible to install turbo sets of 2,000-kw. capacity which probably cost no more per kw. than the large sets installed in the generating station of the Newcastle Electric Supply Co., and without spending a single penny on land, buildings, &c. It is in such cases as these that it will be extremely difficult to make out a favourable case for supplying in bulk.

As far as the boiler-house plant is concerned there is nothing like the same relative difference in cost between large and small units as exists in the case of the engine-room plant, although the figures do not include buildings, foundations, coal bunkers, conveyors, &c.

RELATIVE COST OF STEAM GENERATING PLANT, INCLUDING BOILER, SUPERHEATER, STOKER, ECONOMISER, BOILER AND ECONOMISER BRICKWORK, &c.

(Steam, 200 lb. per sq. in. : superheat, 200° F. : coal, 12,000 B.T.H.U.)

Evaporation from and at 212° F.	Relative cost.	Cost per 1,000 lb. steam.	Cost per kw.*
		£	£
12,000	100	70	34
20,000	84	112	2'85
30,000	77	130	2'35
40,000	72	122	2'45
50,000	69	118	2'35

* All these figures are calculated on the basis of 20 lb. of steam per kw.-hour.

It is quite possible nowadays under normal conditions to put down a very large power station (say 100,000 to 200,000 kw. capacity) for about £10 per kw. of plant installed, and it is more than likely that this figure might under very favourable circumstances be reduced to £8 per kw. It can also be shown that a small station (say 2,000 kw. to 5,000 kw.) would not cost more than £20 per kw., and a very small station (below 2,000 kw.), £30 per kw. The larger station would have an advantage over the smaller one owing to the lesser proportion of stand-by plant, and also by reason of lower working costs.

Fig. 3 has been prepared for the purpose of showing as clearly as possible what might be done, under normal conditions, in the way of generating electricity on a large scale. The figure 265d. has been taken as being a fair figure for total working costs in a station having a load of 80,000 kw. and a load factor of 25 per cent. The curve shows the total cost of production at the switchboard only, and does not make any provision for capital charges on transmission system, transmission losses, conversion losses, &c. Careful investigation, in which proper allowance was made for the capital cost of transmission system, and transmission and transformer losses,

would undoubtedly show that there are cases of comparatively small stations where it would certainly not pay to take a bulk supply. In the majority of cases, however, it would appear that a bulk supply would be of considerable advantage. The curve represents the case of a station laid out with the most modern plant, fully loaded, and unsaddled with capital charges on old plant or any other disadvantages under which all the largest undertakings are working at the present time.

There does not appear to be any serious difficulty in the way of a bulk supply scheme from the point of view of transmission, except as regards the capital cost, which in the case of a large system, such as is referred to in this paper, might very nearly equal the capital cost of the generating station, it being extremely doubtful whether full advantage could be taken of overhead transmission lines owing to the nature of the districts surrounding the great towns in which the bulk supply stations would be situated. Reliability of supply should be the very first consideration; therefore any hypothetical estimate of the cost of the transmission system should be based on underground cables.

Underground cables for three-phase working up to 20,000 volts appear to present no difficulties whatever, and there is no doubt that pressures of 40,000 and even 50,000 volts will very soon become quite common. Such pressures as these will help to eliminate a very large proportion of the cost of the transmission system. It is only by making use of high pressure that the disadvantages of supplying current in bulk over long distances can be overcome. The disadvantage of the adoption of such high pressures is that step-up, as well as step-down, transformers would have to be used, with the result that the transformer losses alone would amount to a considerable sum per annum.

In addition to the above losses it is necessary to allow for the losses in the cables, due to capacity currents and dielectric losses (which are independent of the load), and also the losses due to the load which is variable, not to mention the heavy losses which will undoubtedly be incurred in cases where it is necessary to convert the three-phase energy to direct current or alternating current at a different periodicity to that of the bulk supply system.

The author is of opinion that by the time all these things have been taken into account it will be a very difficult thing to prove that an isolated bulk supply authority is in a position to generate and distribute electrical energy at a price which will allow of a reasonable profit, not only for the supplier, but for the distributor, although the case might be altered materially by the linking-up of other large undertakings, in which case the capital cost per kw. (load) could be substantially reduced.

Steps should be taken to thoroughly investigate the whole question of electricity supply in this country (which is undoubtedly in a state of chaos) because every day increases the obstacles and delays the time which every electric supply engineer looks forward to and hopes for—the day when electricity will be used universally for lighting, heating, cooking, power, and numerous other purposes.

It would appear that the first thing to be done would be to appoint a committee consisting of members of the I.M.E.A., such committee to be representative of not only the larger undertakings, but also the medium and smaller undertakings. This committee should have power to co-opt members of other scientific societies, such as the Institution of Electrical Engineers, the Institute of Chemistry of Great Britain and Ireland, &c. The duties of such committee would be to make a thorough investigation into the whole subject with a view—

- To standardise as far as possible the generation and distribution of electricity throughout the whole country.
- To conserve the supply of fuel used in electricity works and to make a thorough investigation of the important question of extracting from the coal valuable by-products, such as nitrogen, tar, oils, &c.
- To make use of waste heat wherever possible.
- To cut down the percentage of spare plant by judicious linking-up of adjacent networks. (There are numerous instances where this could be done right away.)
- To promote legislation whereby facilities may be obtained such as are absolutely essential to the scheme, and such as do not exist to-day.

DISCUSSION.

Prior to the opening of the discussion by Mr. Robertson, the PRESIDENT mentioned that there had been a conference with the power companies on the question of linking-up, which was of interest in connection with the paper by Mr. Ellis.

Mr. ROBERTSON (Salford) said the paper dealt with a vital question at the present time, and he felt that it could not be decided on the basis of the published tables of works costs used by the author, as certain items varied enormously as between different undertakings, and it was not certain what they actually represented. He questioned the turbine steam consumptions contained in the paper. He (the speaker) had obtained much better figures for 3,000-r.p.m. plant, as follows:—1,000 kw., 14.8 lb. per unit, 2,000 kw., 14.7 lb.; 3,000 kw., 13.2 lb.; and 5,000 kw., 12.7 lb.; there was a difference of 15 per cent. as between 1,500 and 3,000-r.p.m. plant, but if the lower speed were taken there was still an advantage of 9 per cent. between 2,000 and 5,000 kw. He did not consider that

if 3,000-kw. sets could be employed and the stations were economically managed, it would be possible to obtain bulk supply at a competitive price, but the smaller stations would probably have to turn to the bulk supply. On the other hand, when they came to a 20,000-kw. station there was very little to gain by increasing the size to 100,000 kw. He mentioned particularly certain cost data in the author's first table, showing the effect of load, &c., on the cost of production, as an instance of the reserve with which published tables of statistics must be treated; in this case the figures were out of date, the plant had been modernised, and much better results were now obtained. He had no faith in the author's suggested committee, to be appointed by the Association, with a view to investigating the whole subject of electricity supply. The Association was composed of busy men who could not spare the time required by a central committee. The signs were very hopeful for general linking-up in Lancashire, and electrical engineers were practically all ready to co-operate in the movement. It seemed to him that the question of linking-up must be approached from the point of view of each district, and that the strongest argument in its favour was increased reliability of supply.

Mr. LITTLE (West Ham) said he was afraid that municipal jealousy, among other things, had prevented a satisfactory settlement of the London electricity question. The general public owed a debt to municipal authorities for developing electricity supply and financially supporting such work. It was questionable whether the partial linking-up of stations would help the London situation, and he thought that the whole of the municipal stations would need to be included. Looking at the big question of company v. municipal control, the former worked only for dividends, while the latter was always affected by slackness to some extent, and the question was how to get the best features of both. Taking the case of several small undertakings linked-up to a larger one, but in which the plant margin of the smaller stations did not equal one large plant unit in the larger station, it was evident that linking-up alone would not always pay.

Mr. E. T. WILLIAMS said he gathered that the author was not advocating continuing small stations. There was danger in linking-up proposals if they meant leaving the bigger problem alone, and if small stations were perpetuated it would be a mistake. He disagreed with Mr. Robertson's suggestion that efforts should be restricted to certain areas; they must look for a more complete solution, and take in the agricultural areas. He urged that a broader outlook should be taken, with a view to solving the problem in such a way as to provide for the future, and wiping out the division between municipal and company undertakings, if necessary.

Mr. J. W. MEARES (Electrical Adviser to the Indian Government) submitted a table of costs of Indian electricity stations, in which quite good load factors were obtained due to the fan load. He thought that the Indian Electric Supply Acts were an improvement on the various British Acts; for one thing, the "fixed-area" idea of supply had been modified, and electricity could be distributed wherever it was required. Overhead constructional work was much facilitated under the Indian rules, and extensive powers existed under the Government Acts by which it was possible to run an overhead line straight across country, irrespective of landowners, &c., in the same manner as the telegraph lines. The electricity rules were revised from time to time when the necessity arose.

Mr. C. H. WORDINGHAM said there was no question that everyone would welcome an unrestricted supply of electricity all over the country, but was the individual user to pay for it, or was the cost to fall on the community at large? Were they justified in asking the public to subsidise them and make good deficits, and, if so, why should not the gas industry, railways, &c., be similarly treated? They could not attack the whole problem of supply at once, but must take districts and link them up, progressing gradually. It would be an advantage to the supply industry, in regard to extensions, if it had to deal with a Government department composed of engineers instead of lawyers and clerks. He concluded by condemning the practice of basing deductions on statistics, which were misleading.

Mr. S. J. WATSON (Bury) considered that while a good deal could be said from the author's point of view, there was much to say on the other side. In future it would not pay to scrap existing plant and only install a moderate amount of 1,500 or 2,000-kw. plant on the site. He agreed that there were difficulties in the way of linking-up; the London companies with a limited tenure did not want to spend much money, but in contrast the Lancashire and the Yorkshire power companies, which had an unlimited tenure, were making splendid progress. Interconnection of stations was only a step towards the larger scheme. Certain boards had been set up and would determine which undertakings should be further extended, and which should be supplied in bulk. The districts would eventually be linked together, so that they would get the larger scheme.

Mr. W. B. WOODHOUSE said one school of thought wished to create a new organisation, while the other wanted to use the existing organisations. He felt that the only way was to link-up existing concerns and use their experience. It was no good starting at the other end and creating a central electricity board in London, which knew nothing about the provinces. He believed they would find a solution to the problem, and the companies greatly appreciated the broad-minded view of municipal supply engineers in this matter.

Mr. HORACE BOWDEN (Poplar) said linking-up had advantages in the matter of stand-by supply, reciprocal supply, and bulk supply; personally, he had decided that there was no benefit from the latter in his area. He was strongly of opinion that the expenditure was repaid by the advantages derived from reciprocal supply and the ability to attend to plant which could be shut down if required.

The author decided to communicate his reply to the *Proceedings*.

[To correct certain misapprehensions, Mr. E. T. WILLIAMS has sent us a statement, from which we abstract the following:—

The fact that the moment was ripe for dealing with this subject is proved by the remarkable advance which has been made since April 13th, when the subject was discussed at the I.E.E.

The linking-up of power stations was an important part of the original scheme, but *only a part*; the possible development of separate districts until the whole country is organised for electricity supply was pointed out in the original paper. The linking-up of existing stations, however, requires to be carried out as part of the whole scheme, and not as a number of separate schemes in themselves. I suggest the dangers we must avoid in connection with linking-up are:—

(a) The temptation to extend existing stations which are not suitable for the complete scheme, and thus perpetuate to some extent the present unsatisfactory conditions.

(b) The expenditure of capital on certain linking-up feeders which might not be necessary as part of the complete scheme.

(c) The temptation for the powerful industrial areas to be satisfied with the good results which will be attained, and not take advantage of the opportunity which certainly exists for re-organising the control of electricity supply for the whole country.

Some engineers have read into the proposal to establish an electricity board a suggestion for even more legislation and more obstacles. The very reverse is intended, viz., to replace the present unsatisfactory system and put the necessary powers into the hands of a few practical engineers in intelligent sympathy with the industry. This Board would be invaluable in co-ordinating all the various local efforts and shaping them into a homogeneous whole.

At the I.M.E.A. Convention I referred to the business policy of the Canadian Pacific Railway Co. Perhaps an illustration nearer home would be the Port of London Authority, established by Act of Parliament to re-organise and co-ordinate the work of the Port of London. The justification for the step taken and for the enterprise and broad policy adopted is the result attained. In electricity supply we can equally well have a broad policy with sound finance and an electricity board would assist in securing this. Sound finance sometimes means capital expenditure without an immediate return, and it is weak finance to withhold such justifiable expenditure, which is necessary for a progressive industry.]

THE MANUFACTURE OF ELECTRICAL APPARATUS IN INDIA.

WE reproduce the following original and interesting views from *Indian Engineering* just to hand:—

The present war is making India (as it is in fact all other countries) more and more dependent upon herself for the production of material that has hitherto been imported from Europe or elsewhere. As far as engineering material is concerned, there is little doubt that she has proved herself quite up to the task in producing both the quality and quantity required in whatever she has taken up. Why should not she extend her field and introduce the manufacture of such electrical goods that are at present only imported? Most of the large English electrical firms have representatives in this country, but how many of them have either the material or the staff for carrying out any work that may come along? In all works of any magnitude the whole of the material has to be obtained from the factory in Europe, and in most cases the actual erecting staff also is imported for the carrying out of the work. Most, if not all, of the raw material required for the manufacture of electrical plant and machinery is procurable in the country; this being the case, why is it not utilised in the country instead of being exported for manufacture in some other country, and again imported in the shape of the finished article for use in India? The main reason for this seems to be the question of finance, no firms being prepared to lay out a large sum on the opening up of a new industry in a foreign country, the success of which is not assured; then why should not our enterprising Government give the lead? The demand for electrical plant and machinery in India has increased enormously during the past few years, and there is no doubt that this demand is going to increase steadily for several years to come. Why should not India not only have her own concern, or concerns, but also be in a position to export plant and machinery to other countries? Why should she not proceed in the same way as Japan did with her shipbuilding and manufactories? There is plenty of available water H.P. in India, and the general cry has hitherto been that there is no profitable market in the neighbourhood—well, here is the opportunity of creating a market that should benefit the country

machinery. In the case of India, as at the present time some 75 per cent. of the power of 1,000 KW. or more installed in India is of British origin, it is not a great deal of work, not even in any of the many factories, is actually manufactured in the country in a systematic way.

The writer on one occasion, when discussing this question with a representative of one of the largest electrical engineering manufacturing firms, said that it would be very hard to get buyers to purchase electrical machinery that had been manufactured with the assistance of Indian labour, but surely this stumbling block—if it can be considered as one—could very soon be removed. It would, of course, be essential in the first instance to import experts for the various departments, both for the supervision and the labour, but, after a very short time, the subordinate imported staff could very easily be replaced by Indian labour without any detrimental effects in so far as efficiency is concerned. In India, a large manufacturing concern of this kind could be run very economically by Government owing to their being in a position to obtain land, labour, and power at very cheap rates. Of course, it would never do for Government to try to enter into competition with the European firms who import plant to India; it would be necessary for them to invite all firms to join in the combine by having all machinery required for use in and about India manufactured by Government in India in accordance with the respective firm's designs and patents; this system would enable the purchaser to have the same selection as he has at present; it would also benefit the home firms, as their representative in the country—the man who knows his client's requirements best—could actually watch the manufacture of the plant from its initial stage to completion, the purchaser would undoubtedly benefit by being in a position to see what he is getting without the intermediary of a consulting or inspecting engineer, the engineer in charge of the plant would benefit by being able to obtain spare parts and renewals at short notice, and finally Government and the country would benefit by showing not only its enterprise but its independence.

In connection with the above, it would be interesting to know what the output of the Tata Iron Works and Katni Cement Works has been during 1915, compared with the previous year.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

RUSSIA.—An Imperial Decree, dated May 13th/26th, has been published providing for the importation, free of Customs duties for a period of ten years, for the requirements of the Siberian and Ural gold mining industries, of dredges and excavators and parts thereof; also of appurtenances and apparatus for crushing gold ores and for extracting gold by chemical processes, and appurtenances for prospecting dredging areas. The Decree is to take effect as from January 1st-14th, 1916.

SIBERIA.—By a Russian Imperial Decree of May 13th/26th, duty-free admission is accorded to all foreign goods (except spirituous liquors) imported into the Territory of Yakutsk (Northern Siberia) *via* the mouths of the river Koma and to the east of the same along the coast of the Yakutsk Territory of the Governor-Generalship of Irkutsk.

The Decree also makes provision for the duty-free importation into Siberia, *via* the mouths of the river Lena, of certain foreign goods. The Decree was to take effect as from May 14th/27th.

SWEDEN.—The exportation of the following articles has been prohibited, *viz.*: Electrical safety appliances not specially mentioned in the Swedish Tariff, also safety plugs, fusible pieces, cartridge pieces, and excess voltage apparatus (No. 1,077 in the Swedish Tariff); electrical box switches, with casing or inner parts of metals other than iron; incandescent lamp sockets (with or without switches) with casing or inner parts of metals other than iron; gas purifying metal (oxyhydrate of iron) used; and pyrites.

GREECE.—In virtue of a Government proposal which took effect immediately, the Greek Customs Tariff rates of duty have been increased by 10 per cent. except in respect of articles the duties on which are defined by Conventions between Greece and other countries, articles the object of a State monopoly, and articles falling under No. 19-21 of the Tariff (grain and flour).

Accidents to Munition Workers.—At the annual meeting of industrial representatives in connection with Preston Infirmary, on July 4th, Mr. T. Mackenzie of Messrs. Dock, Kerra Co., electrical engineers, drew attention to the large number of accidents occurring at munition works during the year, resulting in increased work for depleted staff. There were only two causes to which the accidents could be attributed. Either the workers were careless, and neglected to see that the guards were properly adjusted to the machinery, or being newly trained, they were not perfectly familiar with the machines upon which they were working.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Published expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 8,957. "Electric control arrangements for conversion of functions, for use with calculating apparatus, &c." H. R. WRIGHT. June 26th.
- 8,959. "Electrical bonding junction boxes for metallic sheathed wires, &c." G. S. BROADBENT AND CALLENDER'S CABLE & CONSTRUCTION CO. June 26th.
- 8,960. "Apparatus for identifying individual cores of multicore cables." CALLENDER'S CABLE & CONSTRUCTION CO. AND R. WOOD. June 26th.
- 8,961. "Time-limit fuses." CALLENDER'S CABLE & CONSTRUCTION CO. June 26th.
- 8,992. "Electric automatic switch controllers." G. A. FRITSCH. June 26th.
- 9,020. "Dynamoelectric machines." CROMPTON & CO. AND N. PENSABENE. June 27th.
- 9,002. "Electric relays." SYKES INTERLOCKING SIGNAL CO. & R. W. TARRANT. June 27th.
- 9,035. "Railway fouling-bars and treadles." SYKES INTERLOCKING SIGNAL CO., J. C. SYKES, & R. W. TARRANT. June 27th.
- 9,036. "Electric welding systems." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). June 27th.
- 9,037. "Advertising device for registering telephone calls." B. SCRUBY AND W. D. WALKER. June 27th.
- 9,050. "Sparkling plugs." C. H. WATKINS. June 27th.
- 9,051. "Sparkling plugs." W. PARKE. June 27th.
- 9,055. "Electric furnace for steel melting." S. STEINBERG. June 27th.
- 9,062. "Shadeholders for gas or electric light fittings." R. W. McLACHLAN. June 27th.
- 9,079. "Sparkling plugs for internal-combustion engines." D. MCGREGOR. June 28th.
- 9,098. "Bucket-fastening means for turbines, &c." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). June 28th.
- 9,099. "Means for controlling electric motors." IGRANIC ELECTRIC CO. (Cutler-Hammer Manufacturing Co., U.S.A.). June 28th.
- 9,105. "Electric spark-gap." F. G. SIMPSON. June 28th. (U.S.A., March 20th, 1915).
- 9,111. "Heating liquids." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. June 28th. (U.S.A., June 30th, 1915).
- 9,127. "Automatic trolley alarm for electric tramcars." R. DODD AND HERTSMANN, GEAR CO. June 29th.
- 9,137. "Sparkling plugs for internal-combustion engines." F. A. L. JORNSON. June 29th.
- 9,139. "Switch-operating mechanism for electric transformer starters, &c." W. BARRACLOUGH. June 29th.
- 9,140. "Switch-operating mechanism for electric transformer starters, &c." W. BARRACLOUGH. June 29th.
- 9,152. "Portable apparatus for producing and transmitting waves in wireless telegraphy." W. R. HERWIN. June 29th.
- 9,163. "Means for controlling speed of electric motor." MARCONI'S WIRELESS TELEGRAPH CO. & G. M. WRIGHT. June 29th.
- 9,171. "Differential gearing for electro-mechanical variable-speed mechanism." J. G. P. THOMAS & THOMAS TRANSMISSION, LTD. June 29th.
- 9,172. "Differential gearing for electro-mechanical variable-speed mechanism." J. G. P. THOMAS & THOMAS TRANSMISSION, LTD. June 29th.
- 9,179. "Telephone systems." E. MERRIMAN. June 29th.
- 9,180. "Joints for electrical conductors." C. VERNIER. June 29th.
- 9,185. "Electrical switches." J. W. TREHERNE. June 29th.
- 9,193. "Telegraph apparatus." W. J. MELLERSH-JACKSON (Western Union Telegraph Co.) June 29th.
- 9,206. "Electric clocks." A. E. J. BALL & I. H. PARSONS. June 30th.
- 9,232. "Dynamo-electric machinery." W. MARDEN. June 30th.
- 9,246. "Measuring instruments, extensometers, ammeters, &c." MARCONI'S WIRELESS TELEGRAPH CO. June 30th.
- 9,249. "Means for controlling electric motors." IGRANIC ELECTRIC CO. (Cutler-Hammer Manufacturing Co., U.S.A.). June 30th.
- 9,263. "Electric regulators or rheostats." R. L. HALSTEAD & VICKERS, LTD. June 30th.

PUBLISHED SPECIFICATIONS.

1915.

- 4,050. REFRACTORY MATERIALS APPLICABLE ALSO AS ELECTRIC RESISTANCES. W. R. JUST. March 15th. (March 23rd, 1914).
- 8,651. RAILWAY SIGNALING SYSTEMS. H. W. MOORE & R. G. BERRY. June 11th.
- 8,748. ELECTRIC MOTOR-CONTROL SYSTEMS. British Thomson-Houston Co. and J. Martin. June 14th.
- 8,850. ELECTRIC METER. R. S. XENAKY & F. GILMAN. June 16th.
- 9,012. SECONDARY BATTERY PLATES. Electrical Power Storage Co. (in liquidation) and W. Schofield. June 18th.
- 9,111. TELEPHONE TRANSMITTERS. International Electric Co. & R. G. le Noir. June 21st.
- 9,587. MEANS FOR JOINTING WIRES. A. G. RALLI (A. Fodor). June 30th.
- 9,960. VAPOUR ELECTRIC DEVICES. British Thomson-Houston Co. (General Electric Co., U.S.A.). July 8th.
- 10,837. FLEXIBLE ELECTRIC CONDUCTORS. A. J. DOWNES. July 26th.
- 12,846. TROLLEY HEADS. G. R. TAYLOR. September 8th.
- 13,441. CLAMPING DEVICES FOR ELECTRICALLY CONDUCTING WIRES. J. Cuthbert. September 21st.

1916.

- 198. STARTING MECHANISM FOR AUTOMOBILES. British Westinghouse Electric and Manufacturing Co. January 6th. Patent No. 100,006.
- 1,707. ELECTRIC HEAT-REGULATING SWITCH. J. KIELL & A. A. STOW. February 4th. Patent No. 100,624.

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ELECTRICAL REVIEW.

ELECTRIC LIGHTING IN PARIS.

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A REVIEW of the situation of the electric lighting industry in Paris, and of the experiences of the companies engaged in the supply of electricity in the environs of the French capital and in the provinces, is contained in the annual report for 1915 of the Compagnie Parisienne de Distribution d'Electricité, which was submitted at the general meeting held in Paris at the end of June. It will, perhaps, be remembered that this particular company, which has a combined share and loan capital amounting to nearly £8,000,000, represents an amalgamation of the former Secteurs or concession areas which were held by several companies within the district of the municipal administration of the City of Paris, and which were combined in accordance with an agreement entered into between the Comité des Secteurs on the one part, on behalf of the Compagnie Parisienne, and the Paris Municipal Council on the other. The agreement conferred a monopoly of supply until June 30th, 1940, whilst, at the same time, it imposed upon the company the obligation to install improved generating plant by a fixed date, and to extend and transform the distributing network without interfering with the supply to the then existing consumers. This work has been carried out at an expenditure which has not exceeded the estimated £8,000,000, and the city has thereby become the owner of the entire works without having to provide any money whatever, as the undertaking will pass into municipal possession on the expiration of the concession in 1940.

The continuation of the war in 1915, the report states, had the effect of considerably reducing the lighting requirements in Paris on the one hand, while, on the other, additional expenses were incurred which were considerably in excess of the increases which were taken into consideration when the agreement was concluded with the City. The contract was entered into on the basis of the progressive development of the system of supply. Thus, notwithstanding the comparatively high charges made to consumers prior to the company taking over the entire work on January 1st, 1914, the aggregate sales of the several companies amounted to 42,855,000 kw.-hrs. in 1906, and they had risen to 87,369,000 kw.-hrs. in 1910, partly owing to extensions of the mains, and partly in consequence of the reduction in prices. It had been expected that this rate of expansion would continue, and the charges to the consumers were further lowered at the beginning of 1914, the scale apparently being subject to no alteration during the currency of the concession, and being held to be justified by the consideration that the prices of raw materials which the company would have to purchase, would only vary in accordance with the fluctuations in the situation of general prosperity. It was under these assumptions that the city was able to stipulate that the redemption of the capital of £8,000,000 should be effected by means of annuities derived from the net profits, and that the city should receive by way of rent from 10 to 25 per cent. of the amount of the company's revenue, and a progressive share in the annual profits which were in excess of 6 per cent. of the capital invested by the company in the form of ordinary shares, which

represents one-half of the total of £8,000,000. On the other hand, the city undertook to bear the charge of any increase in the wages of the company's *personnel* which might be granted on its initiative and in accordance with the assimilation of the *personnel* with the municipal workers. But the agreement did not place at the company's charge the consequences of *force majeure*, and a possible diminution in the receipts was only foreseen in case new methods of production, or the use of new forces, brought about a reduction of at least 20 per cent. in the cost of generation and distribution, in which event the city could require the company to lower its selling prices.

The war, however, has overthrown all former calculations. In the case of the lighting supply, the charges for which permitted of compensation being obtained to some extent for the low price charged to power users, the consumption in 1914 declined to 54,157,000 kw.-hrs., notwithstanding the favourable results in the first seven months, and a further decrease to 38,579,000 kw.-hrs. took place in 1915. The company is co-operating in the national defence by furnishing energy at low prices to all the firms in the vicinity of Paris who are engaged on the production of war material, and the consumption for motive power purposes reached 31,204,000 kw.-hrs. last year, or nearly one-half of the total turnover.

The increase in the working expenses in 1915 is attributed to the scarcity of labour, the inefficiency of workers employed in substitution for the skilled men who were mobilised, the difficulty of obtaining materials and their high prices, the higher cost of work undertaken by contractors, and the costliness of coal, which had to be procured almost exclusively from England. In this connection, we note that the company's consumption of coal is approaching a rate of 200,000 tons per annum; before the war the cost amounted to 19s. 7d. per ton, and it averaged £1 14s. 4½d. per ton in 1915. The latter was merely the result of the operation of old contracts, which, however, it was impossible for exporters to execute in full, whereas for recent contracts it has been necessary for the company to pay approximately £4 16s. per ton. It is considered that unless the new arrangements concluded between the French and English Governments largely modify this disquieting situation, the company will have to pay an additional sum of £400,000 this year for the delivery of coal. Under the circumstances, the company contends that as the war has completely disturbed the state of equilibrium between the reciprocal clauses of the agreement between the two parties, the company is entitled to ask the city for compensation, as it is held to be unfair for the city and the consumers to derive all the advantages of the agreement on the one hand, and on the other for a crushing burden to be imposed upon the company, which only receives a relatively small portion of the fruits of its industry, and has a limited concession. The company, which has made an application to the City Council for compensation, argues that the demand is justified in law and in equity, and it is stated to be in conformity with a recent decision of the Council of State in a similar case. We cannot recall the decision in question, but as the company has been able to declare out of net profits of £209,000 in 1915 a dividend at the rate of 4 per cent. on the ordinary share capital of £4,000,000, the claim for compensation may not receive the consideration which is desired. The company has been remarkably more successful than the Paris Gas Co., which incurred a loss of £800,000 last year. It is true that this loss was recouped by the Municipal Council and the company thereby placed in a position to pay a dividend, but this contingency, we believe, was provided for in the contract between the Gas Co. and the Municipal Council some years ago.

The Rights of a German-owned English Company.

THE question whether a company in which practically all the shareholders are enemy subjects can bring actions in the King's Courts has been discussed, but by no means satisfactorily answered, in the now well-known case of *Continental Tyre and Rubber Co., Ltd. v. Daimler Co., Ltd.* This is one of those cases in which an issue which is of absorbing interest to the public, and to the commercial world, has become confused in a welter of legal procedure and conflicting judicial opinion. An action was commenced in October, 1914, by what is called a specially endorsed writ, to recover the sum of £5,605, the writ being issued by the company's solicitor on the instructions of the secretary. Under this procedure, the plaintiffs are entitled to obtain summary judgment unless the defendants can show that, *prima facie*, they have a right to defend. The defendants asked for leave to defend on the grounds (1) that the company was in fact an alien company with whom it was illegal, apart from a licence from the Crown, to hold any commercial intercourse, which included the payment of money for a trade debt; and (2) that the secretary had no authority either to instruct the company's solicitors to issue the writ in the action or to give a receipt for the money when recovered.

It will be seen that the Court was not bound to decide whether the plaintiff company was entitled to sue; a decision that the secretary had no authority, or that the defendants had a *prima facie* right to defend, would suffice. The Court might, and, in fact, did, refrain from deciding the main and most interesting question. In the House of Lords, all the Law Lords were of opinion that the secretary had no authority *virtute officii* to commence actions on behalf of his company, and that, on the facts, he had no such authority from the directors. That was quite enough to decide the case. The majority of the Court of Appeal and five members of the House of Lords were of opinion that it was a case which ought to be investigated, and not one for summary judgment. It remained for two very distinguished lawyers to pronounce certain *obiter dicta* to the effect that the plaintiff company, as an illegal association, ought not to be allowed to sue. In the Court of Appeal, Lord Justice Buckley (as he then was), differing on this point from all his learned brethren, held that in the circumstances the company was an alien enemy, and could not sue in the King's Courts. No less an authority than Lord Halsbury took the same view in the House of Lords. But the net result of the whole litigation is that the case "went off" on a mere side issue, and the main question is still undecided. What the two great judges whose names have been mentioned said, is entitled to considerable respect; but they uttered mere *obiter dicta*, and, to use the words of an old judge, an *obiter dictum* is "a mere individual utterance which bindeth none, least of all the lips of him that uttered it."

FUNDAMENTAL conditions in this metal have really undergone no change of late, tendency of the

market having been entirely subject to the control of operations at the hands of the Ministry of Munitions. As we suggested, three weeks ago, would be the case, the price has come down a good deal further since then, and even now it is highly premature to assume that the market has reached "bottom." Nobody, at any rate, believes that any recovery of importance could be otherwise than of a temporary character. Prices across the Atlantic still stand at a high parity level, precluding the possibility of any sales being made in the London market at present. The tonnages reaching this side appear to continue of respectable dimensions, and

more than equal to cope with all needs, although the figures as officially returned are most incomplete and most misleading since controlled supplies, or the considerable quantities imported by the authorities, are not included in the returns. The statistical position is thus absolutely a mystery. After the recent further break to below £28 for near delivery, offers of the latter having been made more sparingly, the position somewhat stiffened, but the general trade demand has remained on the whole very quiet, and the market has become very irregular. Judging from the slackness of the inquiries experienced for forward deliveries for some time past, there is certainly no eagerness to anticipate needs, and the result has been that the discount on forward positions has widened considerably to about 30s. a ton.

In view of the not unreasonable assumption that the authorities have made all necessary arrangements to have their needs for munitions well provided for during the remainder of the war, and while ordinary trade requirements are likely to continue abnormally restricted until the war is over, it is hardly possible that any very severe pinch will be experienced by consumers, unless mining operations are seriously interfered with by unforeseen circumstances. It is true that heavy quantities are now being soaked up by munition work in warring countries. French needs are particularly heavy, as may be gathered from the much increased imports made by France this year, the great bulk of the supplies being drawn from Spain direct. During the first four months of this year no less than 21,500 tons of Spanish lead were sent to France, against only 9,816 and 2,324 tons during the same period in the two previous years respectively. The total French imports for that period represent 26,564 tons, or some 13,500 tons more than in the previous year. There is no doubt that good stocks are held in reserve in France, although it is possible that the movement of fresh supplies from Spain may be delayed by the congestion of traffic at the railways, since complications have just lately arisen regarding shipping from the West Coast of Spain to Mediterranean ports, while shipping companies are apprehensive of disturbances through German submarine attacks. The quantities of Spanish lead coming to this side are still of fairly good proportions, though much smaller than last year, owing to the big tonnage absorbed by France, but Australian metal continues to arrive in large quantities, and there is not much doubt that the supplies will continue ample enough to enable the authorities to keep down prices.

Educational Reform. DURING the past few weeks great activity has been observed in circles concerned with educational matters, particularly on the scientific and technical side. Last month the professorial staff of the Imperial College of Science and Technology submitted memorials to Lord Crewe pointing out the urgent necessity for taking active steps towards educational reform, especially in connection with the teaching of science; since then a deputation representing science professors, the Army and Navy, commercial men, and parents has met a committee of headmasters from twelve of our leading public schools and urged the pressing need of giving more time to the study of English and other modern languages, of infusing a scientific spirit into the whole school instead of treating scientific subjects as separate branches of study, of abolishing compulsory Greek for science students, of improving the teaching of mathematics, and of introducing chemistry and applied science into the examinations for first-class clerkships in the Civil Service; the Council for Organising British Engineering Industry has issued

a report, of which we published an abstract in our last issue, dealing with the training of technical students for all grades of industrial rank; last week Lord Haldane in the House of Lords drew attention to the necessity of reform in our system of secondary education, and the Board of Education issued a report of exceptional interest and importance on the subject of technical education, which followed very similar lines. This report was drawn up by a consultative committee appointed as long ago as 1913; its proceedings were in the main suspended on the outbreak of the war, but attention has been given to the training of students in science and technology to supply the needs of commerce and industry, and we are glad to see that the Committee fully realises the extreme urgency of the matter, and the necessity of acting *at once*. With this object in view, the Committee recommends the provision by the Government of the sum of £339,500 a year, to strengthen the higher parts of selected secondary schools, and to provide scholarships to enable meritorious students to proceed from secondary schools to technical colleges and universities, from secondary schools to senior technical schools, and from evening classes and works schools to technical colleges, &c. We are glad to see that the Committee would spread the net wide—how many Faradays may not have been lost to the nation for want of the opportunity to develop their innate genius!—and would not only endow impecunious students with the means to pursue their studies, but even advocates the modification of matriculation tests, to enable them to enjoy the full privileges of a university career subject to their showing merit under scientific and mathematical tests alone, and passing an examination in the English language.

The Committee rightly points out that such expenditure would be abundantly repaid by the benefits accruing to the nation from the increased supply of scientifically-trained students—a fact which, in the past, the politicians by whom we are governed have been utterly unable to appreciate. It adds a proviso to this forecast—"provided that the scholars are well selected," and elsewhere remarks that it has found the provision of scholarships at certain stages relatively abundant, at others absent or deficient; these comments are amply justified by the facts. It is a condition indispensable to success that scholarships shall be awarded on the score of proved merit, and that alone; and it is desirable that the provision of scholarships shall be regulated and co-ordinated in such a way that merit, wherever found, whether in the town or in the country, shall be afforded equal opportunity of proceeding onwards to the very highest degree of training and development.

The Committee points out, also, that the recommendations made are only a beginning; large capital sums will be required, as well as annual subsidies to universities and schools of technology, besides the establishment of new schools, to make good our shortcomings in the past, and to bring our existing institutions into correspondence with the national needs. In this respect, we shall do well to learn from our enemies. The German Government spends in subsidies to universities 1½ millions a year—the British Government, in England and Wales, only £265,000. It is necessary, also, to provide maintenance grants, to counteract the temptation to withdraw students from schools when they attain the age of 16 to 18 years and are capable of earning wages, and the encouragement of research after graduation calls for additional funds.

All these are excellent recommendations. We regret that we cannot deal with them at greater length, but we cannot too strongly urge our readers to support the movement which has been set on foot by every possible means, in order that this country may be enabled to maintain its supremacy in industry and commerce after the war.

NOTES ON ELECTROPLATING.

BY S. V. THORP.

E.M.F. of Polarisation.—When an electrolyte is being decomposed, the anodes thus liberated have a tendency to recombine, and this tendency also tends to oppose the flow of current by setting up a back E.M.F., so it follows that for decomposition to take place the current must flow unless the E.M.F. applied is at least greater than the E.M.F. of polarisation; that is, there is a certain E.M.F. below which continuous decomposition will not take place. In the case of water, the chemical affinity of the oxygen and hydrogen corresponds to an E.M.F. of 1.23 volts, so to decompose water continuously an E.M.F. of over 1.5 volts is required.

The voltage for the various baths is variable within certain limits for a given class of work. In any case, the voltage should be carefully adjusted, so as to give the current best suited to the work in hand. Table I gives the approximate voltages for various baths.

TABLE I. APPROXIMATE VOLTAGES FOR VARIOUS BATHS.

Metal	Volts
Gold	7.5 to 1
Silver	7.5 to 2
Copper (acid bath)	1 to 2
Copper (cyanide bath)	2 to 5
Brass	2 to 6
Potassium	5 to 6
Nickel, strike deposit with 5 volts, diminish to	1.5 to 3

Current required for Plating.—The amount of metal deposited depends on the current density. Definite rules as to the current density required cannot be laid down, as each metal requires different densities, according to the metallic salt used, the metallic strength of the solution, whether during decomposition the electrolyte is agitated or stationary, and whether the bath is hot or cold. Generally, when the current density is low, the rate of deposition is slow, but the deposit is hard and close-grained. With higher current densities, the rate of deposition is quicker, and the deposit is softer and more crystalline in appearance. If the current becomes excessive, the deposit becomes loose and powdery. Table II gives the current densities suitable for various baths, using a stationary solution.

TABLE II. APPROXIMATE CURRENT DENSITY.

Metal	Amps. per sq. ft. of cathode.
Gold	7.5 to 15
Silver	15 to 4
Copper (acid bath)	5 to 20
Copper (cyanide bath)	3 to 1
Brass	3 to 1
Nickel	2 to 8
Tin	3 to 6

By agitation of solutions the current density can be doubled.

Agitation of the Electrolyte for Rapid Deposition.—In electroplating, the anodes, which may be either cast or rolled, are of the same metal as that being deposited, and their function is to dissolve into the solution as fast as metal is taken from the solution for deposition. In the ordinary course of things, the electrolyte immediately round the anode plate is richer in metal than that round the object being plated. With a weak current this difference is very small, but the rate of deposit is slow. The quicker the rate of deposit, that is, the stronger the current with a given cathode area, the greater will be the difference in metallic strength of the parts of the electrolyte round the anode and cathode. Should, however, the deposition of metal proceed faster than the metallic salts can diffuse from the mass of liquid to the surface of the object being plated, the current will begin to decompose the other compounds present. Taking, for example, a copper-sulphate solution, the SO_4 radical will unite with the water of the solution, and thus form sulphuric acid and oxygen. The oxygen, being liberated, is attracted to the anode plate, and forms an insoluble coating of oxide thereon. This increases the internal resistance of the bath, and so decreases the current, and once the anode becomes oxidised it will be unable to dissolve into the solution. The solution will then become poorer than ever, and only a thorough

cleaning of the anode will put matters right. It will be seen from the foregoing that, having a still bath, the current, and therefore the rate of deposit, is limited, owing to the necessity for allowing the solution of metal round the anode time to diffuse. This diffusion, and, consequently, the rate of deposit, may be assisted by keeping the solution hot, about 100°F. , or by agitating the electrolyte by mechanical means. In some cases a mechanically-driven stirrer is used, but the best method is to blow air through the solution, a pneumatic agitator being employed.

By this system of agitation, which is used largely in copper-plating for electrotyping, and also for nickel-plating, it was found by actual trials that for a given quantity of work, with a stationary solution, the maximum amount of current that could be safely used was 35 amperes at an E.M.F. of 2 volts, giving 70 watts, the time taken being three hours. The same vat was used with an agitator, the same solution and anodes, and an exactly similar load was put into the vat, when a current of 65 amperes at an E.M.F. of 3 volts was used, giving 195 watts, with every success, the time taken being one hour, and the deposit was not only equal to the previous load, but was smoother and brighter. Excellent results have been obtained from plants installed on this system, especially in the cycle, cast-iron, and printing trades.

Points to Remember.—In plating it is important to remember that the scientific basis is the same, whether conducted by the amateur or the largest electroplater. The apparatus may be varied according to the requirements of the work, but the principle remains the same whether small or large quantities of work are done. In all branches it is absolutely necessary that the chemicals be pure, and if careless methods and impure chemicals are used, continual trouble will result. Cyanide of potassium must be recognised as the most used, and most important, substance in electrodeposition, nearly all the solutions containing this chemical. The dynamo is the only current-producer used, as to attempt working large plants with batteries is to court constant expenditure. The motive power necessary for the dynamo and the various polishing lathes can be either gas, steam, or electricity. The advantages of using electricity are very great, ease of starting or stopping, economy of space, cleanliness, and maintenance being altogether in its favour.

The Plating Dynamo.—For this class of work, special forms of continuous-current dynamos are needed. Designing dynamos for low voltage and high amperage entails difficulties in the design, for the voltage cannot be obtained low enough without either having few convolutions on the armature, or else a weak field-magnet, and machines with weak field-magnets give trouble on account of sparking at the brushes, as also do the machines with few massive conductors and few parts in the commutator. Special care is needed with the brushes and brush-gear; copper gauze brushes are nearly always used, as the drop of potential at the brushes themselves, if carbon brushes are used, is more than twice that of copper gauze brushes, and, with such a low voltage, this would be serious. The brush-gear should be so designed that it can readily be cleaned or adjusted, many makes being very deficient in this respect. The matter of speed is very important. A high-speed dynamo means a lower price, but more frequent renewals, whereas a moderate-speed dynamo is more expensive to manufacture, but has a longer life than a high-speed one of the same output.

A most convenient mode of obtaining current in places where a power supply is obtainable, is by the employment of motor-generators. In some cases the fields of plating dynamos are separately excited, the advantage being the control or variation which can be exercised over the voltage of the dynamo at all loads. Motor-generators lend themselves admirably to separate excitation, having a small exciter coupled direct on to the same shaft. Where a very large collecting surface is needed on account of the large amperage, the dynamos have double commutators connected in parallel with one another.

The Plating Plant.—Separate shops should be provided for polishing, plating, finishing, and burnishing; but in small establishments the polishing and finishing may be done in the same shop. The polishing shop, where the surfaces of the work are polished preparatory to plating, is

equipped with high-speed polishing lathes. The dust given off when polishing must be carried away from the face of the worker: the best practice is to fix hoods over the revolving wheels with connections to a duct, and to fix the fan which exhausts the dust at the end of this duct. It is important to remember that however the work is polished, so will it leave the plater, and no amount of finishing will eradicate the faults left by the polisher, because every imperfection left on the article after polishing remains in the same condition after plating. In the plating shop, the plating vats, swilling trough, cleaning and water

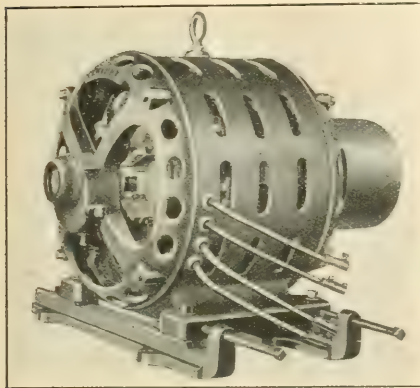


FIG. 1. "CENTURY" SINGLE-PHASE MOTOR OF 30 H.P.

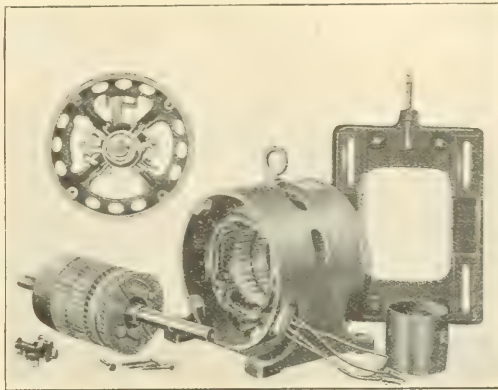


FIG. 2. PARTS OF "CENTURY" MOTOR 2 H.P.

tanks are situated. In all cases, wooden racks or false bottoms are provided for the operator to stand on while at work, and the shop floor should be provided with a slope to allow water to run off into a drain constructed for the purpose. As in most operations solutions and tanks have to be kept hot, arrangements have to be made for either gas or steam heating. For small plants gas is sufficient, but for larger plants steam is best, being far more economical and handy to use. Burnishing is the last process, and it imparts to metal goods a very brilliant finish, more lustrous than can be obtained by any other process. To do this, steel burnishers are moved backwards and forwards over the surface of the article, which is kept well moistened by a thick paste of soap and water. After burnishing, the soap must be washed off with warm water and the article dried in clean boxwood sawdust, then polished with a soft chamois leather. The difference between burnishing and polishing may be briefly described as follows: While burnishing produces brilliance by pressing upon, or laying flat, the surface of the metal, polishing produces it by removing the projecting particles.

(To be concluded.)

International Standardisation.—In the *Electrical World* of June 24th, an interview is reported with Mr. C. le Maistre, general secretary of the International Electrotechnical Commission, who is on a visit to the United States as representative of the Electrical Section of the British Engineering Standards Committee. Mr. le Maistre has visited the principal electrical manufacturing centres of the United States, the Bureau of Standards of the Dominion of Canada at Ottawa, and the City of Montreal; he attended a meeting called by the U.S. Bureau of Standards at Chicago, and visited the Underwriters' Laboratories, and was to read a paper on "Standardisation" at the annual meeting of the A.I.E.E. in Cleveland at the end of June. At the request of the *Electrical World*, he described the activities and achievements of the British Engineering Standards Committee, and stated that, with the specifications that were to be issued, the ratings of American and British machinery would be comparable. Mr. le Maistre could not adequately express his gratitude "for the extraordinary generosity and courtesy he had received from one and all" with whom he had come into contact.

CENTURY SINGLE-PHASE REPULSION-INDUCTION MOTORS.

THE Century Electric Co. of St. Louis, U.S.A., has devoted its activities for many years entirely to the development of single-phase apparatus, and has built up a large business on this basis. Its principal product is a line of single-phase constant-speed motors, on which the energies of a staff of expert designers have been concentrated, with the result that a type of motor has been evolved which possesses valuable all-round characteristics, the aim having been to produce a motor which should combine with the best

starting qualities of the D.C. motor the excellent running characteristics of the pure induction motor. The "Century" motor is self-starting on full load, without the use of any external starting device other than a knife switch, coming up to speed quickly, and is capable of carrying 50 per cent. overload, with high efficiency and power factor. It is illustrated in figs. 1 and 2, and we give below some particulars of its construction and running characteristics.

The stator has a laminated toothed core with a pyramidal winding, and is connected to the supply circuit: the rotor has a progressive winding, connected to a radial commutator, which is in use only during the starting period, the brushes being lifted and the rotor winding short-circuited after the rotor has attained a predetermined speed. The motor, therefore, starts as a repulsion motor, without



FIG. 3. OSCILLOGRAM OF STARTING CURRENT.

compensating or auxiliary windings, and when it has run up to speed it operates as a simple induction motor with the equivalent of a squirrel-cage rotor. By this means the highest possible starting torque is secured, together with the most efficient and steady running qualities.

The machine has been greatly improved during the last 16 years in both its electrical and its mechanical details, and it is claimed that it compares very favourably in starting qualities with the best types of D.C. and A.C. motors.

We give in fig. 3 an oscillogram showing the starting current of a 60-cycle "Century" motor of small size. From this it will be seen that the maximum starting current at the time of closing the main switch was about 250 per cent. of full-load current. This decreased to approximately normal in about one-third of a second, and again increased to a maximum of about 200 per cent. full-load current, being above the full-load current about the same length of time, as the motor changed from repulsion to induction. This second increase is due to the governor being adjusted so as to change the motor from repulsion to induction slightly below full-load speed, the motor then pulling up to speed as an induction motor. This curve is typical of all sizes when the motors are started with D.P. switches. In the larger sizes the governor is more closely adjusted, so that the motor acquires more nearly full-load speed before the governor operates, and as a result the corresponding increase in current is less in magnitude. If the governor were adjusted so that it operated just at full-load speed, there would be no increase of current due to the change from repulsion to induction operation.

As to the operating characteristics, a recent test on a 5-H.P. 50-cycle stock motor, carried out by the Testing Department of

the Manchester Corporation Electricity Department, gave the following results:—

The motor ran at 1,460 R.P.M. and was arranged for supply at either 268 or 116 volts. The starting current, at 412 volts, was about 60 amperes under all conditions of load, and the motor started against any torque not exceeding 250 per cent. of full-load torque. It would run up to speed against any torque less than 150 per cent. of the full-load torque. It continued to run as an induction motor with any torque less than double normal full load. The temperature rise, as measured by the resistance of the stator winding, after 6 hours' run at 5 B.H.P., was 75° F., and after 6 hours' run at 6.25 B.H.P., 95.5° F. The efficiency power-factor, &c., are shown in the accompanying curves, fig. 5.

The motor is well adapted for driving apparatus which requires large starting torque, such as pumps starting under full head, air compressors starting under maximum pressure, rock crushers which are equipped with the necessary fly-wheel, bakers' machinery where the tub is full of dough ready for mixing, meat choppers, coffee mills which have been stopped with the burrs full of coffee, &c., not requiring a starter; the motor is also suited for operating vacuum cleaners, pumps which are controlled automatically, sewage-disposal pumps, organ blowers, and heating and ventilating apparatus, because it can be started from a distance, and starts quickly; and the brushes being removed from the commutator after attaining speed, motors of this type run very quietly.

The installation cost of the "Century" single-phase motor is less than that of a two- or three-phase motor of the same size, the polyphase motor requiring at least three wires, and the transformer costs averaging about 30 per cent. greater for the poly-phase than for the single-phase repulsion-start motor. The transformer losses also are about 25 per cent. greater for the poly-phase installation than for the repulsion-start induction-motor installation.

Large stocks of these motors in sizes from $\frac{1}{2}$ to 40 H.P. are carried by the Swedish General Electric, Ltd., who are the sole agents for the Century Electric Co. in Great Britain.

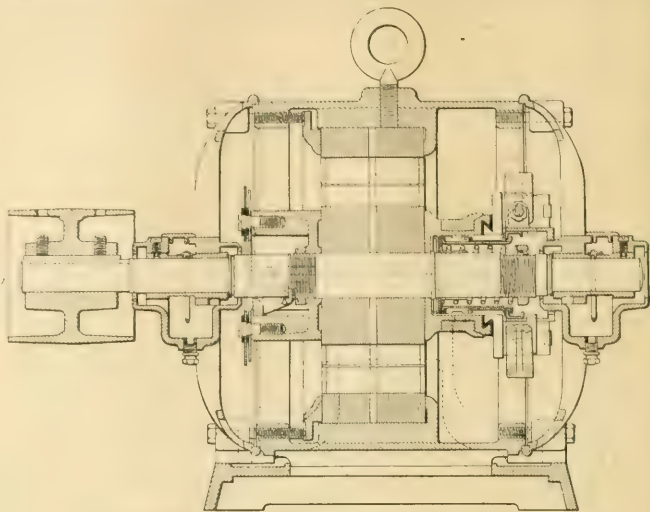


FIG. 4. SECTION OF "CENTURY" MOTOR, SHOWING THE GOVERNOR AND SHORT-CIRCUITING DEVICE.

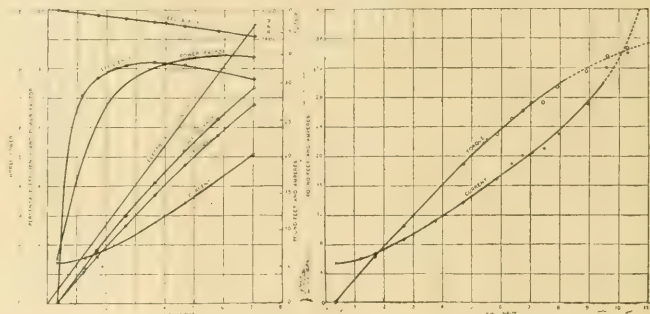


FIG. 5.—CHARACTERISTIC CURVES OF "CENTURY" MOTOR.

REPORT OF THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO.

THE eighth annual report of the Commission, covering the year ended October 31st last, with its 460 pages and numerous illustrations, constitutes an exceedingly bulky volume, and a record of which our Canadian friends may well be proud.



110,000-VOLT SWITCHES, NIAGARA TRANSFORMER STATION EXTENSION.

During the year the attention of the department has been given to the Eugenia Falls development and to acquiring land for the additional line from Niagara Falls to Dundas. About 400 miles of L.T. line have been completed, and permission had to be acquired for about 400 crossings of railways, telegraphs, &c. The possibility of obtaining an additional supply from Niagara, making use of the total difference in level between Lakes Erie and Ontario, is being considered.

Agreements were entered into with 32 municipalities; with the Interurban Power Co., of Toronto, for the supply through the Toronto hydro-system of 3,000 H.P.; and owing to the supply of contract power from the Ontario Co. becoming exhausted, a temporary contract was entered into with the Toronto Power Co. for the supply of 16,000 H.P. A lengthy summary is given of the extensions carried out at the various plants supplied by the Commission, and a total capacity of 236,725 K.V.A. of transformers are now installed or ordered for the various stations.

At October last, there were completed or under construction 1,143 miles of secondary transmission lines of from 46,000 to 2,200 volts; some 45,000 wood poles were used, and 906 miles of single-circuit telephone line has been erected for operating purposes.

Only two total system interruptions occurred in the year on the Niagara system, each of momentary duration. Electrical storms occurred on 49 days, the majority in certain specific areas. Not a single failure of the H.T. line occurred, and insulator trouble appears to have been eliminated. The 162,000 suspension and strain units on the original line sections were tested twice for dielectric strength. There are now three

separate circuits of steel reinforced aluminium cable between Dundas and London, with the exception of the Berlin-Stratford section.

The electrical and mechanical equipment of the H.T. and L.T. stations gave practically no trouble, due to rigid inspection and monthly tests of insulating oil, &c.

Inductive trouble on the private telephone system has been successfully overcome by a new type of protective apparatus, including an insulating transformer designed by the telephone inspector.

The capital invested in the Niagara system totals \$8,824,549; the income for the year was \$1,506,280, and surplus available for sinking fund and depreciation \$239,629.

In addition to the above, the Commission operates the St. Lawrence, Port Arthur, Severn, and Wasdells Falls systems, and others are being developed, including the Eugenia and Muskoka systems.

The total capital expenditure on all these projects, including stock, tools, &c., of the Commission totals \$12,582,221.

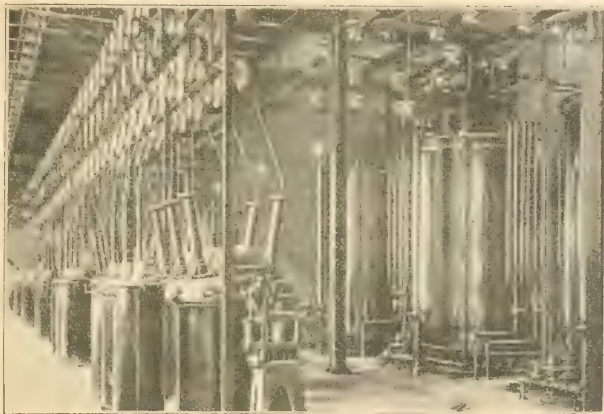
During the year assistance and expert advice was given to a number of municipal authorities, and contracts for the supply to the Canadian Pacific Railway's McNicoll terminal of 800 H.P., National Portland Cement Co., Durham, of 1,300 H.P., and the Canadian Cement Co., Shallow Lake, of 800 H.P. were submitted.

In a number of instances, the street lighting systems have been reorganised, using larger metal-filament and in some cases nitrogen-filled lamps.

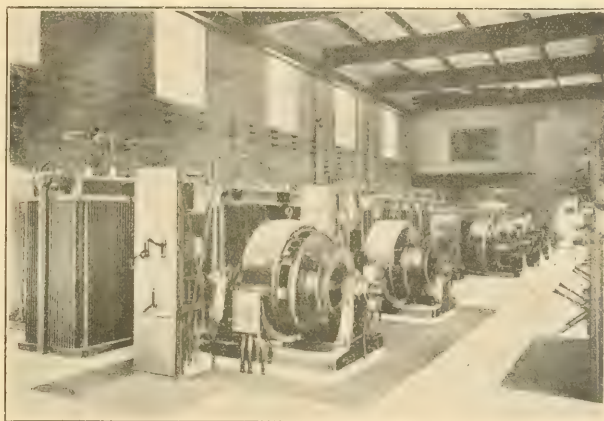
A financial summary relating to 99 municipalities supplied by the Commission in 1915 shows a gross surplus, after meeting debenture and interest charges, for the year of \$702,540, or less depreciation, of \$461,896. The number of lighting consumers was 117,010, and of power consumers 3,818, making a total of 120,828 consumers. The kw.-hr. varied in cost from 11.5 c. to 2.4 c. for domestic use, and from 12.2 c. to 1.9 c. for commercial use, the average figures being 3.9 c. and 3.1 c. respectively.

The municipalities have invested \$17,683,000 in distribution systems and equipment, with a fixed debt charge of \$814,443 per annum.

The report says: "Bearing in mind that these fixed charges include the sinking fund and debenture retiring payments as well as interest, so that the present consumers are not only paying the ordinary operation, maintenance, and interest



30,000-VOLT SWITCHGEAR AND TRANSFORMERS, NIAGARA TRANSFORMER STATION.



ROTARY CONVERTERS, A.C., LONDON SUB-STATION.

The various undertakings are under the supervision of nearly 50 inspectors appointed by the Commission, and some 340 municipalities are dealt with.

The Commission maintains a purchasing department whose services are offered to any municipality in Ontario, whether connected with the hydro system or not, and during the year over \$500,000 worth of goods, &c., have been purchased in this way for 132 municipalities.

It is stated that savings of from 5 to 50 per cent. have resulted in cost through the co-operative buying, which is carried out by an expert staff, having the use of equipment for standardising and testing. The officials of the Commission also render assistance in formulating business campaigns, for which complete data has been collected, and a number of municipalities have benefited from this service.

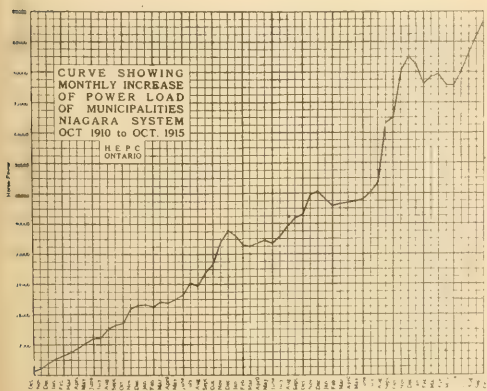
Farm Power.—The report contains data relating to the use of a syndicate outfit and domestic electric supply by a group of seven farmers at Waterloo. The outfit consists of a 20-h.p. induction motor with auto-starter mounted on one wagon and transformers and a standard 3-phase meter mounted on another.

Two services are run to each farm, one a domestic supply and the other a 2,200-volt service for the syndicate outfit, terminating at a point where it is only necessary to use 75 ft. of portable cable to connect the transformers with the motor.

The domestic uses consist of lighting throughout, and the use of irons, washing machines, and one or two pumps. Six of these consumers (outside the town) used 1,869 kw.-hrs. for domestic purposes, and the seven (including one in the town) used 7,203 kw.-hrs. through the syndicate outfit, making a total for the seven, one of whom had no lighting, of 9,072 kw.-hrs. The bills of the six consumers using both power and light varied approximately from \$70 (£14) to \$100 (£20) per annum, the average cost per kw.-hr. being from 5 to 6.5 cents (2½d. to 3½d.).

The syndicate outfit was used for silo filling, threshing, sawing, and chopping; usually from 2,000 to 4,000 bushels of grain were threshed per farm.

Electric Railway Projects.—The Commission has carried out a number of preliminary surveys of electric railway projects



NIAGARA SYSTEM LOAD CURVE, ONTARIO H. E. P. COMMISSION.

charges, but are retiring about 3.3 per cent. of the capital debt each year, thus automatically providing for depreciation regardless of any special provision which may be made in the accounts, the phenomenal success of the enterprise from the municipal standpoint is apparent."

system, the proposed Hydro-Electric Railway Act) covering some 2,000 miles. After consideration, it has been decided to adopt the 1,500 or 3,000-volt direct-current system on such lines, and the proposed system is required for a standard 60-ft. three-compartment steel car. The London and Port Stanley Railway was constructed and equipped under the supervision of the Commission.

A section of the report deals with the work carried out by the testing and research laboratories, which covered tests of line material, switches, and other goods, largely made for the production of equipment, and a series of tests with a view to improving manufacturers' products. The statement is made that the only suitable instrument on the market for the measurement of excess power (i.e., energy consumed in excess of a certain predetermined "firm power") was of foreign manufacture, and efforts are being made to find a suitable substitute of home manufacture.

Tests were carried out on cooking stoves of six different makers, and curves made of temperature and energy consumption, and from the data obtained the comparative costs of doing various classes of cooking were calculated.

In the lamp laboratory a great many tests were carried out; the report states that gas-filled street series lamps have entirely replaced the vacuum series lamp, and are rapidly replacing all arc lamps except the most improved (luminous arc) type.

The illumination laboratory, amongst other work, carried out a test to ascertain the extent of fire risk when using gas-filled lamps in show windows, and certain limits have since been imposed by the inspection department as a result. The photographic department supplied about 10,000 prints during the year, and filed 2,000 new negatives.

The report concludes with a lengthy section on hydraulic investigations, and contains a reference to the preliminary surveys carried out in connection with a possible scheme for utilising the unallotted surplus of water available at Niagara, with an effective head of not less than 300 ft.

The report is, as usual, an instructive commentary on the progress of the Hydro-Electric Commission's undertaking; if it lacks anything to our eyes, it is in the absence of any general indication as to the classes of consumers being served. To judge of the merits of an undertaking, one needs a comprehensive idea as to the conditions obtaining in the area of supply.

WAR ITEMS.

Entertaining "Tommy."—Quite recently the girl workers of Pope's Elasta Lamp Works, at their own expense, entertained 120 wounded men at the Shepherd's Bush Empire. About a fortnight later, the same girls gave a tea and outing to another 60 men in Kew Gardens, and those who could not join the party received cigarettes at the hospital. A third event is now being arranged for, and another 60 wounded soldiers are to be taken to Kew Gardens to a similar treat.

Export Prohibitions.—A special and bulky Supplement to the Board of Trade Journal for July 15th gives full information respecting prohibitions of export in force in British India, the Self-Governing Dominions, Egypt, and certain other British possessions.

To be Wound-up.—The Board of Trade has ordered the following companies to be wound-up:—

Plutte Scheele & Co., Ltd., 18-19, Queenhithe, London, E.C., merchants and agents for electrical goods. Controller: G. W. Roberts, 133, Wool Exchange, Coleman Street, E.C.

Leeds Meter Co., Ltd., Tower Works, Armsley, Leeds, water meter manufacturers. Controller: W. Simpson, 19, Bond Street, Leeds.

Kirchner & Co., 21-25, Tabernacle Street, London, E.C., wood-working machines, &c. Controller: J. Fraser, 31, Cophall Avenue, London, E.C.

British Hulse Metallic Packing Co., Ltd., Snowdon's Wharf, Milwall, London, E., manufacturers of metallic packing for steam engines, &c. Controller: J. E. Wilson, 28, Basinghall Street, London, E.C.

Poldi Steel Works, Sheffield, steel manufacturers. Controller: A. D. Barber, High Street, Sheffield.

A. Barson & Co., 57, Scrutton Street, London, E.C. Engineers' tool manufacturers. Controller: A. Turquand Young, 41, Coleman Street, E.C.

The Board of Trade has revoked the order winding up Phonotacs Co., Ltd., London, W.C., sanitary system for cleaning telephones.

Exemption Applications.—At Southwark Tribunal, Mr. B. E. White, electrical engineer, in applying for exemption, stated that before the war he employed between eight and ten men, but now had only a man and a boy left. He had to work double time himself on repairing electrical motors. He was granted conditional exemption on joining the Volunteer Training Corps.—The Imperial Lighting Co. (Implicio, Ltd.), electric sign contractors, applied for the exemption of a general and electrical engineer. Out of 42 hands before the war, 12 had joined up, and they had only one engineer left out of eight. He was the only man in the machine shop, where

they had a number of boys and girls at work. He was granted three months' extension on joining the V.T.C.

At Battersea, Mr. Pope, trading as F. Williams, electrician, appealed for total exemption. He said he was a contractor for electric lighting, bells, motors, &c. He had been in business ten or twelve years. His partner was in the Army, and he allowed him 10s. a week, and did all the work himself. He was allowed a month's final extension.

Before the Hastings Tribunal, Mr. H. Blackman, of Messrs. Uphill & Son, appealed for Mr. R. H. Pattenden, electrical contractor. He could not get anyone over military age as a substitute. Two months allowed.

Conditional exemption has been granted to Thos. C. Palmer, electrician at Hadham Hall (Herts), the seat of Mr. Wm. Minet.

Nantwich Tribunal has conditionally exempted, on the appeal of Baroness W. Schroder, the electrician at her Red Cross Hospital at Stapley House, where he has been engaged for some years. The Military assented.

At Stratford-on-Avon, the Electricity Co. appealed for A. R. Bailey (24), technical clerk and responsible person when the manager was absent. The Military did not assent, contending that appellant's work could be done by a man over military age. As appellant had been rejected, a fortnight was allowed for him to go before the Army Medical Board.

Mr. G. Miller (40), assistant electrician at the Haggerston Military Hospital, Berwick-on-Tweed, has been given exemption.

At Deal, Mr. R. M. C. Strebbins, electrician, who is a member of the Society of Friends, appealed as a conscientious objector, and was granted conditional exemption on joining the Friends' Ambulance Unit.

Mr. A. R. J. Creasey (31), manufacturer of electrical switchboards, of Herne Bay, who was refused any exemption by the local Tribunal, appealed to the East Kent Appeal Court on July 12th. The appeal failed, and Mr. Creasey was refused leave to go before the Central Tribunal on the ground that he was not engaged in a reserved occupation as an engineer.

At Reigate, on July 11th, Mr. Makovski, of Messrs. Tampion & Makovski, electrical engineers, applied for exemption for their inside manager (Mr. H. Francis, 27), who also appealed on personal and conscientious grounds. The case had been adjourned for a medical examination, and it was announced that Mr. Francis declined on conscientious grounds to be examined. The Tribunal refused exemption, and it was announced that Mr. Francis would not be called up for a month.

Newcastle-under-Lyme Tribunal has given three months' exemption each to two employees at the Corporation electricity works.

Mr. S. Terry (28), electrical engineer, of Canterbury, applied for an extension of his three months' exemption, and also for an employee named Elliot (38), engaged in wiring work. Mr. Terry contended that he was serving national interests as he was carrying out important contracts. Each was allowed six months.

Broadstairs Tribunal granted conditional exemption to several employees of the Isle of Thanet Tramway Co., on the ground that they were engaged in work of national importance. The Military assented.

At Southend-on-Sea, an electrical engineer (35), for nine years in business, appealed on the ground that military service would mean the closing of the business. He said that he had only two youths to assist him. Final exemption until August 1st was allowed.

Hemel Hempstead Tribunal has given conditional exemption to Mr. J. McDermott, manager of the electrical department of Messrs. Dickinson & Co., and three months to A. J. Young (27), the firm's electrician.

Conditional exemption has been conceded, at Bath, to G. N. Slipp (22), stoker at the electric tramway works, and to E. Gilham (30), a brakesman with the Tramway Co.

At Maidenhead, Mr. W. Hogarth Vevers, jun. (26), electrical engineer, responsible for the business of Messrs. W. H. Vevers & Son, has been exempted until October 1st, on condition that he joins the Volunteer Training Corps. Similar exemption was conceded to Mr. W. L. Chubb, assistant engineer and deputy-manager of the electricity works; and until January 1st to Mr. W. H. Arundell, electrician, who is "badged."

Maidshead Tribunal has given conditional exemption to T. Cooker, driver on the Corporation tramway staff, who has served 17 years in the Army; and has given until September 19th, by which time it is expected they will receive the pink form, to seven other drivers, the chief clerk and stores superintendent, a turner and engineer, and an inspector on the tramway staff.

At Watford, a certificate of conditional exemption has been granted to Mr. J. W. Russell (32), electrical fitter.

Maidshead Tribunal has given two months' respite to Mr. A. Leach (36), electrical engineer, to produce proof that he is an American subject.

Settle Tribunal has given conditional exemption to Mr. G. A. Copinger, engineer and manager to the Bentham Electric Supply Co., Ltd.

At Clayton-le-Moors, exemption until the end of September, with leave to appeal further, was granted to an electrician, aged 32, on condition that he joins the Volunteer Training Corps.

At Amersham, on July 9th, Mr. S. Beeson (26), electrician, of Chalfont St. Giles, appealed on the ground that he was running his business single-handed. Dismissing the appeal, the Tribunal requested the Military to delay the calling-up for a month.

When the Imperial Tramways Co. asked the Middlesbrough Tribunal for the exemption of a coach-painter employed on the Middlesbrough, Stockton and Thornaby system, Mr. A. E. Forbes (solicitor), described the man as absolutely indispensable for keeping the cars in proper order. Six thousand munition workers were conveyed to and fro on Teesside on the company's system, and an inspector who recently went over the company's premises for the purpose of "combing out" had not taken a man. The Tribunal announced that as the coach-painter was not indispensable to the running of the cars and was of Army age, the appeal would be dismissed.

At Farsley (Yorks.), the Morley Electrical Engineering Co. appealed for a foreman armature winder and electrician, aged 25, and for a turner, aged 35. Mr. Summerscales, a member of the firm, spoke of the value of these men, in that at the present time it was practically impossible to get men in these trades. They were in use in "controlled" establishments, who would not give them leaving certificates. Conditional exemption to September 30th was granted.

Temporary exemption till October 31st has been granted, at Rochdale, to Mr. G. L. Adamson, who appealed for Mr. F. Rothwell (manager) and Mr. A. B. Hopkins (electric fitter).

At Southport, John Ainscough, who said he was a munitions "case worker" in the employ of Messrs. Schofield & Wright, electricians, appealed on the ground that he had bad health, and also that it was in the national interest that he should remain in his present occupation. He said he would be 41 years of age within a week. The appeal was adjourned so that appellant might go before the Medical Board.

At St. Anne's, Mr. H. W. Laing, manager of the Blackpool, St. Anne's and Lytham Tramways Co., Ltd., appealing for two motor-men and a foreman of the track repairing staff, said that out of the traffic staff of 125 he had lost 110 men. Conditional exemption granted.

Enemy Aliens at Birmingham.—Birmingham Chamber of Commerce has adopted the following resolution in reference to enemy aliens:—

That all members of the Chamber of enemy origin, who have not become denationalised of their enemy origin and have not been naturalised in the British Empire for at least 20 years, are requested to resign their membership. This applies also to limited liability companies or firms whose share capital is held to the extent of one-third or more by persons of enemy origin, and to limited liability companies one-third or more of the directorate of which are held by persons of enemy origin.

Australia and Enemy Shareholders.—A Reuter dispatch from Melbourne states that the Minister of External Affairs will shortly take legal action against the companies incorporated in Australia which have not complied with the precautionary regulations rendered necessary by the war regarding enemy shareholders.

Some Carville Resolutions.—At a well-attended meeting of the employés of the Newcastle-upon-Tyne Electric Supply Co., at Carville Power Station, the following resolutions were carried unanimously:—

1. That this meeting considers it the duty of the State to provide adequate pensions for all men (and those dependent on them) who are disabled in the war, and also for the widows and dependents of those killed, seeing that the men met with their death or received their injuries while serving the State.

2. Seeing that any advance in wages that the employés of the Newcastle Electric Supply Co. have received during the war is in no sense proportionate to the advance in the cost of living, we regret that we are not in a position to start a branch of the War Savings Association.—*Newcastle Journal*.

Trading with the Enemy: Prohibitions.—The "London Gazette," dated July 18th, contains further lists of bodies and persons with whom trading is prohibited in the following countries:—Argentina, Bolivia, Brazil, Chile, Denmark, Greece, Japan, Netherlands, Norway, Spain, Sweden, U.S.A., &c.; also variations in previous lists.

Breakdowns of German Plant. We recently quoted from the report of Mr. T. H. L. Altmann, electrical engineer to the Shanghai Municipal Council, concerning the breakdowns of the A.E.G. turbo-generator plant installed at the Riverside power station. Our readers will be interested to learn that on June 18th, 1916, one of the 5,000-KW. alternators, which was only commissioned last year, broke down very badly. Some of the stator coils either short-circuited or went to earth, causing a very bad burn-out in part of the stator to such an extent that the copper conductors and the iron laminations became entirely fused together, whilst the insulation of half the end windings was completely burnt off. To repair this machine will take at least three months, and even then it is doubtful whether it can be regarded as a reliable piece of apparatus. Of the four A.E.G. turbo-generator sets at Riverside three have already seriously broken down. This sort of thing will damage the reputation of German manufacture very seriously in the Far East.

LEGAL.

FAR OIL FOR ELECTRICITY-GENERATING PLANT, SUFOLK ELECTRICITY CO. AND GERMAN PATENT.

ON Thursday last week, before the Controller, Mr. Temple Franks, and the Deputy Controller, Sir Cornelius Dalton, in the Patents Court, the Suffolk Electricity Supply Co., Ltd., applied for a licence to use a German patent in connection with their electricity undertaking for the town of Felixstowe. The patent in question was No. 4,908, of 1909, in the name of Konrad Aust, of Essenerstrasse 11, Berlin, for a mechanism for employing tar oil, instead of American oil fuel, in engines for generating electricity. It provides for an arrangement whereby, in an internal-combustion engine in which the fuel is injected by gas under pressure through an atomiser, a small portion of fuel is supplied directly to the admission port of the cylinder without passing through the atomiser, through a separate duct, this duct being cut off from the chamber only during the ignition period. The appliance is, in substance, an auxiliary pump which injects oil of lower ignition temperature in advance of the main fuel oil. It is by this means only that tar oil can be used for driving engines of the Diesel type.

COUNSELLOR explained that he understood that by this contrivance the temperature of the air was raised for the ignition period by a small injection of petrol, sufficiently to vaporise the tar. The Suffolk Electricity Supply Co.'s application was opposed by Messrs. Mirreles, Bickerton & Day, Ltd., for whom Mr. Courtney Terrell appeared. Mr. Imry represented the patentee.

Opening the case for the applicants, Mr. NAPIER PRENTICE, their secretary, explained that firms with electricity-generating plant found very great difficulty to-day in obtaining supplies of American fuel oil. In addition to obtaining security of supply, the Suffolk Electricity Co. hoped, with the aid of this new device, to cut down their fuel bill by half. Manufacturers whom he had approached asked £363 for making and fitting this special appliance to two engines. He understood that it was because of the price fixed by the British licences from the Germans that the cost was not smaller than this. If the Board of Trade would give the Suffolk Electricity Supply Co. a licence for this auxiliary pump, he was confident that he could make and fit it for £60, all told, to two engines. For 112 tons of oil, which the company used last year, at the present price the cost would be £960. By using tar oil for a similar amount of work, the cost would be brought down to £576, a saving of £384 for fuel. But if it cost £363 to fit this apparatus for 470 H.P. to two engines, it would hardly be worth while to makers of electricity, unless it were guaranteed that the war would last more than another year. The purchase of American oil was against the national interest to-day: it was to the national interest to encourage the use of tar oils in Diesel engines.

MR. TERRELL explained that the opponents, for whom he appeared, were the sole licensees under the patent in this country before the war. They paid a large sum for the licence—£1,500 down. They had the equipment and plans for making, and could meet the entire demand. If there was anything they could not cover, they were ready to issue licences to sub-licensees.

THE CONTROLLER: I imagine the legal opinion as to your licence would be that it is suspended during the war. If it is so, we may treat your licence as non-existent. I am not sure you ought not to have come here to get a licence yourself.

MR. TERRELL: It may be that that is what we ought to do. We have either supplied, or contracted to supply, 22 firms with a total horse-power of over 4,000.

THE CONTROLLER: You are the only people who can supply this improvement at present, and you can charge what you like. If you charge a reasonable price, I admit there is something to be said for maintaining your position. But the Board of Trade must supervise, and here comes the opportunity for us to exercise that oversight.

MR. TERRELL then called as witness MR. CHARLES DAY, managing director of the opposing firm, who said that on November 29th, 1912, they entered into agreement with the patentee by which they paid £1,500 in cash and agreed to pay a royalty of 2s. 6d. per horse power on all engines fitted. They experimented to ascertain how many varieties of tar oil could be used with these engines, and had to set up an installation for distilling tar oil. In the beginning they found great difficulty in getting tar oil. They engaged a chemist who had been chemist for a tar distillery, and had to use their distillery for the supply of tar oil to their customers. Including payment for the patent, their preliminary expenses came to £3,000. In their price they added the 2s. 6d. royalty for the patentee and 2s. 6d. for themselves towards a sinking fund to recoup themselves for this preliminary outlay. The prices of fuel oil began to creep up a year after the outbreak of the war. They had been from £3 to £4 a ton. In January last they were £8 to £9. Tar oil cost £3 or £3 10s. Mr. Prentice said he hoped to get it at £4. It varied according to the district. This complicated and delicate piece of apparatus required considerable skill to install. Personally, he should object to any stranger fitting it to an engine he had anything to do with. The £360 price cited was not unreasonable. His firm were pioneers in this matter, yet they had not had an inquiry from the company. To everyone who made this type of engine they had offered a licence to make this special apparatus, with the benefit of their experience as to details of manufacture and drawings. These auxiliary pumps had to be watched after fitting, and taking into account all the risks the manufacturer ran, the price was not excessive.

THE CONTROLLER: Don't you think that, like so many more people in a similar situation you were rather slow to this agreement?

MR. DAY said: No more.

The CONTRACTOR: I have seen agreements here that have absolutely cost nothing and that anybody could enter into them.

Asked by Mr. PRENTICE as to the possibility of the Suffolk Electricity Supply Co. making this apparatus, MR. DAY replied that he would not speak of its possibility, but he would speak strongly against its desirability.

Called on behalf of the opponents, MR. HUGHES, of Messrs. Willans & Robinson, Ltd., Rugby, said he thought Messrs. Mirrieles, Bickerton & Day's prices were reasonable and fair. His own firm at Rugby built the Suffolk Electricity Supply Co.'s engines, and they had now practically concluded arrangements to receive a sub-licence from the Stockport firm.

MR. DAY: As to Mr. Prentice's hopeful figure, with several sets going through at the same time, the apparatus would cost £150.

The CONTRACTOR to Mr. PRENTICE: How did you make up your £60 for fitting two engines?

MR. PRENTICE: It is quite a simple affair—£10 for making the pump, £40 for fitting to the engines and running the pipes to the valves, and £10 for sundries—a small distributor, &c. It is nothing more than a pipe conveying the tar oil to another position. I simply want to put the oil in position to enter in advance of the main charge, and that I can quite easily do for the sum I have mentioned.

MR. DAY: Mr. Prentice apparently proposes one pump for three cylinders. One is needed for each, according to our experience.

The CONTRACTOR, in announcing that he would report on the hearing to the Board of Trade, suggested that the electricity company might like it the makers of their machines were receiving a sub-licence, to get into communication with them.

NEWALL & ELECTRO-FLEX STEEL CO., LTD.

IN the Chancery Division, on Friday last, Mr. Lavington, on behalf of the plaintiff in this debenture-holder's action, applied to Mr. Justice Astbury for the appointment of a receiver and manager of the defendant company. Counsel said the debentures had become payable on the ground that the company had passed a resolution for voluntary winding-up. That alone made the debentures payable, and there were other conditions that had not been complied with. The company consented to the application. The company was doing work of national importance, and it was important that it should be continued, and he asked leave for the receiver to borrow money up to £5,000. The company had to purchase machinery and plant, and money was also required to pay wages.

His LORDSHIP appointed a receiver and manager, but referred the application for leave to borrow £5,000 to Chambers, remarking that it was a very large sum to empower the receiver to borrow. He, however, in the meantime, gave leave to borrow £500 for wages.

COX-WALKERS, LTD., v. S. DIXON & SON, LTD.

AT the Richmond County Court, plaintiffs, of Darlington, sued defendants, electricians, of Leeds, for the sum of £16 18s. 2d., for goods supplied at the Richmond Camp. According to the *Yorkshire Herald*, it was stated that the parties had contracts for laying down electric mains at the Camp, and, as the defendants ran short of materials, the complainants let them have a quantity on the understanding that they would be replaced. Since then the prices of certain articles had gone up considerably.

His Honour, JUDGE TEMPLE, said he believed the story of Messrs. Cox-Walkers that the goods had to be replaced, and not paid for at cost price. The prices had gone up considerably since the arrangement, and it was not right for the complainants, who had obliged the defendants, to lose by it. He gave a verdict for the plaintiffs, with costs.

MADRAS ELECTRIC SUPPLY CORPORATION, LTD.

IN the Chancery Division, on Tuesday, Mr. Justice Astbury confirmed a reduction of capital of this Corporation by writing off £2 per share from the ordinary shares. The preference shareholders, Mr. Chinnery stated, were to give up last year's dividend, and were to take it in fully-paid shares. In an affidavit, the chairman said the installation in Madras became very defective, and the result was that they were unable to make any profit out of it. But new plant had been erected, from the issue of further shares and debentures. The plant was now in full working order, and last year they made a substantial profit; the company wished to take advantage of the improved prosperity to write off the balance of loss.

French Industries. A central association has been formed in France to facilitate the resumption of industrial activity in the districts at present in the hands of the enemy, when the latter have been expelled. It will devote itself to the re-establishment of plant and stocks, and of labour, to hastening payment for goods requisitioned and indemnities due to industrial concerns, and to facilitating the raising of loans to enable manufacturing operations to be resumed as quickly as possible. The association embraces all kinds of industries, and will co-operate with other trade groups and associations to prevent waste of effort. —*La Revue Electrique*.

REVIEWS.

Principles in Magnetism. By Prof. F. E. AUSTIN. Published by the Author. Price \$1.10, in U.S.A.

From a perusal of other works by the same author we are led to expect a high standard of practical value on taking up this book. Nor are we disappointed in the outcome. The text is arranged in the form of a dozen "lessons," in each of which several topics are dealt with along the following uniform lines: First there is stated an example designed to bring out the desired points. The laws bearing on the matter are explained briefly, and the algebraic or symbolic expression of them is given. The known data are tabulated systematically, and the complete solution is worked out, each step being explained. Next there is given a problem resembling the example which it follows. The answer to this problem is given, so that the reader can test his understanding of the instruction imparted by the example. Finally, there is a second problem dealing with some other phase of the same subject. No answer is given to this problem, and the student is thus left to apply the principles illustrated by the example in a different manner, and also to devise a means of checking his result. The author then proceeds to the next topic, and, since the topics themselves are well arranged, it will be seen that the reader who works conscientiously through this volume is well equipped to deal confidently with any magnetic problem or its application.

The author attaches special importance to a clear understanding of the principles of mechanics, and certainly does his best to help the reader to this end. The first lesson is devoted to a brief explanation of trigonometrical ratios and relationships, and includes a handy collection of formulae relating to trigonometrical functions of the sum and difference of angles. Trigonometric solution of triangles and the resolution and composition of forces form the bulk of the second lesson, and there then follows a statement of symbols, notation, English and metric units, equivalents and definitions, all arranged so as to be convenient for reference. The force of gravity, moments, and couples being dealt with in Lesson IV, the reader has by this time a knowledge of the fundamental principles and methods of trigonometry and mechanics, as required for the solution of magnetic problems. The general nature of magnets, magnetism, fields of force (magnetic and otherwise), and magnetic poles are then explained, and the next lessons are devoted to elementary calculations concerning the force between magnetic poles and between magnets suspended in various ways. The components of the earth's magnetic field and their bearing on various magnetic problems are next considered; then the resultant field due to two poles; and the restoring couple on a magnet deflected in the earth's field. Further examples on magnetic moment, pole strength, and the investigation of the earth's field and its effects follow, and it is worth noting that the author has so designed and framed his problems as to make them very instructive and of much more interest to the reader than the purely academic problems which are so often used to depress the student of this subject. The concluding lesson deals with the comparison of strengths of magnetic fields, and includes a collection of pithy paragraphs containing useful information regarding the materials and properties of magnets, and methods of mapping magnetic fields. The book is very well indexed, and is thoroughly useful as a work of reference, whilst the large number of examples and problems make it very suitable as a text-book either for class tuition or private study. Considering the cost of setting up the numerical examples, the price of the book is not excessive.

The Electric Railway. By A. MORRIS BUCK, M.E. London: Hill Publishing Co. Price 12s. 6d.

This book is stated by the author's preface to be intended as a text-book for the instruction of advanced students who may be assumed to have a fundamental knowledge of mechanics, to have taken power plant and transmission line work as independent courses, and who wish to specialise in electric traction. United States students are meant, but there are now similar facilities in various British centres, and a distinct demand exists for such a specialised text-book as the author aims at.

The first chapter starts with a statement of the importance of transportation as a necessity of economic development and civilisation, and a short historical account is given of the trunk-line railroad and of the street railway in its various stages. Electric systems are classified by the characteristics of the motors used under three heads: direct-current series wound, single-phase alternating current, and three-phase alternating current. A brief statement of the advantages of electric systems follows, winding up with the statement that the superiority of electric power is great enough to warrant its consideration for any class of railway service, and that its use is the more desirable almost in proportion to the density of the traffic.

The Mechanics of Traction dealt with in the second chapter shows first how the secondary units used for the solution of problems relating to the motion of trains have been derived from the elementary laws of motion, and then defines the components of train resistance. Dealing with gradient resist-

ance, it is suggested that the tangent of the angle of inclination to the horizontal, which is the surveyor's gradient, differs so little from the sine of the angle, which is the resistance factor, that for practical calculations the former may be taken. It might be added that the tangent factor gives a margin on the safe side for the power required, but that when the gradient approaches the limits for adhesion working the difference becomes important. This is, perhaps, outside railway work.

The speed-time curve is next considered, and the superiority of this curve over the alternative distance-time or acceleration-time curves in respect to the information afforded is pointed out. The method of plotting it from given data is gone into with considerable thoroughness, following Mr. Mailloux's well-known paper on the subject, in which the characteristics of the motors to be employed are the principal data. This is hardly the most logical course. What one really has to discover in a practical case is the motor equipment needed to run trains of a given capacity at various speeds, and from that investigation to derive the most economical speeds and equipments. In practice, too, the investigation has to be made for a whole route, not only for the individual runs making up the route, and though it is true that an equipment which will make the most difficult individual run at a required schedule speed will give at least that speed over the whole route, it is also true that it may be more economical to use a smaller equipment, and to calculate on the speeds of the individual runs varying with their ease or difficulty, as always happens in practice.

Chapter III describes and classifies the various types of motors used available for railway work, first by the character of the current supply and the motor structure, and, secondly, by their performance characteristics. The recent return to field-control of speed made possible by interpole construction is duly noted. All the discussions of motor performance are qualitative and general, excepting as regards the characteristic curves, which are figured; and, further, a good deal of general knowledge of the principles and technicalities of motor action is taken for granted. Subject to these remarks, the treatment of alternating-current motors in their different varieties is quite good, but it will not take the place of more specialised treatises, or help the designer.

The chapter on motor construction is slightly historical and otherwise confined to the mechanical arrangements and materials of construction in the various classes of motors.

The chapter on control arrangements is an excellent one, giving sufficiently detailed explanations of the principles of action and their practical application for the various supply and motor schemes in use, including single and three-phase equipments, with a brief notice of phase-splitting and rectifying devices for obtaining continuous from alternating current.

The determination of power requirements from the elements of speed-time curves, train resistance, and gradients is dealt with in a satisfactory way, mostly by graphical methods. The use of the polar current-time diagram (adapted by Mr. Mailloux from Dr. Fleming's *Alternate Current Transformer*) is given deserved prominence for obtaining the R.M.S. value of motor loads. Braking is dealt with in a chapter to itself, much more fully than usual.

The chapter on "Cars and Car Equipment" is necessarily rather mixed in subject, including collectors, lighting, heating and other auxiliaries, but it contains a description of the different types of passenger car, the seating and door arrangements, their relative advantages and drawbacks, which is both unique and of high value. Traffic managers will find some good information, representing the cream of American experience, on this important matter. The design of trucks and electric locomotives is gone into with considerable fullness, with a fair warning that finality in such design has not been attained.

The track has little space devoted to it, the treatment being merely descriptive. It might have been better to omit the subject, as it is not peculiar to the electric railway, and there is a whole literature available.

The chapter on the distributing circuit leaves much to be desired. The problem of most economical distribution is in effect dismissed as too complicated for general solution, and the economic arrangement of return feeders is not discussed at all, although the methods in use are generally described. Overhead and third-rail construction are dealt with in a somewhat cursory way. The same criticism applies generally to the treatment of sub-stations, transmission lines, and power generation.

Signalling systems are very well described, with specially full treatment of track-circuiting, for various conditions, but more might have been said as to the relation between signal spacing and block lengths, and the train service and speed provided for.

The concluding chapters of the book are concerned with "Systems" and "Engineering Preliminaries." The former is a short description of the continuous, three-phase, and single-phase systems in relation to the traffic requirements. It is noteworthy that the concluding paragraph decides strongly for the single-phase system for heavy service, on the ground that the ability to use any known type of motor with a converting equipment on the locomotive makes it as near a universal system as can be obtained. It is doubtful whether the alternating-current commutator motor will survive, says the author, but this is only an incident to the successful

development of the single-phase system. Which pronouncement shows that the author has the courage of his opinions.

The final chapter, "Engineering Preliminaries," is, naturally, only a sketch, but it lays proper emphasis on a careful estimate of traffic possibilities and indicates by example how such estimates can be arrived at with fair accuracy.

It has to be said that the book does, on the whole, fulfil the author's purpose, that it is a valuable addition to the resources of students specialising in electric traction, and by no means without value to engineers and managers designing and operating such systems. The various sections are not of equal merit. Some of the chapters might very well have been omitted, as they deal with subjects somewhat off the main track of the book, which must themselves be specially studied. There are certain signs of haste and ineffective proof-reading, such as the repetition, sometimes in almost the same words and within a few lines, of the same statement. There are also somewhat numerous cases of obscure wording, not all of them due to Americanisms. In few cases, however, will these conceal the author's meaning from a careful reader, and though the Americanisms jar a little on British readers with a preference for the constructions they are accustomed to, they do not detract from the practical value of the book. The diagrams and illustrations are good and clear, containing nothing of the catalogue order, which wastes so much space in many technical books.—H.M.S.

A Treatise on Electricity. By F. B. PIDDUCK. Cambridge University Press. Price 14s. net.

The title of this book gives little idea of its scope; it is not an elementary treatise on electricity, but an advanced text, covering both the theoretical and practical sides of the subject as far as this can conveniently be done in a single volume. And it is not an *ordinary* type of advanced text-book. The first eight chapters contain all the matter usually found in advanced texts, while the remaining chapters form introductory accounts of special subjects which the author suggests may be consulted by students before starting on treatises devoted to them alone. Some of these introductory accounts appear to us to rival in clearness and completeness the more pretentious volumes to which they are intended to lead; they certainly provide all that is necessary for a thorough understanding of even the most advanced sections of theoretical electricity.

It is thus evident that Mr. Pidduck's book is not intended for beginners; rather it is a book whose proper reading and digestion would be substantial fare for the student who aspires to an honours degree in physics.

The first chapter is a mathematical introduction, and deals straightforwardly with all the mathematical conceptions necessary for a proper study of magnetism and electricity: vectors, Green's theorem, the equations of wave motion, and Bessel functions. Chapter II is devoted to magnetism, and Chapter III to electrostatics; both subjects are treated mathematically and experimentally, and suitably illustrated. A very useful account of the theory of dielectrics is given, the prismatic crystal method of mapping electrostatic fields is described, and illustrations are given of two condenser fields.

Into the next 100 pages the author has condensed all that matters in the subjects of electric currents and magnetic effects of currents. Starting from simple cells and galvanometers—and thus leaving very little, even of the most elementary matters, to chance—we have a thorough treatment of units, resistances, Ohm's law, and measuring instruments of all kinds, including moving-coil, string, and ballistic galvanometers, electro-dynamometers, and current balances. Two sections in this part of the book, one on resistance thermometry and the other on the equations of the electro-magnetic field, serve as convenient stepping-stones to two later chapters—on thermo-electricity and electric oscillations.

The treatment of thermo-electricity is a delightfully-written summary of the Seebeck, Peltier, and Kelvin effects, concluding with a section on thermal galvanometers. Without going into many pages, the author has given a much fuller and more satisfactory account of induced magnetism than is to be found even in advanced text-books of much greater bulk, and in the two following chapters on induction of currents and applied electricity the standard set in the earlier sections is well maintained.

As already indicated, the first part of the book is intended as a foundational basis upon which to build a structure of advanced work, and there is no doubt whatever that in the first 300 pages the essential facts in the sciences of electricity and magnetism are set forth with a painstaking thoroughness which leaves nothing to be desired.

The second part of the book consists of five chapters, which introduce the subjects of electrolysis, electric oscillations, conduction of electricity through gases, radioactivity, and the theory of electrons. The treatment in every case is suggestive rather than exhaustive, but it is a suggestiveness which has nothing in common with the superficiality of treatment which sometimes masquerades as "introducing more advanced topics without enlarging upon them."

In the chapter on electrolysis, the ionic theory is developed and applied to voltaic cells, reversible cells and concentration cells, the last type being treated with exceptional clearness in a very few pages. The important experimental methods of Kohlrausch, Lodge, Whetham, and Nernst are described, as

well as an important method of measuring liquid resistance, is generally accepted by the author, and used in the Electrical Laboratory at Oxford.

The sections devoted to electric oscillations, conduction through gases, and radio-activity are, perhaps, the most interesting in the book. The measurement of transients by thermal galvanometers, their detection by crystals and oscillation valves, the experiments of Hertz, Tesla, Bjerknes and others on electric waves, the theory of electric oscillations and its application to resonance circuits and wireless, are all important features of the first of these chapters—a chapter remarkable for its sound practicality as well as for the completeness of its theoretical treatment.

The remaining sections are equally exhaustive and up-to-date, and include interesting references to the work of Bragg on X-ray spectroscopy, the Zeeman effect, and the still more recent theories and speculations of Planck and Einstein. The book is well illustrated throughout, and we have seldom read an advanced treatise with more profit and pleasure.—P. H. S. K.

Pole and Tower Lines for Electric Power Transmission. By R. D. COOMBS. London: Hill Publishing Co. Price 10s. 6d. net.

The rapid growth of the use of electric power within the last few years has necessarily led to large extensions in the use of overhead transmission lines—noticeable even in this country, but more particularly so in America. In the future these extensions will become more marked, and for this reason we welcome the advent of a book of this character.

Only the mechanical and structural side of the problem is dealt with, purely electrical details being entirely omitted. This is well, since the mechanical strength and the stability of a transmission line are, of course, of overwhelming importance as regards continuity of supply.

Chapter I deals with types of construction, and is well illustrated with a number of photographic reproductions.

A good deal of practical information regarding the loads to be expected in transmission lines due to sleet and wind is next given. A distinction is rightly made between the effect of wind on cylindrical surfaces and on flat surfaces, but to the reviewer the figures given appear to be on the optimistic side.

Chapter III discusses wires and cables. A considerable number of formulae and tables are given, dealing with the stress due to temperature changes, &c., and the properties of materials respectively.

We next have a chapter dealing with the special parts of structural engineering which are involved in this subject. A large number of column formulae are given, together with curves plotted from them, although, as the author himself says, the principal load that a pole or tower must withstand is that which it takes as a cantilever. Useful advice regarding the use of poles on curves and at corners is given.

Wooden poles, ladders in timber, methods of preservation, and so forth are treated in a distinctly satisfactory manner in the succeeding chapter, while Chapter VI deals with steel poles and towers in a similar fashion.

Chapter VIII is devoted to the comparatively new subject of concrete poles. The author has evidently had considerable experience with this class of work, and the chapter is a decidedly valuable one. It is illustrated by a large number of photographs, some of which, however, could have been displaced by line drawings with advantage.

The remainder of the book is chiefly devoted to the erection and costs, and to the protection of transmission lines. The treatment is good and practical, but, of course, the costs being those of American practice are not of much use in this country.

On the whole, the book is a decided acquisition to technical literature. The chief fault the reviewer has to find is that the numerous photographic reproductions are on too small a scale, and, further, in some cases dimensioned drawings would have been of more use. The book is got up in a style to be expected from the publishers.—H. G. S.

AN INTERNATIONAL HIGH-PRESSURE SUBMARINE CABLE.

THE submarine cable, which has been in service since December last, connecting Sweden and Denmark across the Øresund, is a remarkable achievement of international nature and of a still greater extent of scope, in the fact that it is the longest high-tension cable without a reserve cable yet installed. The cable represents the fulfilment of an agreement by which the South Swedish Power Co., Malmö, undertook to furnish energy to the North Sea and Electricity and Transport Co., Hellerup, Copenhagen, from its power house at Lagan, about 30 miles north-east of Helsingborg. The power station, it may be remarked, also supplies energy to the Swedish town of Helsingborg. The Lagan, a Local Marine Station, is situated in the Lagan, a small inlet, about 10 miles north-east of Helsingborg. The possibility of securing power from Sweden has been under serious consideration for some years past, but the Danish Government had hitherto opposed the use of military grounds, which certainly did not seem at all trivial in view of the important role soon played by electricity in

any community when it is available. However, the agreement between the Swedish and Danish companies was completed early in 1914, and the Hellerup-Göteborg firm was given the contract for the submarine cable and the lengths of land cable connecting it to the transformer stations on each side of the crossing. The sea cable was laid in June 1914, but the outbreak of war delayed completion of the land lines till last autumn. Only about 350 k.w.s. at present transmitted from Sweden to Denmark, but as the sea land network extends the land will become much heavier.

The submarine cable itself is about 34 miles in length and was made in nine pieces, each about 650 yd. long, and 20 tons in gross weight (including the cable drum). Impregnated paper insulation is used between the three cores (each 70 sq. mm. in section), and profile-wire armouring is applied over the lead sheath. The cable operates normally at 35,000 volts, and was tested after manufacture to 87,500 volts. It is to be hoped that the margin of safety is sufficient, for if a fault should develop due to pressure surge or other cause, and the sheathing of the cable were pierced, the whole section concerned (if not the whole cable) would be ruined by ingress of sea water before the fault could be located and recovered.

Laying the cable and completing the joints satisfactorily was a far more serious problem than manufacturing the material. Greater precautions had to be taken than are necessary in laying and joining gutta-percha telegraph cables, and there was little or no previous experience from which to work. The difficulty of keeping the cable and the joints dry was magnified a hundredfold as compared with land conditions, and there was always the risk of damaging the cable mechanically, and hence electrically, by stresses due to its own weight or other cause. Special equipment and special precautions were required to provide against jamming of the paying-out gear, too sharp bending of the cable, injury by wave action, and so on. The joints were made according to usual land practice, the lead sleeve being enclosed in a strong guard-sleeve extended on to the armouring at both sides of the joint, so that the latter is moisture-proof and relieved of mechanical strain. The deepest joint lies in 125 ft. of water. After being laid, the whole cable was tested for half-an-hour under $1\frac{1}{2}$ times the working pressure.

The complete power scheme consists of a 50,000-volt transmission line from the Lagan R. power house to a transformer station at Helsingborg, where the pressure is reduced to 25,000 volts. Thence an underground cable (three miles in length) runs to a switch-house at Falsjö, north of Helsingborg, where connection is made to the submarine cable. The latter is brought ashore on the Danish side north of Marienlyst, whence about one mile of underground cable leads to a transformer station at Elsinore. About 200 yd. north of the power cable, there is laid a heavy, armoured four-core gutta-percha cable which serves the double function of telephone cable and guard cable, catching the anchors of vessels drifting in storm or current, and thus protecting the high-tension cable. South of the latter there are three telegraph cables.

No trouble has been reported during the six months this cable has now been in operation, and its future behaviour will be watched with interest, since there are many places in the world where submarine power transmission over a distance of a few miles will be much appreciated if it can be arranged reliably and at reasonable cost.

Similar submarine power transmission schemes, of less importance, between the mainland and islands in the Baltic, were described in our issue of July 11th, 1913, the methods employed for laying the cables being fully illustrated.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Female Sub-station Attendants.

IS it not time that putting women in charge of converter sub-stations is put a stop to? Surely this is the very job for disabled naval and army men, yet Glasgow has some sub-stations entirely in charge of females, and your contemporary who has an article on the subject goes on to state that these women are drawn from the educated business class of woman, which possibly means that they have already good homes and fathers earning good salaries. Your contemporary also mentions the rate of pay, viz. £21s. to 27s. per week; this possibly explains that what is wanted is cheap female labour, as the pre-war rate was, I believe, 40s. to 45s., which wage would be fairly good for a disabled soldier or sailor with a small pension; if educated business women must be given good berths in electricity works, would it not be much safer to train them for, and make them into, the chief engineers and managers of the same at $\frac{1}{10}$ th of what some of the present figure-heads get, and leave mechanics (male) to look after all running machinery. The money thus saved could be used to employ a good firm of (male) consulting engineers to look after the extensions and other interests on the technical side of the concern.

Commercial.

[Certainly the posts in question are admirably adapted for disabled soldiers and sailors; we have no doubt that the employment of women in sub-stations is only a temporary measure, and that every effort will be made to employ the former as far as possible.—EDS. ELSC. REV.]

Induction Motors on Circuits of Different Frequencies.

Not being acquainted with the designing of single-phase induction motors, but interested in their installation, I should very much like to hear what other readers of the REVIEW have to say with regard to the use of induction motors on circuits of slightly different periodicity to that which the machine is designed for. For instance, a 30-cycle machine on a 60-cycle circuit, or vice versa.

I frequently find motors in use under the above conditions, although I have always understood that it is bad practice, and presume the "power factor" and efficiency of the machine run under such conditions suffers, and also, to some extent, the output.

I should very much appreciate it if one of your correspondents would enlighten me on this subject which I happen to know is not quite clear to many others.

Practice.

July 12th, 1916.

Decimal Coinage.

With regard to the letter written by Mr. Alfred Bridges in the current issue of the ELECTRICAL REVIEW, if he is unable to obtain samples of the 1 and 2 centimes pieces I have some for disposal out of my collection, which I have much pleasure in offering. He may also be interested to know that the pieces I have were collected by me over 30 years ago in a country village near Armentières, namely, Au Bas Mesnil, where the charge for seats in the church was 2 centimes for front seats and 1 centime for the rear seats, and 30 years ago these coins were used in the town of Lille by children in purchasing sweetmeats.

G. Delebecque.

Walsall, July 15th 1916.

BUSINESS NOTES.

North-Eastern Manufacturers.—We have received a copy of a new and revised edition of the "Directory of Manufacturers, Wholesale Importers, and Exporters, of the North-Eastern Railway System." The Commercial Agent of the N.E. Railway Co., at York, has been induced to publish this third edition of the book by the unqualified successes of the earlier issues; also in view of the new trade conditions which will obtain after the war, causing a much heavier demand for British products. In the course of some 1,300 pages there are over 36,000 entries appearing under more than 1,200 trade headings, the entries being classified as to town and as to industry. There is a coloured map of the railway system showing the principal natural products of different districts, and particulars of normal Continental and Overseas sailings are given. As many as 15,000 copies of the "Directory" have been prepared for purely gratuitous distribution, and Consuls and Chambers of Commerce everywhere will be among the recipients.

Electrical Goods Wanted in Spain.—The Consul Général of France at Barcelona forwards to the Office National du Commerce Extérieur a list of the articles which were supplied by Germany before the war to the big stores which go by the name of "El Siglo," and which are probably the largest distributors in Spain. Among the articles enumerated are:—Instruments of precision for the arts and trades, steam and electric motors, pocket electric lamps, dry cells for electric lamps, electric and steam toy motor and railway accessories.

Australian Trade Inquiry.—Reuter reports that the Australian Commonwealth has decided to appoint a Commission, consisting of six manufacturers and six workers, to visit the United States and investigate and report upon American methods of manufacture and production, and upon conditions of employment. A scheme is proposed for the establishment of Government cable works for the manufacture of wire cables and metal ropes, rendering Australia independent of outside sources for these commodities.

Patent Applications.—Application has been made by F. J. Laverack & B. D. Potter, liquidators of the Eloesser Steel Driving Belt, Ltd., for the restoration of the following patents granted to Carl Eloesser:—

Nos. 18,169 and 18,170, of 1908, for "Improvements relating to endless metal driving bands."

No. 22,472, of 1907, for "Improvements in power transmission gearing."

German Enterprise in Morocco.—M. Lucciardi, the French Vice-Consul at Tetuan, states that German travellers have arrived in that town, and are offering German goods at extremely low prices. French travellers, the Vice-Consul says, would, therefore, do well to pay a visit there forthwith, or at least send in their price, particulars and catalogues. He is prepared himself to distribute these, but urges the need, in any case, for immediate action.

Italy.—An amalgamation has been arranged between the Società Elettrica Prealpina and the Società Bergamasca, the new company formed being styled the Società Elettrica Bergamasca, with a combined share capital increased from 4,450,000 lire to 6,800,000 lire.

Book Notices.—*The Coming Crash of Finance and Business.*

Mechanical Renaissance. By T. C. Elder. London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd. 2s. net.—The writer's object is to state forcefully the need for organising our increased engineering capacity in readiness for after the war, and taking proper steps at once to that end, without depending too much upon the Government. The consolidation of industrial forces through the United British Industries Association, in which a £1,000 individual subscription will ensure a continuous interest in the organisation, is favourably commented upon, and a proposed chart of departmental interests of a Ministry of Commerce is drawn up. For the rest, the book consists in the main of a reprint of the series of addresses delivered by the author before meetings organised in the provinces by the B.E.A.M.A. on "Engineering Industry and Public Policy," "What After Munitions?" "The Business Side of Science," "Engineering Industry in the Economic War," and "Engineering for the Empire."

Trade as a Science. By E. J. P. Benn. London: Jarrold & Sons. 2s. 6d. net.—We have read this book with an interest which has been sustained practically from cover to cover. We are not required to state that we are in agreement with everything that the author says, but in his efforts to raise the status of industry and trade, and to secure for them a larger measure of recognition in high circles, he certainly has our best wishes. As Mr. Benn remarks, the organisation of trade (in which, like many other people, he includes industry), is a subject worthy of the closest attention of every business man. He desires to see it organised, in order that it may have a corporate existence and a voice of real authority. He rightly dwells somewhat fully upon the possibilities of associated action, and in one of his chapters puts forward a tentative scheme for the organisation of a Ministry of Commerce, and a system of official trade associations. He wants to see trade and party politics divorced: would arrange and control the trading associations in Government co-operation, so as to prevent the evils attendant on trust systems; advocates co-operation between manufacturers in respect of production, avoiding the needless locking up of capital in unnecessary stocks; and shows that if the export trade is developed to its fullest extent, no man need fear the lack of a job or be content with low wages. We may not entirely concur in his opinions regarding the average British business man, and on some other matters, but the volume forms a timely contribution to the literature of a subject which is in most men's minds to-day, and will well repay reading. Indeed, we have no hesitation in strongly recommending it.

Fire Protection for Passenger Ships is the title of Red Book No. 203, which the British Fire Prevention Committee has issued for the use of ship owners, ship builders and their technical advisers when considering schemes for laying down new mercantile tonnage for post-war purposes. The subject is exhaustively discussed, and the installation of automatic fire-alarms, and ordinary fire-alarm systems, is recommended, amongst many other precautions. The publication is obtainable at the Committee's offices, price 3s. 6d.

"Mechanical Engineers' Handbook." Edited by L. S. Marks. Price 21s. net. "The Electrical Contractor." By L. W. Moxey, Junior. Price 6s. 3d. net. London: Hill Publishing Co., Ltd.

"U.S. Bureau of Standards." Scientific Paper, No. 277, "Photometric Comparison of Glass Screens and of Tungsten Lamps"; Scientific Paper, No. 280, "Volatilisation of Platinum"; Technological Paper, No. 58, "Strength and other Properties of Concretes."

Bankruptcy Proceedings.—R. E. CONNOLD, late electrician, Canterbury. The following are creditors:—

Bentley-Thomson-Houston Co., Ltd.	140	Henderson's Telegraph Works Co.	40
Countess,	12	"Bankers"	28
Buckle, Messrs.,	167	Spring, C.	21
Edison & Swan Elec. Light Co.	30	British Ever-Ready Co., ..	17
Elbridge & Montagu,	10	Reuben Bros.,	17
Gabb, Mrs.,	100	Millard Bros.,	15

F. Brown (partner in Hugh Bros. & Brown, Llanelly), electrician. —Receiving order made July 11th, at Carmarthen, on debtor's petition.

Liquidations.—PLUTTE, SCHEELE & CO., LTD.—Creditors must send particulars of debts, &c., to the controller, Mr. G. W. Roberts, 133, Wool Exchange, E.C., by September 30th.

OTTO BOHNDEL, trading as Schoen Bros., an enemy subject.—Final notice is given asking creditors to communicate with the controller, Mr. J. W. Barrett, 19A, Coleman Street, E.C., by August 15th.

ELECTRO-FLEX STEEL CO., LTD.—This company is winding-up voluntarily, with Mr. B. A. Fitzgerald, Collingwood Buildings, Newcastle-on-Tyne, as liquidator. A meeting of creditors is called for to-day (July 21st).

ASTER ENGINEERING CO. (1913), LTD.—A meeting is to be held at Wembley on August 25th to hear an account of the winding-up from the liquidator, Mr. S. D. Begbie.

Catalogues and Lists.—MESSRS. H. TINSLEY & CO., Eldon Park Works, South Norwood, London, S.E.—Twenty-four page catalogue, containing full particulars with illustrations and prices of Dr. Drysdale's combined inductance and capacity testing bridge, also instructions and diagrams relating to same.

MESSRS. DOWNES & DAVIES, 1 and 3, Stanley Street, Liverpool.—Handy reference table of carrying capacities for cables and fuses, which they are issuing to their customers.

Trade Announcements. **Messrs. Koutell, Bees, & Co., Ltd.** have been appointed sole agents for the S. S. & A. Electric Co., Ltd., for the sale of their products in the United Kingdom. The S. S. & A. Electric Co., Ltd., is a company incorporated in the United States of America, and has its principal office at 17, Cortlandt Street, New York City, U.S.A. The S. S. & A. Electric Co., Ltd., has a branch office in London, at 1, Victoria Street, E.C.

Australian Metal Manufacturing. The annual report of the Australasian Metal Manufacturers' Association for the year 1915-16, in association with the Australasian Metal Manufacturers' Association, has been published. The Australasian Metal Manufacturers' Association, Ltd., objects to any company manufacturing or supplying electrical machinery. The company has received assurances support from Commonwealth authorities justifying establishment industry. There is increasing demand for goods contemplated manufacturing hitherto imported. Capital of company is £25,000, of which £10,000 is paid up. This company's production is about 20,000 units.

Argentina. In the construction of the new electric power station, the first of a new construction and mechanical works, started in Buenos Ayres and Messrs. D. A. Vignola and A. Vignola have opened an electrical manufacturing works in the city of Entre Rios. The specialties of the former firm are the construction of dynamo motors into Diesel engines, and the construction of accumulators.

The Italian Trade Outlet.—The French Chamber of Commerce at Milan has begun a canvass of Italian buying firms with a view to ascertaining the kinds of goods which are likely to find a sale in Italy. Among the electrical requirements there is an opening, it is stated, for three-phase 15-kw. electric motors 2,000 volts, 50 per cent duty and 500 to 550 revolutions per minute. A list of the names and addresses of buyers has been compiled.

LIGHTING AND POWER NOTES.

Aberystwyth. **PRICE INCREASE.** The Electricity Co. has informed the T.C. that the price of current has been further advanced by 10 per cent.

Accrington. Through the reduced consumption of electricity for domestic purposes following upon the adoption of the Daylight Saving Act the electricity department has adopted a suggestion by the borough treasurer that very small accounts for the June quarter should be held over until the close of the next quarter.

Argentina. The Government has made a grant of 350,000 pesos, towards the total of 361,000 pesos, required for the illumination of the Capital on the occasion of the national festival, held for six days in July. Over 160,000 electric lamps were to be employed, and 240,000 kw.-hours of energy were to be consumed, at a cost of 25,000 pesos, for additional energy consumed in the ordinary service.

Barnes. **JOINT WORKING ARRANGEMENTS.** The Council has decided to allow the electrical engineer to represent it on the Joint Advisory (Engineers') Board, which the chief engineers of the municipal undertakings supplying electricity in the Western Metropolitan Police area decided, at a recent conference, should be formed as the first step towards concerted action regarding the future development of the undertakings in the area mentioned. An application from a neighbouring authority inquiring upon what terms the Council would be prepared to furnish it with a supply of current in bulk has been referred to the engineer for report.

Bradford.—At a meeting of the City Council, recently, the chairman of the Gas Committee made a statement in answer to a number of questions of which notice had been given by a member of the Corporation. It was admitted that since July, 1913, whilst 138 firms had introduced gas engines, 50 of these had ultimately changed over to electric motors. A few new gas-engine customers had given up electric motors in favour of gas. The gas department had made no effort to prevent a gas engine being replaced by electric drive when the latter had been obviously more suitable to the particular purpose; indeed, he added, the Gas Committee itself had recently installed 13 electric motors at its own new plant at Birkstall Park.

Burton-on-Trent.—At a recent meeting of the T.C., Councillor King was thanked for his report on the recent Municipal Electrical Convention, particularly as regards the portion referring to the uses of electricity for agricultural purposes, which Alderman Lowe considered would result in great advantages to the agricultural community in the not distant future.

Canada. It is stated that the Ontario Hydro-Electric Commission being unable to secure sufficient electricity under its contract from Niagara sources, the Ontario Government has asked the Dominion Government to prohibit the export of power to the United States where it is at present used by many American industries.

Carlisle. **YEAR'S WORKING.**—The annual report on the city electric supply undertaking shows a total revenue of £25,109 and gross profit amounting to £9,725 (as compared with £8,341 in 1914-15), while after meeting financial charges the net surplus amounted to £174 (as against £76 in 1914-15). During the year 3,273,992 units were sold, an increase of 502,547 units on 1914-15; power and lighting units alone totalled over 3,000,000, and the increased output was mainly confined to this section. Mr. Purse, the electrical engineer, points out that 154 power consumers averaged a revenue per h.p. of £9.15, giving a total of, roughly, £16,000 revenue, while 711 lighting consumers, with an average revenue per h.p. of £3.65, produced only about £8,000 total revenue, despite the fact that the power consumers paid only a little over 1d. per unit, while the lighting consumers paid about 3½d. per unit. An increased coal cost during the year of £1,332 was entirely due to increased prices, as actually 100 tons less was consumed than in the previous year. The various increased costs and special charges amounted to £3,600 for the year.

Caterham. **REVISED PRICES.** The Committee appointed by the Urban Council to deal with the proposed increased charges for the supply of electricity by the Urban Electric Supply Co. reported that the rate now proposed is a flat rate of 7d. per unit as a maximum charge. The company is prepared to agree if the Council withdraws its opposition to the proposed alteration, the rate of charge for electricity during the war, and for six months after, shall not be raised by more than 15 per cent. That thereafter the charge shall not exceed 6d. per unit unless with the written consent of the Council, provided that if the company considers the Council is unreasonable in refusing consent under the then existing conditions, the matter be referred to an arbitrator appointed by the B. of T. The Committee recommended the Council to adopt the proposals, which it has decided to do.

Eastbourne.—**YEAR'S WORKING.** The report of Mr. Brydges, the borough electrical engineer, on the last year's operation of the electricity department, shows that the output sold declined from 1,816,667 units in 1914-15 to 1,773,737 units in 1915-16. Power, heating and cooking units, however, showed a satisfactory increase. The gross income decreased by £2,907; expenditure increased, and the final result, after meeting capital charges, was a deficit of £911, as against a net profit of £2,208 in 1914-15. A 1,250-kw. Ljungström turbine set was put into service in June, 1915, and has apparently improved the efficiency of the plant generally; a 750-kw. turbine set has been run, partially stripped, owing to the difficulty of getting it repaired, with a decreased steam efficiency of about 10 per cent.

We note that the 12-ton steam motor wagon used by the department for carrying coal from the railway to the works, has carried 1,411 tons and run 2,921 miles, at an all-in cost per ton delivered of 11 5½d.; it is interesting to compare this with the cost of operating the 1-ton electric coal wagon used by the Board electricity department for an exactly similar purpose, viz., 9½d. per ton carried. This latter wagon in 65 days ran 793 miles, and carried 2,812 tons, showing, if the conditions are comparable, a considerable saving over steam-wagon haulage, besides advertising the electric vehicle.

Eton. **PUBLIC LIGHTING.**—The U.D.C. has accepted an offer from the Windsor Electrical Installation Co. reducing the charge of £231 for public lighting by £64 until normal lighting conditions are resumed.

Halifax.—The inauguration of new turbo-electric plant installed at the works of the Ripponden Commercial Co. took place last week. The new plant supersedes a beam-engine drive, and was supplied by the Brush Co., at a total cost of £11,000.

Harrowgate.—It is stated that the output of the electricity works for June showed a considerable increase over the same month last year, despite the lighting restrictions, and that the development of electric heating and cooking may account for this.

Heywood. **BULK SUPPLY.**—At a meeting of the T.C. on July 12th, Councillor J. Ashworth, speaking on the electricity report, said that last year they purchased from Bury nearly half the total units supplied, and now they were taking the whole of their supply from them. Owing to the war Bury had not been able to obtain delivery of new boiler and other plant, and consequently had not been able to meet all the demands, and the Heywood Corporation was unable to fully supply its new customers. The bulk supply scheme was fulfilling all that was said in its favour, and its adoption had lifted the electricity department out of a rut, which at one time seemed to be impossible save at an enormous capital expenditure.

Holmfirth. **PLANT INAUGURATION.**—The Council's new electricity works were opened on Saturday afternoon last; the installation was carried out by Messrs. Broadbent, under the supervision of Mr. A. B. Mountain. The gas lamps for public lighting have been disconnected, and are being removed, as public electric lighting is being adopted.

Hull.—**YEAR'S WORKING.**—The report of Mr. J. F. Magor, acting city electrical engineer, on the year's working of the electricity undertaking to March last, shows that 14,795,426 units were sold, against 12,969,776 in the preceding year, and the revenue (£89,208) increased by £6,908. Due to restrictions, lighting revenue fell off very considerably—average per kw. connected, 1913-14, £5.13; average per kw. connected, 1915-16, £3.79—but this was more than compensated for by the increased revenue from power—viz., £9,517, as compared with 1914-15. Total working expenses, inclusive of special charges, amounted to £47,178, leaving a gross balance of £42,030, and after meeting

interest and sinking fund, and special charges, war allowances, &c., the net surplus remaining was £1,217, which was carried to reserve. Despite the increased coal costs, the average works cost (64d. per unit) and total costs (79d. per unit) are the lowest yet recorded in the case of this undertaking. The maximum load was 7,810 kW., with 4,888 consumers, and a connected load of 28,790 kW., of which 20,470 kW. represented power, and took 12,834,145 units of the total, producing nearly £53,000 revenue. The Committee, which, we regret to say, has lost the services of its chairman for the past ten years, Ald. Hanger, has contributed nearly £50,000 in the past from reserve towards the cost of capital work, and now has a reserve in hand amounting to £20,500, or over 7 per cent. on the outstanding loan debt, £285,858. We may add that Councillor Pybus has been elected chairman of the Electricity Committee.

King's Lynn.—**YEAR'S WORKING.**—At a meeting of the T.C. last week, the Electricity Committee presented a statement showing that during the twelve months ended March 31st last, the income of the undertaking was £8,068, as against £7,992 in 1914-15. The expenditure was £7,049, and the profit £1,018, against £1,350. The Committee resolved that the surplus be applied in reduction of capital. It was also recommended that the charge for current supplied for lighting be increased 3d. per unit, and that an extra 3d. per unit be charged for power, in place of the last increase of 10 per cent. The report was adopted without discussion.

London. **HAMSTEAD.**—**YEAR'S WORKING.** The annual report of the chief engineer, Mr. Wyld, shows that, as anticipated, the working of the electricity undertaking during 1915-16 resulted in a loss—viz., £6,700—as against a net profit of £2,767 in the preceding year. The net income was £67,518, showing a decrease of £2,206 on 1914-15, despite an increase in price during the year. The total expenditure, including interest and sinking fund, amounted to £74,228, an increase of £7,271 on 1914-15; fuel alone cost more than £5,000 extra, averaging 79d. per unit, as against 48d. The total output sold amounted to 5,069,397 units, as against 5,550,000 units in 1914-15; the maximum load was 3,128 kW. Modern mechanical-remote controlled R.T. switchgear is being installed by the B.T.H. Co. to replace the old Ferranti board at the generating station. A total of 275 motors, of 1,468 H.P., are connected to the supply, as also 428 hired heaters, cookers, and similar apparatus.

ISLINGTON.—**YEAR'S WORKING.** The annual accounts of the Council's electricity undertaking show a net profit for 1915-16 of £2,117, as compared with £2,807 in the previous year. The total revenue amounted to £69,660, and the gross profit to £30,609, or slightly more than in 1914-15. The output sold reached 8,552,729 units, as compared with 7,831,593 units in 1914-15, and included 4,640,000 units for day lighting and power, an increase of a million units on the previous year. The maximum load was 4,989 kW., and the load factor 19.57.

Oldham.—**YEAR'S WORKING.**—The joint engineers and managers of the Corporation electricity undertaking, in their report, show that the total income for the year amounted to £63,920; the gross profit was £26,698, and the net profit, after meeting financial charges and expenditure on meters, amounted to £5,107, as compared with £3,550 in the previous year. This result is traceable to the supply for power purposes of 5,385,229 units, as against 2,779,150 units in the previous year, giving an increased revenue on this account of £9,280, other branches of supply having declined in amount. The total output sold amounted to 10,487,235 units, as against 7,985,859 in the previous year. During the year consumers' sub-stations have been erected at five factories: a 3,000-KW. turbo-alternator, three boilers and accessory plant were commissioned, and a further two boilers are being obtained. One 3,000-KW. turbine set on order was released on the appeal of the authorities for its employment elsewhere. The plant capacity of the Greenhill works was 10,140 kW., the maximum load was 5,260 kW., and the load factor 22.7 per cent. The works, &c., and management costs advanced slightly from '812d. to '852d. per unit.

Radcliffe.—**PRICE INCREASE.**—Advances of 5 per cent. in the price of electricity for lighting, and 10 per cent. for power and heating, are about to be made.

Southend-on-Sea.—The "Economy" Committee has asked the Finance and Light Railways Committee to arrange for the more economical control of the accounts of the light railway and electric supply department.

South Africa.—A meeting of electricians and fitters in municipal employment has been held at Johannesburg, at which a resolution was passed demanding an increase of 15s. per week in wages.

The Cape Town Corporation electricity department is experiencing great difficulty in coping with the demand for energy, and it is proposed to install additional plant. There has recently been a greatly increased load owing to the use of radiators and cooking apparatus, the rate for which has been reduced to 1½d. per unit, as against 7d. per unit for lighting. The increase has been so great that the department is requiring all consumers to forward particulars of all lamps and other current-consuming apparatus connected to the supply mains. In many districts applications for the installation of radiators have been refused until the new plant is running, which will, of course, be too late for the present winter's radiator demand.

Tasmania.—A Launceston syndicate has offered to construct a railway along the Tamar to the cement and steel works, and to provide an electric transmission line from the Great Lake supply, at a cost of £500,000.

Taunton.—**PRICE INCREASE, &c.**—The statement of accounts for the year ended March 31st last, shows a gross profit of £5,955 on the Council's electrical undertaking.

Owing to the reduced demand for electricity for lighting due to the lighting restrictions and the Summer Time Act, it was decided to increase the charges from Midsummer by a further 10 per cent., thus making altogether an advance of 25 per cent. on the scale charges for lighting and power.

Teddington.—**PRICE INCREASE.**—The District Council has been notified by the Twickenham and Teddington Electric Supply Co. that the charges for electricity for all purposes will be further advanced by 10 per cent., making 20 per cent. in all, to take effect from the June quarter.

Uckfield.—The D.C. has been notified that the B. of T. has extended the time for the completion of the electricity works of the Crowborough District Gas Co. for 12 months from July 4th, 1916.

Welsh Water Powers. In the House of Commons, in reply to a question as to whether steps had been taken with a view to utilising Welsh water-power to produce electrical energy for agriculture and other industries, Mr. Harcourt said he was not aware of any inquiry into the matter.

Whitehaven.—The Harbour Commissioners have asked the T.C. to quote terms for installing the electric light at the West Pier lighthouse.

Winchester.—**YEAR'S WORKING.** The past year's working of the electricity department showed a gross profit of £5,826, and after meeting interest repayment and other charges, there was a net surplus of £575, as against £1,317 in the previous year.

TRAMWAY and RAILWAY NOTES.

Bolton.—**ELECTRIC VEHICLE.**—The Electricity Committee has deferred consideration of a proposal to purchase an electrically propelled vehicle for the use of the department.

Colchester.—The T.C. has decided to increase the price of current for the tramways by ½d. per unit.

Continental.—**ITALY.**—Plans are being prepared in connection with a proposed electric tramway to connect the town of Osimo with the Osimo-Ancona railway station.

Heywood.—**TRACK MAINTENANCE.**—The Electricity and Tramways Committee has requested the Surveyor's Committee to undertake the ordinary maintenance of the tramway track for a further period of 12 months, ending March 31st, 1917, for the sum of £750.

YEAR'S WORKING.—The annual report of the tramway undertaking shows a total income of £11,985, compared with £11,626 in 1915; a total expenditure of £8,188, compared with £7,944; and a gross profit of £3,796, compared with £3,681. The car-miles numbered 263,553, and passengers carried, 2,366,551. The sum for interest and sinking fund charges, including £1,165 for the award to the Bury, Oldham, and Rochdale Tramway Co. was £4,314, and there was a net loss of £518.

Hindley.—The Wigan Corporation has informed the U.D.C. that, owing to Government restrictions, it had been compelled to postpone further consideration of the Market Street tramways matter for a short time.

Huddersfield.—**DEFERRED EXTENSIONS.**—The tramway extension to Brighouse to link up with the Bradford system has again been postponed, this time to the end of the war.

London.—**YEAR'S WORKING OF L.C.C. TRAMWAYS.**—The annual accounts of the Council's tramways for the year ended March 31st last shows total receipts amounting to £2,339,291 and working expenses (including war service allowances) of £1,683,660, leaving a gross surplus of £655,631. Interest, sinking fund, and other charges amounted to £729,426, showing a deficit of £73,795 on the year's working. This figure compares with the original estimated deficiency of £91,614 and a subsequently revised estimate of £61,190. No payment has been made to the renewals fund during the year, but £73,255 has been spent out of it, leaving a balance in the fund of £329,968. The deficiency for the year has been met out of the general reserve fund, leaving a balance in hand of £70,118. In order to meet the expenditure on renewals and the transfer from general reserve, it was necessary to realise certain securities at a loss of £11,532 and £23,621 respectively on cost price.

During the year, 545,423,397 passengers were carried and 47,879,675 car-miles run, these figures comparing with 550,497,993 passengers and 58,978,792 car-miles in 1914-15. The capital ex-

proceedings at March 14, 1916, amounted to \$18,160.77, and the debt outstanding has since that time been reduced to \$1,000.00. Capital expenditure on the system has been estimated to be provided for amounts to \$1,000,000. The report also states the project is made to reconstruct the system with tramway power station, by which its capacity will be increased from 34,000 kW. to 52,000 kW. The tramway system is linked up with another source of supply to provide against breakdown, and inquiries are now being made with a view to interconnection for reciprocal supplies of power: 150 trailer-cars have been ordered, and 120 of them are in use. The route length of electrified tramway amounts to 141½ miles; two horse tramway routes, on which electrical reconstruction has been stopped by the war, are not now being worked. Through services are in operation with the Metropolitan Electric Tramways and the Leyton and Bexley Councils' systems; various through booking arrangements are in operation also. There are 1,150 women conductors employed on the cars.

Local Finance Estimates. For the year 1916-17 it is estimated that there will be a gross surplus of £674,165, while debt charges and taxes will amount to £748,557, leaving a deficiency of £74,392, which will be met in the first instance from the general reserve fund. The estimates contain provision for £20,000 contingencies and £122,500 for war service allowances, but it is considered probable that this latter sum will be insufficient. But for these special charges the working would show an estimated surplus of £68,108. No addition is contemplated to the renewals fund, while it is estimated that £96,300 will be expended from it. The balance of the general reserve fund, after meeting the estimated deficit, is estimated at £66,798, and it is considered probable that this will be more than absorbed, particularly as the value of investments has been taken at cost price.

Sheffield. **YEAR'S WORKING.** The annual report on the working of the Corporation tramways and buses during 1915-16, shows a total tramway revenue of £456,609 (car receipts being £58,000 in excess of the previous year), and gross profits amounting to £173,460, after allowing for £11,209 war allowances. Deducting interest and sinking fund charges, income-tax, &c., the surplus balance remaining was £95,789, an increase of £25,841 on 1914-15. From the surplus £41,856 was allocated to rate relief, over £30,000 to renewals, and the balance for various purposes, including a special grant (£5,000) to the Sheffield University. During the year 123,429,410 passengers were carried, as against 107,023,195 in the previous year, the average traffic revenue amounting to 12½d. per car-mile, as against 10½d. The car-miles at 8,867,726 represent a decrease of 57,000 miles, as compared with 1914-15. The route mileage of the tramways amounted to about 10½. The electricity department has taken over the Kelham Island Tramway power station and cables, and, pending its regular transfer, is responsible for debt charges, &c., on the capital expended. The tramways now employ 706 women conductors, depot workers, &c. The department also operates motor-buses on 10 routes, having a total length of 30 miles, some of which extend beyond the city boundary. These vehicles run 540,628 miles, earning 1s. per mile, or a total income of £27,565; the net balance, after providing for debt charges, depreciation, taxes, &c., was £38,166.

Talycafn. The Aluminium Corporation, whose works are situated between Talycafn and Trefriw (North Wales) is making application to Parliament for powers to construct a railway from the works to join the London and North-Western Railway at a point in the parish of Maenan, where it is proposed to provide a goods and passenger station.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. August 16th. P.M.G. Distilling apparatus (Schedule 302), telegraph and measuring instruments (Schedule 198). See "Official Notices" June 16th.

SYDNEY.—August 17th. Portable internal-combustion engine and dynamo (2½ kW.) for the Departmental Stores, Sydney, for P.M.G.*

August 24th. P.M.G. Automatic switchboard and apparatus for North Sydney Exchange. Schedule No. 511.*

Basingstoke.—July 28th. Wiring the Conservative Club for electric light. Mr. A. E. Grant, Secretary.

London.—L.C.C. The Highways Committee recommends that tenders be invited for steam, exhaust, &c. piping, in connection with the third additional turbo-generator at the Greenwich generating station, and that the chairman and vice-chairman of the Committee be severally authorised during the summer recess to open any tenders received for the work.

July 26th. H.M. Office of Works. Batten holders, ceiling roses, switches, plugs, and cut-outs. See "Official Notices" to-day.

New Zealand. **INVERCARGILL.**—September 28th. Borough Council. Steam turbo-alternator, condensing plant, and switchgear. Specifications from the Tramway Office. Contract No. 10.*

Walthamstow. July 26th. Council. 500-KW. rotary or motor converter: L.H.P. switchgear; L.T. switchgear. See "Official Notices" July 14th.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Ashton-under-Lyne.—Electricity Committee:—

T. King. 75 tons of coal per week for three months.
Kelsall Bros.—60 tons of coal per week for six months.
J. Rawlings.—30 tons of coal per week for six months.

Barnsley.—Electricity and Lighting Committee:—

Thomas Lindley. Reinforced concrete flooring and concrete foundation for engines at electricity works, £543.

London. **L.C.C.** The Highways Committee purchased 43,835 tons of coal for use at the Greenwich generating station, at a cost of about £70,000, during the quarter ended June 30th last. The Committee has accepted the tender of Messrs. Pinchin, Johnson & Co. for insulating varnishes. The Stores and Contracts Committee accepted the tender of the British Westinghouse Electric & Mfg. Co. for the supply of electric traction glow-lamps for the Tramways Department, for the three months ended June 30th.

Southend-on-Sea.—Lighting Committee. Recommended tenders:—

Venner's Time Switches, Ltd.—200 current limiters.
Callender's Cable & Construction Co., Ltd.—Various cables (six months).
B.I. & Helsby Cables, Ltd.—100 pairs cut-outs for sectional boxes.

Stoppage of Building and Engineering Works.—The following important notification has been issued by the Ministry of Munitions:—

"In pursuance of the powers conferred on him by Regulation 8E of the Defence of the Realm (Consolidation) Regulations, 1914, the Minister of Munitions hereby orders as follows:—

"On and after the twentieth day of July, 1916, no person shall without licence from the Minister of Munitions commence or carry on any building or construction work, that is to say, the construction, alteration, repair, decoration, or demolition of buildings, or the construction, reconstruction, or alteration of railroads, docks, harbours, canals, embankments, bridges, tunnels, piers, or others works of construction or engineering. Provided that where the total cost of the whole completed work in contemplation does not exceed the sum of £500 and the use of constructional steel is not involved, the licence of the Minister of Munitions shall not be required."

The notice does not relate to Government contracts, or to already-authorised municipal contracts.

All persons desirous of obtaining a licence should apply in writing to the General Secretary, Ministry of Munitions, 6, Whitehall Gardens, S.W., giving full particulars of the description and locality of the work, the purpose for which it is intended, and its estimated cost, and such further information as the Minister may require.

TELEGRAPH and TELEPHONE NOTES.

Automatic Telephones.—The automatic telephone exchange which has been installed at Paisley was to be put in operation on Monday last. The installation at present takes 4,200 lines, but its ultimate capacity is 2,500. The plant has been manufactured and installed by the Automatic Telephone Co., of Liverpool.

Rhodesia.—At the end of 1914 there were 5,300 km. of telegraph line under the control of the Administration, and 12,554 km. of wire, the total number of offices being 108; over a million messages were handled during the year. The receipts for the year were 971,382.15 fr.—*Journal Télégraphique.*

South Africa.—At the end of 1914 the telegraph system of the Union included 24,182 km. of line and 81,066 km. of wire, as well as 10,054 km. of wire used also for telephonic communication. The number of telegraph offices was 1,602. Telegrams handled during the year amounted to 6,383,564, and the revenue was 8,918,500 fr. The telephone system comprised 6,872 km. of line and 137,644 km. of wire in use, with 29,400 telephones connected; 57,400,000 messages were dealt with. The receipts amounted to 6,968,250 fr. The expenses of the telegraph and telephone systems are not separated from those of the postal service.—*Journal Télégraphique.*

Telegrams by Telephone.—The Post Office is calling attention to the facilities offered for the delivery of telegrams by telephone. It is pointed out that there is a scarcity of boys for messenger duties, and the prompt delivery of telegrams is difficult.

Telegraph Rates.—Telegrams may now be sent to Greenland by cable for 1s. 2 d. word and by Marconi at 1d., also to the Caroline Islands for 3s. 11d.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

B.T.H. Ironclad Switch Fuses.

We illustrate in fig. 1 one of a range of totally enclosed ironclad switch fuses, which have been put on the market by the British Thomson-Houston Co., Ltd., Rugby, for circuits up to 700 volts, in 20-ampere and 60-ampere sizes. The fuse clips and terminals

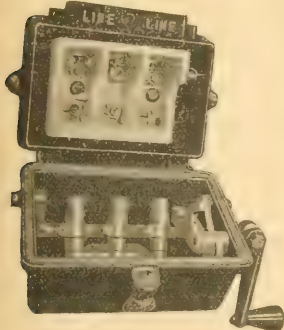


FIG. 1. 20-AMPERE TRIPLE-POLAR SWITCH FUSE, OPEN.

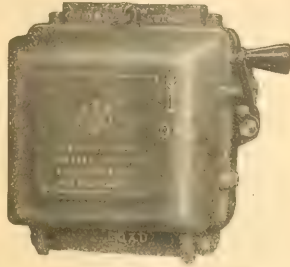


FIG. 2. 60-AMPERE SWITCH FUSE, CLOSED.

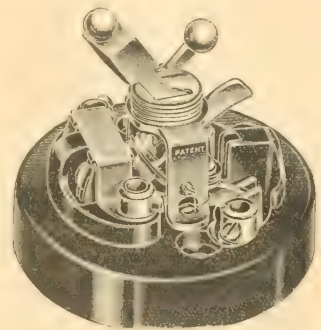


FIG. 3. TWINOB MOTOR CONTROL SWITCH.

are mounted on porcelain bases, with insulating barriers to prevent arcing across or to the case; the movable parts are carried by the hinged cover, and all parts are accessible when the case is open. Quick make and break and interlocking arrangements are provided; the hinges are machined, and a tight joint is made between case and cover. Adapters for screwed conduit and glands for back of panel connection can be provided.

"Arora" Cooking Apparatus.

THE ARORA CO., of Loughborough, is placing on the market a new electric grill, designed to meet the pressing need for rapid grilling and toasting; as shown in fig. 3, it is made of cast-iron, with an aluminium finish. The heating elements are formed of an extra heavy section of wire, and are mounted on the underside of strong fireclay bars; thus the heat is thrown downwards, and, owing to the high radiation of the elements and the fireclay, the grill is ready for use directly the current is switched on. The power consumption is about 1,100 watts, and the operation of grilling takes from five to ten minutes, according to the thickness of the steak or chop. The electrical part of the grill can be lifted off, so that the rest of the device can be thoroughly washed without risk of damaging the elements; the detachable part can also be used separately as a "salamander."

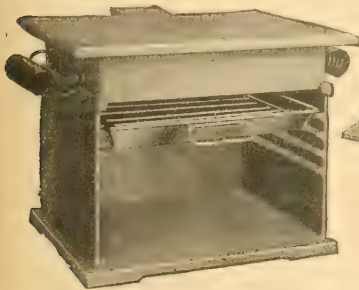


FIG. 3. "ARORA" GRILL.

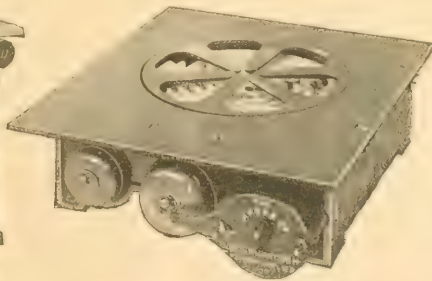


FIG. 4. ARORA BOILING PLATE.

Another new device, is a three-section electric boiling plate, for rapid boiling, shown in fig. 4. This has a cast-iron frame, so designed that it will not crack with the heat, which supports a heavy fireclay disk retainer; three sector-shaped heating elements are supported on the disk, each being held in place by two wing nuts, so that any sector can be replaced without interfering with the others. The full-load consumption is 1,500 watts; by means of two switches, one-third and two-thirds of the full heat can also be obtained, and the interlocking slide seen at the front adds a further control, giving one-ninth of the full heat, which is useful for simmering purposes. Heavy flexible cable armoured for 18 in. is provided, as well as an earthing wire. The cooking surface measures 14 in. x 12 in., and the grid has an opening 8 in. in diameter.

An electric fire, with three bars, has been added to the list of sizes available, as well as a neat cast-iron hearth stand.

"Twinob" Switch Motor Controls.

The Lundberg "Twinob" tumbler switch has been slightly modified, as shown in fig. 5, to ensure that one arm shall be put on before the other, and that both shall be put off together. The illustration shows one arm on and the other off; this being the starting position of the switch. The arm which is "on" has an open box at its extremity, which encloses the knob of the other lever when both are on or off. The switch, of course, is provided with a cover.

The switch can be used for the control of shunt or

series motors. In the simplest connection for a shunt motor, and without a resistance, the box lever completes the field circuit, and the ordinary lever the armature circuit. Fig. 6 shows the connections for a shunt motor with a starting resistance R . The lever which goes on first is marked K , this putting the supply straight on to the field, and through K to the armature. The second lever bridges R . The same arrangement of resistance may be used for a series motor. The switch is made in 10- and 5-ampere sizes, and can be fitted with ordinary or Admiralty pattern terminals. The makers are MESSRS. A. P. LUNDBERG & SONS, of 477-489, Liverpool Road, London, N.

NOTES.

Commerce and Industry after the War: A General Committee.—We already have a number of Board of Trade Committees investigating the steps that are to be taken for the assistance of particular trades after the war. We have also had the

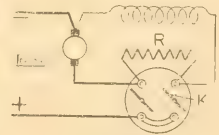


FIG. 6.
DIAGRAM OF CONNECTIONS
OF MOTOR CONTROL.

Economic Conference of the Allies and its important conclusions. It is now announced that the Prime Minister has appointed a Committee to consider the commercial and industrial policy to be adopted after the war, with special reference to the conclusions reached at the Economic Conference of the Allies, and to the following questions:—

(a) What industries are essential to the future safety of the nation; and what steps should be taken to maintain or establish them?

(b) What steps should be taken to recover home and foreign trade lost during the war, and to secure new markets?

(c) To what extent, and by what means, the resources of the Empire should, and can, be developed?

(d) To what extent, and by what means, the sources of supply within the Empire can be prevented from falling under foreign control?

The Committee is composed as follows:

The Right Hon. Lord Balfour of Burleigh, K.T., G.C.M.G. (chairman).

Mr. Arthur Balfour.
Mr. H. Gosling.
Mr. W. A. S. Hewins, M.P.
Mr. A. H. Illingworth, M.P.
Sir J. F. Maclay, Bt.

Sir A. Mond, Bt., M.P.
Mr. Arthur Pease.
Mr. R. E. Prochbert, M.P.
Sir Frederick H. Smith, Bt.
Mr. G. J. Wandle, M.P.

Together with the following gentlemen, who are presiding over Boards or other Committees on the position of important industries affected by war.

Sir H. Burchenough, K.C.M.G. Sir C. A. Parsons, K.C.B., F.R.S.
Lord Faringdon. Lord Rhondda.
Sir G. Hyde. Mr. G. Scott-Smith.

Mr. Percy Ashley, of the Board of Trade, and Mr. G. C. A. Peppitt, of the Treasury, have been appointed secretaries to the Committee.

Women in Sub-Stations.—The accompanying illustration shows a female substation attendant at work in the Dudley sub-station of the Shropshire, Worcestershire and Staffordshire Electric Power Co. Several women are employed on this work by the company. For some time past the Glasgow Corporation electricity department has employed women on similar duties, and it is understood that in both places they have proved very satisfactory



operators. They have been trained also as switchboard attendants for generating stations.

A correspondent in this issue points out that such work is admirably adapted for disabled soldiers and sailors; we believe that up to the present the latter have had no difficulty in obtaining employment, but we cannot hope that this happy condition will be maintained for long, and as we stated in our last issue under "War Items," p. 40, a Committee of the Institution of Electrical Engineers has made arrangements for training them to undertake such duties. We have no doubt that disabled fighting men will be employed in preference to women whenever they are available.

Our Contemporaries "Caught Napping."—An amusing paragraph appears in the *Electrical Times* of yesterday, in which our contemporary says: "We may as well own up to it first as last, they [the Council of the I.E.E.] have caught us napping. Neither is it a legitimate excuse that they caught our contemporaries napping also. They made a highly interesting announcement in the *Journal*, and for a whole week two of the electrical editors even saw it." The reference is to the recommendations recently submitted to the Electrical Trades Committee of the Board of Trade on behalf of the Council by the President, Mr. C. P. Sparks. So far from being "caught napping," we saw the announcement in the *Journal*, and in our issue of July 7th we published the whole of the recommendations, and congratulated the Council upon the new spirit by which it was animated (*ELEC. REV.*, July 7th, p. 17). In the following issue we made the recommendations the subject of our leading article, and commented upon the fact that none of our contemporaries had referred to them at all. But what was more remarkable was that, even then, the only one of our contemporaries which awoke to their publication was *Electrical Industries*, and we have reason to believe that we were instrumental in directing its attention to the matter.

Now, after we have twice covered the ground, the *Electrical Times* brazenly alleges that the Council "caught our contemporaries napping."

Educational. In the House of Commons on Tuesday last, Mr. A. Henderson stated that he had been decided to appoint three committees, to inquire respectively into the education of young persons after the war, and the position of science and modern languages in our educational system. In the course of the debate which followed, the general desire for educational reform was manifest.

Volunteer Notes.—1ST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place. Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Saturday, July 22nd. Instructional Class, 2.30, Company Commander Fleming.

Monday, July 24th. Technical for Platoon No. 9, 16, Regency Street, S.W. Squad and Platoon Drill, Platoon No. 10. Signalling Class and Recruits.

Tuesday, July 25th.—Officers' Instructional Class, 6-7. Recruits, 7-8. Lecture, 7.15. Lantern Lecture by Mr. W. Aitken: "Telephones."

Wednesday, July 26th.—Platoon Drill for No. 2 Platoon.

Thursday, July 27th. Platoon Drill, No. 6 Platoon. Recruits, 5.15-7.45. Instructional Class, 5.45.

Friday, July 28th.—Technical for No. 10 Platoon, 46, Regency Street, S.W. Squad and Platoon Drill, No. 9 Platoon.

Saturday, July 29th. Parade Headquarters, 2.15, for Company Drill. Uniform.

Sunday, July 30th.—Entrenching duties. Parade, Victoria (S.E. and C. Railway Booking Office), 8.40 a.m.

MACLEOD YEASTLEY, Adjutant.

July 17th, 1916.

London Electricians' Wages Advanced.—Electricians in the London district have been awarded an advance of 1/4 per hour by the Committee on Production. *Times*.

Appointments Vacant.—Senior shift engineer for Birmingham electricity department (£130). See our advertisement pages to-day.

Memorial to Prof. Thompson.—As we go to press, we have received the following letter:—

"Suggestions have been made in several quarters that a memorial to the late Prof. Silvanus P. Thompson should be established. I have to inform you that the Finsbury Technical College Old Students' Association have taken the matter up, and are now engaged on the formulation of a scheme to enable all those interested to perpetuate the memory of the deceased in a suitable manner.

"JOHN E. RAWORTH.

"President, the Finsbury Technical College
"Old Students' Association."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the *ELECTRICAL REVIEW* posted as to their movements.

Central Station and Tramway Officials.—Mr. C. W. SHEPHERD, late general manager of the Edinburgh & District Tramways Co., Ltd., who has recently been acting as secretary, has, owing to ill-health, resigned his position with the company. Mr. J. WISEMAN, who has been with the company for over 30 years, has been appointed to succeed him.

General.—Mr. HEATHMAN, of Parson's Green, Fulham, wishes his correspondents to kindly take notice that there is not a second "N" to his name, as he is not a German. His antecedents for the past 300 years were Devonshire folk.

London Gazette notice.—Territorial Force. *London Electrical Engineers*: Sergeant C. L. PALMER, from R.E., to be Second-Lieutenant (on probation).

At the University Court of Edinburgh last week, Sir J. A. EWING, Director of Naval Education, who was recently elected principal, was installed as head of the University Court.

Mr. H. V. HENNIKER, engaged at Edinburgh with Messrs. Bruce Peebles & Co., Ltd., was married at Ramsgate, on July 11th, to Miss K. Riches. The presents included a canteen of cutlery from the staff of Messrs. Bruce Peebles & Co., Ltd.

Roll of Honour.—Captain DAVID D. HORNE, who has fallen in action in France at the age of 40, was the representative at Newcastle-on-Tyne of Messrs. Crompton & Co., Ltd.

Captain GEORGE CLIFFORD WHITAKER, the youngest son of Mr. Matthew Whitaker, railway contractor, who is reported as killed in action whilst serving with the Leeds "Pals" Battalion, was, on his next leave, to have married Miss Mary Hamilton, youngest daughter of Mr. J. B. Hamilton, the general manager of the Leeds Corporation tramways.

Corporal WALTER HUTCHINSON, of the Bradford "Pals," who has been wounded, was an assistant engineer at the Batley Corporation electricity works prior to joining the Army. Lance-Corporal JACK RAE, of the King's Own Yorkshire Light Infantry, who is severely wounded, was an apprentice to electrical engineering with Mr. Fisher, of Doncaster.

Private WILLIAM RUSSELL, of the West Yorks. Regiment, who is wounded and in a Bristol hospital, was formerly employed at the Bradford electricity works.

Second-Lieutenant JACK M. CLARKE, Royal Irish Rifles, wounded, is a son of Canon Clarke, Killead, Ireland, and is an electrical engineer.

Signaller VINCENT CURE, of the Bradford "Pals," who has died of wounds, was an employé at the Bradford telephone headquarters.

Lance-Corporal WILLIAM GIBSON, of the Lonsdale Battalion, Border Regiment, who was killed in action on July 1st, was, before the war, an electrician in the employ of the Windermere & District Electricity Supply Co., Ltd.

Amongst those wounded in the fighting in France is Lieutenant R. E. BULLOUGH, of the South Midland Royal Engineers, son of Mr. R. C. Bullough, manager of the Colchester tramways.

Lance-Corporal WILFRED WATERMAN, of the Essex Regiment, who has fallen in action during the advance in France, was, before the war, engaged at the Chelmsford works of the Marconi Co.

Private FRED F. SMITH, of the East Yorkshire Regiment, who is in hospital at Rouen seriously wounded, was, before the war, on the electrical engineering staff of Henley's Telegraph Works Co.

Private H. W. FRASER, of the London Scottish, who was, on his enlistment, in the electricity department of the Woolwich Corporation, has been wounded.

Sergeant F. F. ROSSON, of the 2nd Coldstream Guards, who was on the staff of the Hull Corporation Tramways, has gained the Military Medal for gallant conduct on the field.

Private FRANK PRICE, of the Royal Fusiliers, who was with the Electric Construction Co., of Busbury, Wolverhampton, before the war, has been wounded in France.

Sergeant C. H. SMITH, of the Devonshire Regiment, who was on the staff of the Electric Light Co., at Barnstaple, has been wounded, and is in a hospital at Birmingham.

Second-Lieutenant JINKS, of the Northants Regiment, who has been wounded in France, was an engineer in the test department at the Rugby works of the British Thomson-Houston Co., Ltd. Before being wounded he was in the enemy lines with his two machine guns for a day. He is in the Duchess of Westminster's Hospital at the base.

Private W. J. BAKER, of the 7th South Staffs. Regiment, officially reported killed in action, after being missing since August 9th last, was, before his enlistment, engaged with the British Thomson-Houston Co., Ltd., of Rugby.

Rifleman HARRY KING, of the Rifle Brigade, who was, prior to the war, with the British Thomson-Houston Co., Ltd., at Rugby, has been wounded.

Gunner SPENCER MILAN, of the Royal Field Artillery, who has died of double pneumonia, contracted in training, was an electrician in the employ of Mr. Guy Laycock, of Huddersfield.

Private C. H. LONG, of the West Yorks. Regiment, who is wounded, was formerly employed at the Bolton Road electricity works, Bradford.

Private BEAT ROBINSON, an employé of the Lancashire Dynamo & Motor Co., Ltd., Trafford Park, has been wounded.

Sergeant WALTER A. CHADWICK, killed in action, was formerly a costs clerk employed by Messrs. W. T. Glover & Co., of Trafford Park. Private T. HORROCKS, an employé of the same company, has been wounded.

Lance-Corporal E. H. HOLME, for many years in the employ of the British Westinghouse Co., Trafford Park, is unofficially reported killed. Private JOSEPH ACKERLEY, another employé of the company, has also been killed in action.

Private F. HORTON, wounded and in hospital at Glasgow, was an employé of the Lancashire Dynamo & Motor Co., Ltd., Trafford Park.

Private JAMES GILLOW, of the Royal Warwick, formerly employed by the British Westinghouse Co., Trafford Park, has been killed in action.

Private A. SINGLETON, who has been wounded, was formerly employed by Messrs. Baxendale & Co., Ltd., of Manchester.

Private JOHN MCGUIRE, a former employé of Messrs. Saunders & Taylor, Ltd., electrical engineers, Manchester, is reported killed.

Private S. NEEDHAM, an employé of the British Westinghouse Works, Trafford Park, has been killed in action.

Private HERBERT SMITHURST, who has died in hospital at Rouen from wounds, was an employé at the Chloride Electrical Storage Works, Clifton Junction.

Cyclist H. E. BATES, an employé of the British Westinghouse Co., Trafford Park, has been wounded.

Private C. KENNY, of the South Lancashire Regiment, and his brother, Private L. KENNY, of the Manchester Regiment, both of whom were employed by the British Westinghouse Co., have been wounded.

Company-Sergeant-Major HARRY GILL, West Yorkshire Regiment, an electrical engineer, of Leeds, who was wounded on the first day of the recent advance, died two days later.

The *Times* states that Captain NORMAN VAUDREY, Manchester Regiment, killed on July 1st, in his 32nd year, was the second and only surviving son of Sir William and Lady Vaudrey. Captain Norman Vaudrey was a civil engineer at Manchester.

Major W. A. VIGNOLES, borough electrical engineer of Grimsby, has been wounded in the left hand, and is in hospital in London.

Private E. O. WILLIAMS, of the West Yorks. Regiment, who is wounded, was in the electric lighting department at Leeds.

Private E. GLEDHILL, wounded whilst serving in the West Yorks. Regiment, was in the Bradford tramways department.

Lieutenant W. C. MCCONNELL, Royal Irish Rifles, officially reported killed in action on July 8th, was the youngest son of Sir Robert McConnell, Bart., D.L., Strandtown, Belfast, and was a partner in the firm of McConnell & Bailey, mechanical and electrical engineers, London, E.

The *Times* reports the death from wounds, on Tuesday, of Second-Lieutenant F. R. HOGGETT, A.M.I.E.E., Royal West Surrey Regiment, aged 29, who had been connected with Callender's Cable & Construction Co., Ltd.; also the death of Lieutenant ERIC B. R. SCOTT, R.E., a student of the Royal School of Mines, South Kensington, aged 20, who joined the London Electrical Engineers (T.F.) at the outbreak of war; also of Second-Lieutenant NOEL D. EDINBOROUGH, Middlesex Regiment, aged 22, who was an Associate of the Institution of Electrical Engineers and of the City and Guilds of London Institute.

Private FRANK TYSON, an employé of the British Westinghouse Co., Trafford Park, has been wounded.

Private HERBERT WHITNEY, of the Cheshire Regiment, who has been killed in action, was formerly employed in the electricity department of the Sale (Cheshire) District Council.

Private EDWARD MILLAR, formerly on the staff of the Manx Electric Railway Co., has been killed in action in France, where has was serving with the Canadian Contingent.

Captain ALFRED LEE WOOD, to whose death in action in France we referred last week, was a brother of Mr. Arthur P. Wood, general manager and director of the Lancashire Dynamo and Motor Co., Ltd. Captain Wood, who was on the staff of the same company for some years, and had represented it in India, was a son of the late Mr. J. Lee Wood, for many years secretary of the Clifton & Kearsley Coal Co., Ltd. He was given a commission as lieutenant in the Lancashire Fusiliers in October, 1914, was afterwards raised to a cap-



THE LATE CAPTAIN ALFRED LEE WOOD

taincy, and went out to France last November. A Manchester paper gives the following account by his orderly, who killed him wounded at Manchester, of the way in which the gallant officer met his death:—

"On the morning of the attack our camp began a heavy bombardment at 6.30, and continued for an hour. About an hour later the captain was standing below the parapet calmly smoking his cigarette and glancing occasionally at his wrist watch. At 7.30 sharp he leapt over the parapet, followed by his men. A perfect tornado of bullets was encountered from every side. Barely 50 yards had been covered when he was hit by a bullet which grazed his head, whilst I got one in the arm. Without pausing we went on a little further, when a second bullet struck the captain on the head, causing a nasty gash, and almost at the same moment I was shot through the leg. Turning to me, the captain asked, 'Are you badly hit?' and I replied, 'Yes, sir, I can't go on this time.' He then ordered me to try and get back to our trench, and although I begged him to come back with me, as he was badly wounded, he said, 'No, I will get that machine-gun.' The gun was causing fearful losses amongst his men. The machine gun was taken later, and it was found that the man working it was chained to it and wearing an Iron Cross."

"I heard that the captain reached the third line of German trenches before receiving his third and fatal wound. I managed to get my leg dressed, and later on saw the captain lying in our trenches, with the Colonel by his side. He was known to us as the 'puffer' and we could have followed him anywhere."

CITY NOTES.

General Electric Co., Ltd.

The annual meeting was held at the Conner Street Hotel, E.C., on Monday, under the presidency of Mr. H. Hirst, secretary and managing director. Mr. Hirst said that the outstanding features of the balance sheet were that they had made a net increased profit of nearly £90,000, that they had spent, roughly, £80,000 on works extensions, that they had been able to carry on their present business and yet keep the large sum of £252,000 invested in War Loan and Treasury Bills, and, finally, that their proposed appropriation provided for an increase to the reserve fund of £100,000, and an increased carry forward of £11,000. All the other figures were substantially of the same character as those of a year ago. The distribution on the ordinary shares was the same as last year. Dividends absorbed a slightly larger amount, namely, £92,000, instead of £87,000. The advance shown was all the more remarkable as a great portion of the previous year's output was for Government requirements, and the prices charged were, almost without exception, the same as those ruling prior to the war; only in certain cases had they asked for advances, and then only in proportion to the increased prices of raw material and labour. The higher profits were mainly due to the fact that under present conditions they had obtained more repetition work than one could expect in normal times, and all engineering repetition work cheapened the cost of production, because they were able to get more work from the machines. They had benefited in some manufacturing departments which, under pre-war conditions, showed an annual loss, whilst under present conditions they had yielded a legitimate profit. He referred to some of the departments which had been adversely criticised on previous occasions, but which had proved of exceptional value to the Government. The shell factory which they had laid down was now in full swing, and had been responsible for a considerable proportion of last year's capital expenditure. At the first starting up, some temporary dislocation was caused in the works owing to the necessity of training women and unskilled labour with a depleted staff, and, perhaps, owing to want of experience in this direction on this company's part. Their deliveries had given the greatest satisfaction, but they had not yet succeeded in making a profit in this section of the works. Their large reserve stock of standard lines had naturally benefited by the general rise in prices, and this had been a contributory factor to the success of the year. Above all, their results were mainly due to the loyalty, co-operation, and resourcefulness of the staff and the majority of the workpeople, who had appreciated the utility of their products to the country. A goodly number would not be lured away into the many concerns started since the war, which temporarily were offering such tempting and abnormal wages. All the work which they had done did not show itself in actual business returns. Many of their people had been able to devise, and give useful assistance to, Government departments and committees in experiments, and in the solution of scientific problems which the conditions of war had created. This was not a time for thinking of larger dividends. With the ever-increasing difficulty of obtaining raw material, the probable further diminution in the supply of labour, and the necessary limitation to imports and exports, it was impossible to forecast what surprises might be ahead of them before the war was over. They must, therefore, persevere in the policy of conserving their strength and keeping their assets liquid. They must bear in mind, also, that a big task confronted the electrical industry in this country. Much was expected of them, and they, the General Electric Co., were anxious to fulfil these expectations. As soon as they had the slightest indication as to what would be the Government policy after the war, and in what way new enterprises would receive the necessary measure of Government assistance which present conditions demanded, they would be willing to open up in new fields and avenues which had hitherto been closed to the manufacturers of this country. The stronger they made themselves internally, the more fit they would be to wage the fierce commercial and industrial contest which was bound to ensue after the war, and the better would they be able to make use of the opportunities held out to the electrical industry by the Allies. Their strong financial position and reserves would permit them to go full speed ahead with the constructional work, and their sales organisations overseas were so unique and firmly established that they were prepared for any challenge. It was just this desire to keep their overseas branches alive and well organised that was causing them anxiety, as export business was now rendered so difficult, due to lack of tonnage, and they were consequently able to execute only a small percentage of the orders and contracts which they were offered. Where an industry never seemed to get out of the state of evolution, the directors and managers could not keep pace with the times if, with every experiment and with every fresh step involving expense, they were to feel that they were incurring expenditure which might deprive the shareholders of their dividends for the current year. If a portion of the past profits were always available for pioneer work, for testing, sounding and studying new inventions, and investigating fresh fields of inquiry, one had the greatest chance of remaining at the top of the industry. As regarded investment, they were

committed to a policy, and, according to the present plans of the board, the investment account was likely to be still further increased next year. He presumed, however, that as long as this account showed a handsome yield, the shareholders would encourage them to go ahead. They had given a full account of their investments, and would continue to do so in the future with the same frankness. Through one of their associated companies, the Peel-Conner Telephone Works, they had now established a magnets factory near Coventry. Under the title of the Conner Magneto Ignition, Ltd., that company had evolved a magneto for which Government contracts had already been secured. The works had been started on quite a considerable scale, and they hoped within a very few months to be able to make good some of the present deficiency in the supply of so important and essential an appliance. Conditions of war made it impossible to discuss fully and thoroughly all the various operations in which they were engaged, but if, after the cessation of hostilities, this ban was removed from his lips, he would be able to tell such a story of G.E.C. war activities as might well fill both the shareholders and the staff with pride. Their labour and resources were being, and would continue to be, used to the utmost to further the end they all had in view, namely, complete victory. No fewer than 52 of their men had laid down their lives, 133 had been wounded, 61 had been invalided, and four were either missing or prisoners of war. This was indeed a heavy casualty list out of a total of 1,500 men who had joined the Forces. It could be better understood, however, when it was remembered that most of their men joined at the commencement of hostilities. The company would endeavour, as far as lay in their power, to help the dependents of the fallen. They had created a complete scheme for regularly communicating with and supplying comforts to those serving at the Front, and they fervently hoped that, at a not far distant date, they might see them back again at their old places in the firm.

Mr. ERNEST BYNG seconded.

Mr. WALKER thought they were entitled to get as much information as could properly be given to cover the question of what was going to be done, in view of the fact that, roughly, £80,000, or considerably more than the amount of their profits, had been expended in works extensions. He would like to know whether that money had been spent in order to place the company in a position of only doing work for the Empire during the present time of stress. They must bear in mind that the Government were taking 50 per cent. of their excess profits, which was to be increased to 60 per cent., and eventually, he believed, to 95 per cent. He thought such a policy would have the effect of driving industries from this country to America and other neutral countries, where they would not contribute 50 or 60 per cent. of their excess profits to the Chancellor of the Exchequer. He was a director of a small company which did not pay any profit until 1914, and then it made a profit of £2,600. Then followed the war, and because the balance sheet of that company was made up after July 31st, 1914, they were asked to contribute half of their profits to the National Exchequer, whereas if the balance sheet had been made up before July 31st, 1914, they would have contributed nothing. At the same time, their profits had nothing to do with war profits, but were made before the war started.

Dr. MOODY congratulated the directors upon being able to present a balance sheet showing such large liquid reserves. After two years of war, it showed the company was well managed, and that they had sufficient resources to carry through any enterprise they might undertake.

The CHAIRMAN said he sympathised with Mr. Walker in what he had said. In the electrical industry they turned out products of both peace and war, and both those classes of products could be turned out from the same machines with but slight alterations. With regard to the £80,000 they had spent in extensions, a very large proportion of that expenditure would be useful to them, after Peace was declared, in the development of their business. Some portion of the money, of course, would be useless from the commercial point of view after the war was over, but no doubt the Government would have to consider the position of firms who had sunk much more capital than they had done for war-work purposes, and no doubt they would be treated with equal consideration by the Government. He thanked Dr. Moody for his kind comments, which were very encouraging.

The motion was carried unanimously, and the dividend declaration was approved.

The CHAIRMAN said he had now to propose that the appointments of Mr. M. F. Armstrong, Mr. G. H. Ide, and Mr. M. Solomon as directors of the company be confirmed. He was glad Mr. Armstrong had accepted their invitation to join the board. He had known him for a great many years, and he had always shown great interest in their work. He had all those qualifications which would make him very useful—in fact, he might say eminently useful—to the company, and he hoped the shareholders would approve of his selection. Mr. Solomon, the manager of their carbon works, was unable to be with them that day, but he had been associated with the company for upwards of 14 or 15 years, and Mr. Ide, the manager of their metal works, had been with them for upwards of 20 years, and he was sure they would prove two very valuable additions to their board.

Mr. M. J. RAILING seconded, and the motion was carried. The CHAIRMAN proposed the re-election of Mr. E. H. Byng, who took a very great interest in their company, but, unfortunately, had suffered from ill-health. He was with them that morning, and he hoped he would shortly be able to resume work.—This was carried.

Mexican Companies. A joint meeting of the holders of the bonds issued by the Mexico Tramways Co., the Mexican Light & Power Co., Ltd., the Mexican Electric Light Co., Ltd., and the Pachuca Light & Power Co. was held last week in London, to decide upon the policy to be adopted for the protection of the bondholders' interests until conditions in Mexico improve. The matter has been fully reported in the financial dailies. Mr. W. E. Rundle, general manager of the National Trust Co., Ltd. (the trustee for the bondholders), who presided, said that the total bonds outstanding, including all the issues, was £12,330,371. Of this amount £9,074,020 had been deposited with the committee, representing 73.75 per cent. of the total outstanding issues. From the time defaults were first made by the companies in payment of interest the trustee was impressed with the necessity of obtaining as soon as possible an independent report upon the properties. It was recognised that the default had not been brought about through bad management, but owing to conditions wholly beyond the control of the directors and the executives of the companies. Nevertheless, it was deemed advisable to secure independent advice. In February last the trustee, in conjunction with the receiver of the Mexican Light and Power Co., and the directors of the other companies of the group, induced Mr. Phippen and Mr. Trowbridge, a former manager of the Light & Power Co., to proceed to Mexico. After a study of the position and conditions of the companies, and after carrying on certain negotiations with the Government and others, they returned to Toronto and made to the National Trust Co. the report which was in the hands of the bondholders. Substantial results were obtained by their representatives. He strongly emphasised the necessity for the bondholders of all the companies of the group to stand together at this time for mutual protection. In this was the hope for the future. The circumstances and conditions were most unusual, and unless they were met in a broad, strong, and courageous manner the bondholders' interests, in his opinion, would undoubtedly suffer, if not end in catastrophe. He moved a resolution approving of the resolutions intended to be proposed at the formal meetings of the bondholders and recommending that such resolutions be passed.

Mr. E. R. PEACOCK (chairman of the Bondholders' Protection Committee), in seconding the resolution passed by the Chairman, said that Mr. Rundle had emphasised what the committee regarded as the most important point, namely, the necessity for single control and management of the companies during the troubled period in Mexico. That involved that someone should have full power of action, and in the present circumstances of the companies obviously that power should rest with the bondholders. The bondholders had by a very large majority relegated their powers to the bondholders' committee, and the resolutions directed the committee to take such steps as they found necessary to ensure that they had that control.—The resolution was carried unanimously.

Crompton and Co., Ltd.

For the year ended March 31st, 1916, the gross profit was £63,118, and after deducting general charges, depreciation, interest on debentures, and other items, there remains, including the sum brought forward, an available balance of £37,950. Out of this, £6,500 is to be put to general reserve, £10,000 to special depreciation account, £1,608 is written off the balance of preliminary expenses, 7 per cent. is paid on the preference shares, requiring £9,363, and £10,479 is to be carried forward, subject to excess profits tax and to assessment under the Ministry of Munitions Act, 1915. In view of the last-named liabilities, the directors do not deem it prudent to recommend a dividend on the ordinary shares. Mr. T. Britten, manager of the works at Chelmsford, has been elected to the board. Annual meeting: July 24th.

For the previous year the gross profit was £57,911. £6,500 was put to general reserve, £9,500 to special depreciation account, £1,608 was written off preliminary expenses, 7 per cent. was paid on the preference shares, and £7,691 was carried forward.

Liverpool Overhead Railway Co.—Interim dividend to June 30th, on account of the year ending December 31st, 1916, at the rate of 5 per cent. per annum on the preference shares, and 2½ per cent. per annum on the ordinary shares. Income-tax will be deducted at the rate of 4s. 6d. in the £.

To be Struck Off the Register.—The following companies will be struck off the register within three months and dissolved unless cause is shown to the contrary:—

Atlas Anti-Friction Metal Co.
Eclipse Rail-Truck Co.
Electric Ozone Syndicate
Traffic Indicators, Ltd.
Wireless Electric Light Co.

Sao Paulo Tramway, Light & Power Co.—Dividend, 2½ per cent. on the common stock.

Rio de Janeiro Tramway, Light & Power Co.—Dividend, 1½ per cent. on the capital stock.

Brazilian Traction, Light & Power Co.—Dividend, 1 per cent. on the ordinary stock.

Verity, Ltd.—By an Order of the Court, separate meetings of the holders of the ordinary shares and of the management shares respectively are to be held on July 25th, to consider a scheme of arrangement between the company and such holders. The Court has appointed Mr. G. Verity, or failing him Mr. B. C. Evans, as chairman of the meetings, and he has to report the result to the Court. A copy of the scheme can be seen at the office, 31, King Street, W.C., by arrangement.

STOCKS AND SHARES.

TUESDAY EVENING.

The cheering news from the Front has been hailed with delight in the City, where there is keen appreciation of the first fruits of the Great Offensive. This encouragement compensates for an unexpected advance in the Bank Rate to 6 per cent.—the first change since August 8th, 1914. The reason for this step is taken to be due to financial conditions in New York, and criticism hesitates to say much on a subject of which the essential elements can be known only to the Bank of England and a few other authorities.

Naturally, the rise caused a sharp set-back in Stock Exchange prices. Perhaps the previous upward movement had rushed ahead too sharply, and reaction was fairly due. Reaction came, anyway, and most of the investment prices are down on the week. Even the profit-makers out of the war are not likely to buy Consols on a 4½ per cent. basis when they can get Treasury Bills of the British Government to pay them £6 7s. 8d. per cent. on the money, and War Expenditure Certificates that return 6 per cent.

The Home Railway market was amongst the first to suffer. Gilt-edged stocks fell back one to three points, and the eager demand for them became abated. This was quickly reflected in the ordinary stocks, which gave way without exception. At the lowered levels, however, evidence of bargain-hunting appeared. The argument revived that investment requires a more permanent home for its money than is provided by the short-term policy of war finance to which the Treasury seems so greatly wedded. Before the month is out, we make bold to prophesy people will have become familiarised with a 6 per cent. Bank Rate, and will be buying previous favourites in the Stock Exchange markets. Always provided, of course, that the Bank Rate is not put up further.

The Stock Exchange Committee have under active consideration a scheme for restoring, where practicable, double quotations, officially, for stocks and shares dealt in through the markets. This will come into operation in a month's time, according to present intentions. One of the chief difficulties of re-establishing double prices is aptly furnished by the market in electricity supply shares.

At the present time, there is a pronounced scarcity of supply. Shares can be sold with comparative ease, but they cannot be bought in a number of cases. The jobbers may say, therefore, that to quote a price at 6½ to 7 in the Official List is misleading and unreliable if they have no shares to offer at 7. Probably the position would be the same if they called the price 6½ to 7½, when they would incur the charge of quoting an absurdly wide margin between buyers and sellers. Where a free market exists, reversion to the double prices could be reliable and valuable. What will happen, we take it, is that a start will be made with certain stocks and shares, leaving blanks for a great many others, and these latter would gradually come into line as business in them developed enough for double prices to be accurately and reliably quoted.

Underground Electric Incomes dropped 3½ of their previous week's gain of 4 points. The shares are also down. Metropolitan shed 1½ and Districts lost ¾. South-Western deferred, which shot up to 27½ on the excellent results which electric traction is said to be affording the company, reacted to 26.

Electricity Supply shares are amongst the few to which the 6 per cent. Bank Rate made no difference. Charing Cross preference are 5s. up, and so are City of London ordinary. The reason is the same as that already mentioned, namely, that there are no shares on offer. Neither the rise in the Bank Rate nor that in the price of coal brought in any sellers of the shares.

The Telegraph market is equally firm. Several stocks from which dividend payments were deducted last week have begun to recover the amounts. Chile Telephones are a particularly good spot, again putting on 3/16 with a rise of 7, so that they are the fraction higher than United River Plate Telephones, with which previously they had been keeping in step. Marconis experienced a swift drop to 3 1/16 on a shake-out of the bull position. From this there was something of a rally, but the price is still down on the week, and with it there subsided also the American, Canadian, and Spanish shares, these dropping abruptly to 17s. 6d. for the first, and half-a-guinea for the two others.

Bondholders of the four principal Mexican Utilities companies met last week to consider what policy should be adopted for the protection of their interests until conditions in Mexico improve. The meeting was an informal one, but informing details were given, and the importance emphasised

of all the bondholders standing together at this crisis. Further meetings are to be held in about six weeks' time. Meanwhile, rumour has since been busy with a report, made in America, that the United States has offered President Carranza financial assistance in restoring order provided that he agrees to certain terms. Prices of the various bonds are none too firm, but the first mortgage bonds of the Light and Power have been dealt in actively on the basis of 41.

In spite of the declaration of a 1 per cent dividend, Brazilian Tractions are dull and heavy at 62. The Anglo-Argentine Tramways group shows no change. Alabama Traction Light & Power shares rose to 32, but gave way afterwards to 29. The report states that the net revenue for 1915 came to \$569,000, which is just about double that for the previous twelvemonth. City Services shares came down from 85 to 40 on New York selling.

The Sao Paulo Tramway, Light & Power announces a dividend of 2½ per cent on its common stock, and the Rio Tramway a dividend of 1½ per cent, both payable on August 1st.

British Westinghouse preference are a strong spot with a jump of 2s. 6d. to 4s. 6d. The shares, of course, are 15 per cent., but at present receive 7½ per cent. They are non-cumulative. British Insulated improved upon their previous week's advance of 15s., with a rise of 5s., which brought them to 11½. General Electrics are steady, on the meeting. Henleys rose to 15½, Electric Constructions to 16s. 3d. Other industrials remain firm as a whole. The rubber market pursues a humdrum way, the price of the material keeping about 2s. 3d. per lb. No decision has yet been arrived at as to the basis upon which the younger producers will be assessed for excess profits tax.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend	Price	Rise or fall	Yield
	1914. 1915.	July 18, 1916.	this week.	p.c.
Brompton Ordinary	10	10	62	27 18 2
Charing Cross Ordinary	5	5	82	6 18 0
do. do. 34 Pref.	44	44	8	6 8 7
Chelsea	9	9	8	6 19 4
City of London	9	8	12½	6 8 0
do. do. 6 per cent. Pref.	6	6	10½	6 11 8
County of London	7	7	10½	6 11 9
do. do. 6 per cent. Pref.	6	6	12	6 15 8
Kensington Ordinary	9	7	6½	6 16 7
London Electric	4	8	12	7 5 5
do. do. 6 per cent. Pref.	5	6	24	6 12 4
Metropolitan	34	9	24	6 6 4
do. 44 per cent. Pref.	44	44	8	7 10 0
St. James's and Pall Mall	10	8	6	6 13 4
South London	5	6	24	6 13 0
South Metropolitan Pref.	7	7	18	6 4 6
Westminster Ordinary	9	7	62	6 14 9

TELEGRAMS AND TELEPHONS.

	Dividend	Price	Rise or fall	Yield
	1914. 1915.	July 18, 1916.	this week.	p.c.
Anglo-Am. Tel. Pref.	5	6	104½	6 16 6
do. Def.	30	30	23	7 10 9
Chile Telephone	8	8	7	5 14 5
Cuba Sub. Ord.	6	5	7½	6 18 4
Eastern Extension	7	8	12½	6 7 8
Eastern Tel. Ord.	7	8	14½	6 7 8
Globe Tel. and T. Ord.	6	7	12½	6 8 8
do. Pref.	6	6	11½	5 9 1
Great Northern Tel.	22	22	38	6 18 0
Indo-European	13	13	48	6 12 8
Marconi	10	10	92	3 4 0
New York Tel. 44	44	44	109½	4 7 10
Oriental Telephone Ord.	10	10	27	5 0 0
United E. State Tel.	8	8	63½	6 15 6
West India and Pan.	1	—	14	—
Western Telegraph	7	8	15½	6 6 8

HOME RAILS.

	Dividend	Price	Rise or fall	Yield
	1914. 1915.	July 18, 1916.	this week.	p.c.
Central London, Ord. Assented	4	4	78	5 9 7
Metropolitan	11	11	26	8 17 0
do. District	Nil	Nil	19	Nil
Underground Electric Ordinary	Nil	Nil	118	Nil
do. do. Income	6	6	84	6 16 2

FOREIGN TRAMS, &c.

	Dividend	Price	Rise or fall	Yield
	1914. 1915.	July 18, 1916.	this week.	p.c.
Adelaide Sup. 6 per cent. Pref.	6	6	5	6 0 0
Anglo-Arg. Trams, First Pref.	54	54	34½	7 2 0
do. 2nd Pref.	54	54	31	8 9 2
do. do.	5	6	6	8 9 2
Brazil Tractions	4	4	62	6 9 0
Bombay Electric Pref.	6	6	104	6 14 3
British Columbia Elec. Rly. Pref.	5	5	50½	8 6 8
do. do. Preferred	Nil	Nil	40	Nil
do. do. Deferred	Nil	Nil	39	Nil
do. do. Deb.	42	42	65	6 10 9
Mexico Trams 6 per cent. Bonds	Nil	Nil	42	Nil
do. 6 per cent. Bonds	Nil	Nil	42	Nil
Mexican Light Common	Nil	Nil	30	Nil
do. Pref.	Nil	Nil	80	Nil
do. 1st Bonds	Nil	Nil	42	—

MANUFACTURING COMPANIES.

	Dividend	Price	Rise or fall	Yield
	1914. 1915.	July 18, 1916.	this week.	p.c.
Babcock & Wilcox	14	15	8	5 0 0
British Aluminium Ord.	5	7	25½	5 7 8
British Insulated Ord.	15	17½	11½	7 12 9
British Westinghouse Pref.	7½	7½	51½	5 16 3
Callenders	15	20	124	8 0 0
do. 6 Pref.	5	5	44	5 11 1
Cattner-Kellner	20	19	86	6 6 8
Edison & Swan, 23 paid	Nil	Nil	92	Nil
do. do. fully paid	Nil	Nil	12	Nil
do. do. 5 per cent. Deb.	5	5	57	8 16 8
Electric Construction	6	6	169½	4 4 8
Gen. Elec. Pref.	6	7	19	8 0 0
Henley	20	25	14	9 1 3
do. 4 Pref.	44	44	4	5 12 6
India-Rubber	10	10	124	8 9 4
Telegraph Con.	20	20	89½	8 4 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered in making use of the figures appearing in the following list that in some cases the prices are only general and they may vary according to quantities and other circumstances.

Wednesday, July 19th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/8
a Ammonia-Sul	per ton	1/75
a Ammonia-Muriate (large-crystal)	per ton	4/5
a Bisulphide of Carbon	per ton	2/3
a Borax	per ton	2/50
a Copper-Sulphate	per ton	2/1
a Potash, Chlorate	per lb.	2/6
a Perchlorate	per lb.	2/1
a Scheele	per cwt.	5/8
a Sulphate of Magnesia	per ton	2/15
a Sulphur, sublimed Flowers	per ton	4/1 inc.
a Lump	per lb.	11 10 inc.
a Soda, Chlorate	per lb.	1/45
a Crystals	per ton	1/30
a Sodium Bicarbonate, casks	per lb.	—
METALS, &c.		
c Brass (rolled metal 2 to 12 basis)	per lb.	1/24 to 1/3
do. Tubes (solid drawn)	per lb.	1/24 to 1/3
do. Wire, basis	per lb.	1/3 to 1/4
c Copper Tubes (solid drawn)	per lb.	1/62 to 1/62
g Bars (best selected)	per ton	2140
g Sheet	per ton	2140
g Rod	per ton	2145
d (Electrolytic) Bars	per ton	2123
d Sheets	per ton	2141
d Rods	per ton	2139
d H.C. Wire	per lb.	1/32
f Elomite Rod	per lb.	2/8
f Sheet	per lb.	2/8
n German Silver Wire	per lb.	2/3
h Gutta-percha, fine	per lb.	2/11
h India-rubber, Para fine	per lb.	Nom.
i Iron Pig (Cleveland warrants)	per ton	4/36
l Wire, galv. No. 8, P.O. qual.	per lb.	2/3 5
g Mercury	per bot.	217 12 6 to
e Mica (in original cases) small	per lb.	64. to 8/.
e " " medium	per lb.	8/.
e " " large	per lb.	7/6 to 14/.
d Silicon Bronze Wire	per lb.	1/84
r Steel, Magnet, in bars	per ton	2/8
g Tin, Block English	per lb.	2/10
n " Wire, Nos. 1 to 16	per lb.	2166 to 2167

Quotations supplied by—

a G. Boor & Co.	g James & Shakespear.
c Thos. Bolton & Sons, Ltd.	g Edward Tilt & Co.
d Frederick Smith & Co.	g Bolling & Lowe.
e F. Wiggins & Sons.	g Richard Johnson & Nephew, Ltd.
f Indo-Rubber, Gutta-Percha and	g P. Ormiston & Sons.
Telegraph Works Co., Ltd.	g W. F. Dennis & Co.

Registration of Firms Bill.—Following up our recent reference to this subject in our leader columns (ELECTRICAL REVIEW, March 31st, p. 357), we are glad to learn that the Select Committee of the House of Lords, to which the Bill was referred, has reported, urging that it should be pressed forward without delay. That there was, and had long been, a public demand for the Bill was recognised when it was read a second time without a division. According to the *Financial Times*, the Committee thinks that the title of the Bill should be "Registration of Business Names," as the Bill is not confined to trading firms, but includes professional partnerships. The object of the Bill being to include not all partnerships, but only those where the style conceals the identity of the actual traders, the Committee thinks the most convenient limit would be expressed by requiring registration by all who do not use their true surnames to designate their business. It is true that the surname does not exhaust the trader's description, but it goes a long way towards it, and opens the path to further inquiry if necessary. Such a description covers the case of the small local traders who already use their actual surnames, or can very easily do so. It is very difficult to provide a means of enforcing registration which shall not be either ineffective or oppressive. The Committee, after much consideration, proposes that anyone coming within the Act who does not register shall be disabled from suing on a contract made while he is in default, but that the Court, in proper cases, shall be able to give relief from this disability. The Committee also thinks that the Board of Trade should have power to enforce by penalty registration by a person who comes within the Act. The Committee looks upon the proposed registration as by no means a large, expensive, or complicated operation. The details are left to be worked by rules of the Board of Trade. The Committee expresses its strong opinion that the Bill would be of special value under the conditions both of the warfare now prevailing and of the state of things which may be expected to arise immediately afterwards. Events have shown how desirable it would have been to have had at the beginning of the war, and still would be to have ready to hand, such information as this Bill provides, and without entering upon any controversial matter relating to trade after the war, it may be generally accepted that the identity of those concerned with trade will be in the future an element of the greatest importance.

LABOUR AND INDUSTRY.

(Continued from page 32.)

WE are at present the subjects of conflicting emotions. An urgent appeal from the Commander-in-Chief moves us to redouble our efforts for turning out abundant supplies of everything required, so that the Advance, now that it has begun, may not be held up. Thousands of lives and millions of pounds sterling may be saved if we can maintain supplies so that we may continue to strike hard until the end. Yet, while the national cause demands still more labour and a sustained effort on the part of all, we are compelled to be simultaneously considering ways and means for safeguarding the interests of millions of workers when we have all won the Victory. Those who prefer to leave such things to chance, who have a dislike for any energetic movement or policy, or who would "let things slide" until it is "too late," are becoming fewer every day. We thought that the decision of the Government to appoint a number of committees to consider the after-the-war interests of various staple British industries was approved by all practical-minded students of national affairs. What are we, then, to think of the maunderings of an esteemed electrical contemporary, which, if it had a weaker faith, would deduce from the appointment of so many committees that "our country must have been in an exceedingly bad way two years ago"? It finds in the unparalleled prosperity that prevailed in our industries before the war an indication that "there is nothing fundamentally wrong with our methods." Not being willing to do "as the fool does," our contemporary, instead of "pulling down everything before we know for certain that we have something better to take their place," would endeavour "so to modify existing institutions as to bring them into line with twentieth-century requirements." What on earth is our contemporary driving at? Has the writer observed that there is a sort of war raging in Europe? that we and some nations whom we call our Allies are engaged in it? that the industries of the country have been turned practically upside down in order to wage that war successfully? and that, therefore, the condition of our industries and trades may need a little looking into? The seriousness and extent of the problems are so great that in one case it has been found necessary to make two committees where one was thought to be sufficient before. There may be something in the desire for co-ordination, but there is a Reconstruction Committee of the Cabinet, and as we go to press there is announced a "Commercial and Industrial Policy Committee," to which the proposals of all the other committees will find their way. The spirit that inclines a man to do nothing, and to leave alone what he calls "well," is reprehensible in these very anxious times; in the electrical world it is particularly so.

We shall, no doubt, hear many dark forebodings respecting a "sex war," but there are more immediate matters in hand, and while the future position of Labour, as a whole, is so obscure, it cannot be dealt with as a problem by itself. Indeed, at the moment, the more pressing problem regarding female labour is how to secure more of it from less essential and from leisured walks of life. For some time past the Home Office and the Board of Trade have been engaged in a vigorous campaign to that end, owing to the needs of various occupations and industries. As part of the steps taken in this campaign, an appeal, signed by the Home Secretary and the President of the Board of Trade, has been issued to employers urging them to take immediate steps to extend as far as possible the employment of women in their works. A Central Advisory Committee on Women's War Employment (Industrial) has been appointed to advise the two departments on questions arising out of the substitution of women for men and to watch the progress of this substitution in various localities and industries.

The Board have also appointed in a number of important centres local Committees under the Labour Exchanges Act, 1909, to assist the two departments in dealing with the various questions that arise locally. The work undertaken by these Committees includes the collection of information as to the labour requirements of employers in their area, the

organisation of a supply of women workers, the making of arrangements for housing accommodation for women brought in from other districts, and the initiation of schemes for the welfare of the women employed in their area.

The following is a list of places where local Committees have already been or will shortly be set up:—

Bacup and Rawtenstall (Rossendale)	Edinburgh and Leith	Llanelli
Batley and Dewsbury	Glasgow	Mansfield
Blackburn	Gloucester	Peterborough
Bradford	Greenock	Nelson
Bristol	Grimsbj	Newtown and Welsphool
Burnley	Halifax	Nottingham
Carlisle	Huddersfield	Paisley
Carnarvon	Hull	Preston
Derby	Keighley	Sheffield
Dundee	Kettering	Todmorden
Ebbw Vale	Leeds	Woolwich.
	Leicester	

Further Committees will probably be appointed at a later date, as the need for their services arises.

In most of the great industries (outside munition industries) conferences with employers and operatives have been arranged by the Home Office, and the Board of Trade. In almost all cases a formal agreement has been concluded whereby the Operatives' Unions have undertaken, subject to certain conditions, to relax their trade rules in regard to the employment of women on processes hitherto regarded as men's processes. In many industries such agreements have been reached, and in others they are contemplated.

To assist in these schemes a series of pamphlets has been prepared, and others are in course of production, setting out the processes in each industry in which women have been, or can be, introduced to replace or assist male operatives: these, together with notes of any trade agreements or other relevant points of interest, are being brought to the notice of employers. An Information Bureau of the Board of Trade Employment Department has been opened at the Victoria and Albert Museum, South Kensington, and employers who are anxious to secure more information should communicate with that Bureau, where they will find on file many particulars respecting new occupations and processes for female labour.

Mr. J. H. Thomas, M.P., of the National Union of Railwaymen, in a recent speech admitted that they had no right to set up a sex war, but they had a right to say that no employer should be allowed in future to take advantage of women's labour as a means of reducing the value of man's labour. He added that there was only one way, and that was to insist that wherever women were doing the work of men they should be paid the same rates as men. Does this mean the same class of work, leaving such questions as quality and output out of account? We have had some striking cases of excellent performance on the part of women, putting male labour almost to shame, but not all the evidence, by any means, is to that effect.

We may not attach undue importance to speeches, but it is only right to keep ourselves informed of the drift of opinion among the workers and their representative spokesmen. In this connection we note that the mover of a resolution at the meeting of the Railwaymen's Union mentioned above, said that the brightest feature of the present time was the growing strength of Trade Unionism. "It was unlikely that they would have to use the power of the Alliance (railwaymen, transport workers and miners) before the international conflict was ended, but when they looked at what was likely to happen when peace was declared, the best solution they had was that which lay in their splendid organisation, for the triple Alliance could effectively look after their welfare, if they used it in the proper way."

We have already quoted in detail the proposals which this Alliance will put before Mr. Asquith when he receives the deputation.

Mr. H. Wilson Fox, of London, writing to the *Times* on the British error of the past in paying too little attention to production and too much to the interests of the consumer, expresses the conviction that the time has arrived for a change of policy. "Production must be stimulated," and "it behoves us to consider on what terms Protection (for home industries) must be given." He makes the following suggestions:—

1. Reasonable conditions of life for the workers—to be attained by means of minimum wages.

2. Partly paid for by S.I.C. grants exceeding a reasonable amount, and partly by the operation of a graduated excise upon tax. The question of what should be regarded as a reasonable rate of return for the electrical industry might be determined by a Commission of experts wholly independent of the Inland Revenue authorities.

How much, perhaps appropriately, quote from the *Times* (1915), was made recently by the chairman of Canadian Electric & Co., Ltd. (Mr. W. L. Hickens), on the question of wages and profit:—

It is often stated that Capital got too large a share of the product of labour, and that labour was exploited for Capital's benefit; but if all the sums to be paid in dividends were distributed in wages by the firm, it would be well under a 10 per cent. increase. Wages could only be increased either by higher cost to the consumer or increased output, and the last-named way was the only real one in which to substantially increase wages. All this was very obvious, but, unfortunately, it was too little understood in the Labour world, where the policy of restricting output was so deeply ingrained that even at the greatest crisis in our history, when every ounce of effort was needed to win the war, it had not been, so far, overcome. However deplorable this might be, it was unnecessary to lay all the blame at Labour's door. The mistrust and suspicion which had caused restriction of output were an heritage of the past, in which employers and the Government, and, indeed, the whole community, had played their part. It was idle to speculate and be shocked because, in the light of past experience, Labour was suspicious that speeding-up would result in a reduction in piece-work rates. The arrangements of the Ministry of Munitions to meet this problem had worked most unsatisfactorily, and led to the most absurd anomalies. The problem remained unsolved. Its solution was of more than immediate importance: it was of far greater moment to our trade after the war. It was our biggest domestic problem, and because of its difficulty was left severely alone or dismissed with the suggestion that there was bound to be trouble after the war. And there was bound to be trouble if the present policy of drift was tolerated.

(To be continued.)

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION, 1916.—V.

The Application of Electricity to Agricultural Purposes.

By W. T. KERR.

(Abstract.)

Up to the present time the use of electricity in farming has not attracted the attention that it undoubtedly deserves on the part of the electric supply authorities, electrical manufacturers and engineers in this country. This is the more surprising in view of the very close attention which has been given to the subject on the Continent of Europe and in America, and the important and extensive schemes for supplying agricultural areas which have been carried out in different countries.

It is noteworthy that California—a purely agricultural State—uses more power per head of population than any other American State. Canada also furnishes an interesting example of farm supply on the Ontario Hydro-Electric Commission's extensive distribution system, and practical examples of a similar kind are to be found in Australia, New Zealand and elsewhere.

There is awaiting development in this country an enormous business of a similar kind, which will also place at the disposal of the agriculturalist a labour-saving source of power and light superior to any other. The writer's conclusions are based on some years' experience in farm supply work in the neighbourhood of Hereford, where conditions are not more favourable than in many other parts of the country for this particular class of supply.* It has been rightly said that electricity can give a new stimulus to agriculture and farming, and at the same time open up a way by which the rural population can be induced to remain on the farm, instead of flocking to overcrowded cities, and taking up an entirely new form of work to earn a living.

Several of the important Continental electrical firms specialise in electrical apparatus for farms; portable motors of fairly large size are built for driving thrashing machines, &c., and some engineers in the United States have even gone so far as to incorporate the motor in the farm machine in the same manner as in modern machine-tool work.

In an article in the *ELECTRICAL REVIEW* of June 4th, 1915, it is shown that very similar conditions exist in Britain, although it would seem that the average would be greater in this country, both as regards units consumed and horse-power demand, as the farm machinery in general use here is of larger and more substantial type.

The last report of the Ontario Hydro-Electric Commission contained some particulars of farming supply in Ontario, with data as to energy used on farms; the average yearly consumption per farm for all purposes was 4,700 units, and the average revenue £27.

In the Hereford district a system of light transmission lines has been erected to reach the agricultural consumers. These are built with larch poles, 28 ft. long, with cross arms of quarter oak 2 ft. 6 in. by 3 in. by 3 in., the bottom arm 3 ft. The lines are usually now made up to 7/10 B.S.G. bare stranded aluminium, weighing about 392 lb. to the yard, and costing before the war 1s. 0½d. per lb., with two No. 12 galvanised guard wires below, which are also used as the neutral, the supply being given at 440 volts, three wire (220 volts for lighting). The total cost, including labour, works out at £110 per mile. These lines have withstood the gales of December, 1915, and March, 1916, without a breakdown.

The farthest distance a supply is given is 3,400 yd. from the generating station, 1,200 yd. of which is by overhead lines; these radiate in five districts from the station to an average distance of 3,000 yd.

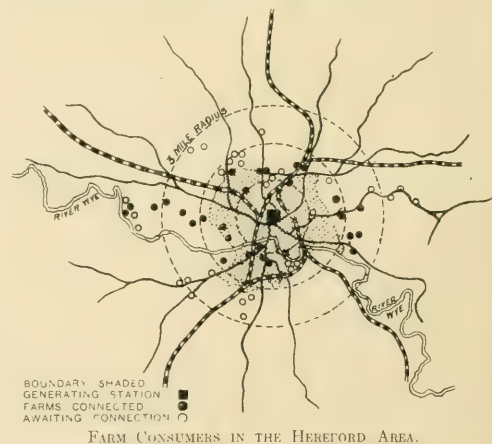
When erecting the poles, it has been found better to place them close into the hedges, otherwise the cattle use them for relieving themselves of insect life, to the detriment of the line; also farmers object to their being placed any distance out in the fields, and the hedges and ditches act as a guard. Such lines can be arranged with quite long spans, 75 yd. in places, to cut across corners, if the route is carefully considered before the erection.

Tappings to consumers are taken off by means of a twin-lead cable clipped to the pole. It is very important to seal both ends of the cable where the leads are taken off, and this is usually done at the top of the pole by securing a small sealing box to the pole and taking off leads, leaving a short bare space on the wire between the lead-covered and rubber-covered leads where the thimble is sweated, and afterwards sealing this with compound.

The connection to the aluminium wire is made by means of a "jim crow" shaped clip, which grips the wire in two positions, the lead being sweated to a screw used for tightening in the centre, and the whole joint afterwards painted over with aluminium paint; no trouble whatever has been experienced with such a joint, although one section has been in constant use for nine years, connecting up a supply to a 50-H.P. motor from an aluminium overhead line running alongside a main-line railway.

In an average case, a 10-H.P. motor will meet all the power requirements of a farm, except for thrashing and cider milling, but motors up to 20 H.P. have been hired out for these purposes, which are only seasonal jobs, and do not require a permanent fixing.

The greatest obstacle to cheap rural supply is the question of wayleaves; when it is necessary to go outside the boundary



of a Provisional Order area to supply in a district without such an order, many unnecessary legal difficulties are encountered. A line to supply a farm building and residence was held up over twelve months, although it was only necessary to cross two small meadows, certain members of the local District Council viewing the application for permission to supply electric power as a means of negotiating for an extension of water supply to a house quite two miles away. Application was made to the Board of Trade for an over-riding order, and they suggested further negotiations before granting it. When an agreement was eventually come to, the legal costs amounted to more than twice the cost of the transmission lines.

This, obviously, is not as it should be; such obstacles prevent proper development and are a bar to progress.

A typical installation on a Hereford dairy farm consists of

*An illustrated description of the Hereford system appeared in the *ELECTRICAL REVIEW* of June 11th, 1915.—Eds.

an 8.5-h.p. open-type motor, running at a speed of 960 R.P.M., with the starting panel mounted alongside. A vacuum pump for the milking machinery requires $1\frac{1}{2}$ h.p.; this machine is used twice daily, for about two hours in the morning and one and a quarter hours in the afternoon. The cows milked average about 70, and the machinery has a capacity of 88. The farm bailiff states that it would require at least five expert milkers to do the work in the same time, or with his present staff five or six hours a day longer.

Root-pulping and chaff-cutting machines are placed on an upper floor in order to keep out all the dust which generally arises when dry hay is being cut. The roots are thrown over into the machine hopper, and the chaff comes down a chute on the wall; the two are mixed and fed fresh to the cattle. Experience shows that owing to the easy starting of an electric motor the exact quantity of food can be cut and mixed fresh as required, a very important result being a greater yield of cream in the milk.

A machine for kibbling corn and rolling oats is installed, and a circular saw for splitting wood and fencing material. There are many other operations that could be done most efficiently by electricity. In the future an apparatus for electrically heating water will be installed. The farm buildings are lighted throughout with 25 lamps each of 25 c.p.; the bailiff's house and some cottages are supplied off the same line through "penny-in-the-slot" meters.

The units consumed on this farm for the year 1915 amounted to 2,411, at 2½d. per unit, and the revenue reached £25, or an average of 9s. 7d. weekly. The quarterly energy consumption for power was:—

June	...	...	...	...	369
September	...	...	...	...	716
December	...	...	...	...	665
March	...	...	...	...	631

The use of electricity means a considerable saving in labour, although the operations could be performed, as on many other farms, by oil or gas engines. Engine stopping and starting, however, require time, and it would also be necessary to send men and carts for oil or coal to the nearest town or railway station, all of which takes time, and should be added to the cost of any other type of power, but rarely is taken into account.

There are many operations requiring power always to be found in agricultural areas, which are peculiar to the particular district. An old stone cider mill in Hereford is used to crush apples, and the presses are driven by a 10-h.p. motor.

A portable motor is used for filtering and racking cider; it is also used for shearing sheep, by a flexible shaft driving the cutters, regulating being done by the controller in the motor starter.

Machines are used for the drying of spent apples after the juice has been extracted, and the apples are afterwards used for cattle food; one large machine of this description requires about 25 h.p., and runs for three months, 24 hours daily, with as few stops as possible. The same motor is used for sawing wood during other months of the year.

Similar drying machines are used for grains and spent hops, the grain being used as a cattle food and the spent hops for bedding, while the seeds from the hops are used for the preparation of a dye stuff.

In the greater part of the hop-growing district, the demand per farm would run up to 25 h.p., which would be used for spraying the hopyards, and driving fans and pocket-filling presses; it is also possible that electroculture would be of assistance in extinguishing blight, and this would open up a field of incalculable value.

The introduction of electrical ploughing, and of electrically-driven wagons for the general hauling work, is a possible development of the near future.

It requires about 1.5 acres of land to provide food for each horse kept on a farm, and the work being seasonal, at times many horses are needed for a few weeks together; again, there are many weeks when horses cannot be used owing to the land being in an unsuitable state due to weather conditions.

An electrically-driven plough or wagon would not be standing in a stable, eating its head off, and the elimination of horses would release further land for cropping. From a mechanical point of view, it would not be a difficult matter to design a machine that could be used alternately to plough, or to drive a thrasher, and which could be run into position to drive the general farm machinery. With a suitable pulley and geared counter-shafts for varying speeds, 10 to 12 h.p. would cover the power requirements for all usual operations, and the machine would be a farmer's "Mary Ann." But the vital necessity is a permanent power supply available on the farm; the rest would be simple, as no other form of power could be utilised in such a manner. The ordinary size of battery used on an electric vehicle would be sufficiently large to plough a good many acres of land, and could be charged in the usual way at night, with a boosting charge during the day if necessary.

A petrol-driven two-furrow plough weighs about 20 cwt., and develops about 11 h.p., requiring about two gallons of petrol, or benzine, per acre, with a certain amount of lubricant. The total weight of a battery on a one-ton van, for a 50-mile radius, is about 1,260 lb., giving a speed of 12 miles per hour; the total weight of the chassis is 3,400 lb., and if we substitute the plough blades for the weight of a pair of wheels and gear it to travel about 120 ft. a minute, it would

be fair to assume that a battery-driven plough is not an impossible machine.

The battery charge capacity being equal to 18 k.w., the cost would be very low, at usual power rates, per charge. There is little doubt that with charging facilities available, some persons would be enterprising enough to invest in such a plough and hire it out to farmers.

The ELECTRICAL REVIEW of February 11th, 1916, contained a description of an electrical ploughing gear driven from overhead lines on a Nottinghamshire farm; most farms have a certain area of arable land permanently used for cropping, round which light overhead lines could be erected to certain points, and by means of a trailing cable carried on a drum, geared with the speed of the plough to pay in and out (the cable being sheathed with tough rubber compound), the double-winding rope-hauling ploughing gear of the usual type could be dispensed with, and a plough carrying a single motor and controller used. The slow rate of speed of a plough along a furrow would not endanger the life of a trailing cable.

Electric ploughing on an extensive practical scale has been carried out in Germany, Sweden, Italy, and France, the results being usually stated to be in favour of electricity as compared with either animal, steam, or oil ploughing tackle. German investigators have declared that for really heavy ploughing, the only competitor of steam is electricity. Many of the published data regarding ploughing costs are, however, not really comparable, as the local conditions, depth of ploughing, &c., greatly influence the results obtained.

In the Hereford supply area, the district is typically agricultural. The horse-power of motors in use and units consumed generally in carrying out the operations are as follows:—

Cider making	...	...	160 H.P.	67,404 units.
Milling	...	...	142 H.P.	347,856 "
Farmers' supply	...	...	106 H.P.	19,673 "
Water pumping	...	...	157 H.P.	331,295 "
Sawmilling	...	...	130 H.P.	22,804 "

A scheme of high-tension three-phase supply has been prepared for the Hereford area, which it is proposed to carry out after the war, there being a growing demand for electricity from farmers and private residences that cannot be met by a 440-volt three-wire supply. There are as a rule five farms to the mile along an average road; there are also many ordinary country residences. We can estimate an average revenue of at least £100 per annum from the five farms, and anything from £20 to £200 from the private houses. Large country residences are only too anxious for such a permanent source of supply, and sixpence a unit could be quite easily obtained.

A few notes have been taken of the consumption and generating costs of several large mansions in the Hereford area, of which the following is typical:—

The installation consists of an oil-engine of 16 B.H.P.; a battery of 54 cells, of 400 ampere-hour capacity; and 300 25-c.p. lamps are installed.

Average cost of "Royal Daylight" oil for twelve months, 10d. per gal.; 24 units of electricity delivered into house for every gallon used—4d. per unit for oil. There were also 25 gallons of cylinder oil used at 8s. 2d. = £3 19s. 2d. The cost of small repairs, not including repairs to wiring in the house, amounted to £4 12s. 3d. Wages of man to look after engine, &c., 28s per week, plus house and coal, 10s. per week = £9s 16s. An allowance of 15 per cent. depreciation. must be added on the cost of the battery. In all such private installations the current consumption could be increased considerably. It will be found that generally those responsible for running these small lighting plants deprecate the use of anything but lighting, and put as many difficulties in the owner's way as possible, with the result that for power and other purposes numerous small oil engines are being run in out-of-the-way places, for instance, for water supply, ice making, stable work, &c.

Electric cooking and heating offer enormous possibilities, and a permanent supply would be received with open arms by the residents, who are under no misapprehension as to being able to produce electricity cheaper themselves. The average revenue in such a case should amount to between £150 and £200 per annum; the owners in most cases would be quite willing to meet the cost of the service extensions, running over their own estates, from the main supply, or agree to a minimum charge of 10 per cent. on capital cost of extension, with a kilowatt demand and small charge per unit.

In recent years a good deal of attention has been given to the future development of electric supply in this country on a wholesale scale, and some engineers have pictured a future in which the country will be served by a network of transmission lines. Such lines will in most cases have to pass through agricultural districts, which, if properly exploited by the existing supply authorities, would be in such a state of development that a paying load could be obtained along the route to commence with. In such a case it may be assumed that it would cost something like £2,000 to cut into the E.H.T. lines for a supply of low-tension energy.

Existing data show that the average consumption of current in an agricultural district with a population of 22,500 is 58 units per head, so that taking the county of Hereford as a whole, with a population of 114,296, the possible sale of energy on the same basis would amount to, say, 6,637,000 units.

This supply would be given to an area 10 miles long by 35 miles wide, from a central distributing point. Throughout England, towns of any size of over 20,000 population are 25 to 30 miles apart, with smaller towns of up to 10,000 people between; this is the case in all the agricultural areas, and the distribution lines from most E.H.T. transformer stations would thus extend to about 15 miles radius.

It will be seen that the estimated output of 6,637,000 units, at an average price of 3d. per unit, would represent a revenue of £82,962, or taking as a basis the number of farms in the county—3,573 of an average of 150 acres—and allowing the same yearly revenue as already obtained from farms connected to the Hereford city supply, viz., £25, we obtain a revenue of £89,325 from farms alone. If the farms did not all elect to use electricity, there would still remain numerous country houses and rural industries as available consumers, as well as village water supply and electric lighting installations. It is probable that the estimated consumption given would be exceeded.

As a matter of comparison, it may be pointed out that the South Metropolitan Electric Supply Co., during the year, had an output of 6,695,481 units sold, at an average price of 2.23d. per unit, resulting in a total revenue of £62,068.

In this case, mains and distributing system would be a great deal more expensive in capital cost than a system composed of E.H.T. overhead trunk lines, radiating from a transformer station in four directions and interconnected by H.T. transmission lines, off which small transformers would supply individual farms and rural consumers; it would be much easier to sell the current in these districts than in large towns where there is competition in the form of gas supply and better railway facilities for coal and oil for generating power. Electricity would have a field to exploit alone.

There are many other directions in which electricity is making headway in connection with agriculture which should not be overlooked, and the foremost of these is "Electro-Culture." Experiments that have already been carried out have given most favourable results, notably those of Mr. J. S. Newman, of Bristol, and Miss Dudgeon, of Lincluden, Dumfries.

Miss Dudgeon is still carrying on her experiments, the current supply being obtained from a 30-volt storage battery used with a spark coil and rectifying vacuum valves; these are, however, expensive instruments and quite out of the question for an ordinary farmer, besides requiring a certain amount of expert knowledge to get the best results. If a high-tension alternating supply were available, a small transformer with valves for rectifying and an automatic time-switch for controlling would be less costly, and could be built up in such a manner that it would be quite safe to place it on any farm. The current consumption alone would not be great, but the increased yield per acre of foodstuff would be of the utmost value to the country.

For the first three years, 1912, 1913 and 1914, the crop experimented on was potatoes, with the result that each season there was a considerable difference between the weight of the crop lifted off the electrified and unelectrified areas. The increase in yield of tubers lifted under the discharge wires over those from the control was in 1912 1,209 lb., in 1913 1,561 lb., and in 1914 2,633 lb.

The total acreage under potatoes in the United Kingdom was for years 1911 to 1913, 1,200,000 acres, and the average yield per acre 5 tons 7 cwt.

Last year, 1915, the crop chosen for experiment was oats, which was grown on the same field as used in previous trials for potatoes. The season was an exceptionally dry one, there was a scorching sun, and the field being of a gravelly nature, devoid of all shade, these combined conditions were not conducive to the harvesting of a heavy crop.

From the very commencement of the growth, the oats under the electrified network showed a conspicuous difference in comparison with the unelectrified, and did not suffer from the prevailing drought to the same extent; which fact seems to confirm the theory suggested by Prof. Lemstrom, that the electrified current causes an ascent of liquid in the capillary tubes of the plant, and by means of this attraction it is quite possible that these tubers obtained moisture from a lower stratum, which the plants not under the discharge were unable to do.

When the crop was ripe for harvesting the two plots were cut, thrashed, and weighed separately, showing the remarkable difference of 31 per cent. in grain, and 63 per cent. in straw, in favour of the electrified oats.

The subject of electroculture is still in the experimental stage, but it may be remarked that the majority of the numerous investigators in this field are optimistic as to the future, and more than one foreign Government is officially investigating the matter. From the farmer's point of view the first cost of the installation appears to be the dominating factor; the power requisite would be comparatively small—Mr. J. E. Newman estimated that 1 h.p. would be sufficient for 50 acres. The fact of electricity being required for such a purpose would, however, inevitably lead to its adoption for lighting and power purposes.

Some of the other uses of electricity in agriculture are the incubation of chickens, and chicken culture, an industry rapidly gaining in importance in England. Eggs hatched in incubators sometimes yield a percentage of weakly chickens, so that many young chicks die during the first few days.

The application of suitable high-frequency current for the chicks almost entirely prevents this death, owing to its

stimulating effect, while they gain weight on their normal amount of food at an increased rate, becoming in two months as heavy as chickens grown for three in the ordinary way.

According to the *Electrical World*, the great sheep ranches in the stock-raising regions of Oregon are large consumers of electricity for light and power. Central-station energy is used for pumping in the irrigation districts and for chopping grain for stock feed in the winter. In one of the stock-raising farms, electricity has been put to a novel use for the winter fattening of sheep.

The sheep pens are wired, and the electric light is turned on during the winter months from 4 p.m. to 9 p.m. Under this artificial illumination the sheep continue to feed until the lights are extinguished; at 4 a.m. the lamps are again turned on and then burned until daylight, and again the sheep feed. In this way the sheep are made to feed during the equivalent of a long summer day, and thus, despite the winter season, are brought quickly to the condition for marketing.

The foregoing notes represent only a brief outline of the possible directions for electrical development in connection with agriculture. No reference has been made to the domestic uses of electricity on the farm, which will almost certainly exceed those of the town consumer; nor has any mention been made of future developments in connection with the production of artificial fertilisers by electrical means. For the moment it is sufficient to point out that electric power and light appeals so strongly to the agriculturist that but little exertion would be required on the part of the central-station authorities to secure a really profitable business.

Successful as individual efforts might be, the results obtained would be insignificant compared with those which might be secured were an organised campaign in favour of agricultural electrical supply to be instituted, and efforts made to equip demonstration farms in suitable districts near existing towns.

Concerted action is strongly called for, both for private reasons, to frustrate the efforts of the oil-engine makers to monopolise the farmer's power business, and on national grounds, because it is imperative that no effort be spared in obtaining the mutual support of our industries with a view to securing the maximum of industrial efficiency after the war.

DISCUSSION.

The discussion was opened by Coun. LANGFORD (Hereford), who, speaking as a practical farmer, gave a short account of the use he was making of electricity supply. He employed electricity for driving a milking machine for 80 cows, for chaff cutting, root pulping, water pumping, and sheep shearing; he lighted all the farm buildings and the yard, and, in addition, operated a cider making plant electrically. He was satisfied that agriculture offered great scope for the electrical engineer in regard to power, light, &c. However, there were certain other things which he wanted to do electrically, such as to plough the land, till it, mow grass, reap it, and haul it home, all matters which the present skilled labour shortage had brought to the front. Moreover, in a dry season he wanted to be able to pump river water on to the land and irrigate it. As a market gardener with 12,000 apple and plum trees, and 4,000 current bushes, he appreciated how much easier it would be to wash the trees and keep down blight if electricity were available there. He had arranged to give electroculture a trial, but this was now deferred till after the war. He had been connected with farming for 24 years, and had scrapped steam power for oil power, and later turned from oil to electricity; to-day many farmers had said good-bye to steam, but others were waiting for electricity to come along. The steam engine was dirty, noisy, and thirsty, and the oil engine was apt to jib at times, and the smoke affected the milk, unless great care was taken. It was possible to procure an electric motor for about half the cost of the steam or oil engine, which was a great consideration to the farmer; then, no engine-driver was required if electricity were used, and that represented a saving of £70 or £80 a year. From experience, he found electrical equipment extremely reliable, the only trouble having been the blowing of fuses, and there was no possible contamination of the milk. The motor took practically no room, and it required no space for fuel storage. He thought the advantages of electric light were even greater than those of electric power, as it enabled working hours to be extended by as much as three hours in winter, and was a great improvement over hand oil lamps. As an instance of the results, he mentioned the case of a farm hand who gave notice for the sole reason that he had never worked so many hours a day before. Electric supply to farms would confer a great boon on agriculture and on the nation; he was quite certain that if the problem was generally attacked a successful result would be attained.

Mr. FRANK AYTON (Ipswich) said those engineers who were intent on getting the agricultural land would find much useful matter in the paper. A battery-driven plough on the lines suggested by the author would require a very large battery to provide for emergencies. The paper raised the question of wayleaves; they must get more reasonable legislation on that matter, and he suggested that the Association had stronger grounds now for making representations to the Government on the subject. It would probably be necessary to adopt the three-phase H.T. system of supply, and suitable

plant could easily be added to existing direct-current stations. Engineers must educate the agriculturists in their vicinity on the subject through the local papers.

Coun. DYMOND (Hereford) pointed out that their local farmers did not need educating; they were "howling" for the supply, and just now could not get it. Leaving out four large consumers, the remaining 983 ordinary consumers gave them an average income of £5 12s. each, while the 19 agricultural consumers paid them an average of £25 apiece, showing the value of this type of consumer, which, so far as he could see, should be the case in other districts. The bar to connecting all the farmers in the district was the wayleave difficulty; the process of obtaining leave for one connection had to be all repeated for another. The present was an appropriate time to get the agricultural load, as the questions of labour saving and increasing agricultural production were very much to the front. If the local authorities could get resolutions passed by local agricultural councils and forward them to the Board of Agriculture, which in turn would deal with the Board of Trade, they might get some amelioration of the conditions hampering supply in rural areas. Electro-culture was in an experimental stage, because electricity supply was so rarely available on the farm, but in the future great developments would take place, and he thought that the increased value of the crops which would be obtained would be out of all proportion to the cost of electricity used in obtaining it, and that they should be allowed to charge a special rate for such a purpose. For many years much technical supervision would be required, and the supply would be worth a good deal more than the statutory maximum of 8d. per unit.

Mr. W. B. WOODHOUSE (Yorkshire Power Co.) said attention should be drawn to the lessened fire risk when using electricity on the farm. Many small farmers were using energy from the Yorkshire Power Co.'s mains, being supplied through pole-type transformers. If the farmer wanted a supply, the wayleave was easily obtained. The Yorkshire Agricultural Council had carried out an interesting investigation to find out the influence of smoke on vegetation in the town and at various distances outside. In the case of a lettuce, grown under comparable conditions and watered with rain-water obtained in the centre of Leeds, it was found to weigh 44 grm. as against 56 grm. one mile out, 120 grm. 3½ miles out, and 175 grm. 6½ miles out, showing the effect of the acid in the smoke, which would be practically done away with by the adoption of electrical methods in the town.

Mr. S. E. BRITTON (Chester) mentioned that he had been supplying a 500-acre farm during the last twelve months; previously the farmer used coal, costing £33, and this had been replaced by electricity, costing £23 (at 1d. per unit), and the farmer was delighted with the result.

Mr. BEXON (Kilmarnock) said they had five farms connected to their H.T. transmission system*, and the annual revenue varied from £15 to £19; all the farmers were quite satisfied that electricity was much cheaper than steam, and he was now connecting another five farms. The supply was given through pole transformers, and it had facilitated obtaining wayleaves across agricultural land.

Coun. LANGFORD, replying to Mr. Fedden, assured him that the modern milking machine was quite satisfactory in use, and the suction was adjusted to allow for the gradually diminishing pressure of milk.

Mr. WILLIAM LOW (Marykirk), in a communication, said he had been using electricity for farm purposes for a number of years, having developed a small water power and taken the supply a distance of 2,000 yds. A dry summer stopped the plant, and he regarded it as essential for the supply to be available always, which could only be guaranteed by a public supply undertaking. The overhead line consisted of six strands of No. 4 hard-drawn copper, 16 ft. above ground, with poles 65 yds. apart. Electricity was used for lighting buildings and cottages, and for threshing—a 15-h.p. motor, 660 a.p.m., being employed to drive the mill and straw carrier; for driving a cream separator, an operation taking 20 to 30 minutes, and releasing a dairymaid for other work; he considered that the electric motor had great advantages over steam or oil power. He had some doubt as to the feasibility of electric ploughing, and would not recommend a battery-driven wagon to pull the plough, while the cost of conductors at every fence on a farm would be great for seasonal use and ugly. He used a 15-h.p. motor to drive a band saw for timber cutting, and found it more satisfactory than the circular saw; the same motor was used to drive a stone breaker for road repairs. Water pumping was also done at two points, using a 1-h.p. motor. A 1-h.p. motor driving a mangle was considered to save quite a day's work a week. Electricity was used for heating by means of radiators, and a ventilating fan was a convenience. A cold storage plant driven by a 2½-h.p. motor was also in use, and no doubt there was a future before electric cooking, given a reliable supply. He had experimented in electroculture for six years, and while he was satisfied that he obtained increased crops under certain conditions, he was not able to ascertain the cost. Such experiments were necessarily uncertain owing, amongst other things, to the wind carrying the discharge away from the plot, often on to the control plot if situated to leeward. He had tried to intercept part of the drifting discharge by means of small-mesh wire net-

ting, but did not prevent it getting to the control with a wind in that direction. A difference of 20 per cent. was observed on two different hay plots in 1914, but the year was exceptional, as the wind blew continuously from the control plot. In conclusion, he suggested that the supply authorities, in view of the results being obtained by the author and others, should endeavour to interest the agricultural and rural community in the subject.

The author decided to contribute his reply to the *Proceedings*.

[Mr. BEXON, in a letter received by us before the Convention, stated that electricity was used by local farmers for lighting, ironing, heating, motors for crushing and chopping, and for driving milking machines. He added that when the question of farm supply first arose, he was personally of opinion that it would yield a very poor revenue, but from experience he found that the revenue obtained was very good.]

THE NATIONAL PHYSICAL LABORATORY.

THE report of the Executive Committee for the year ended March 31st, 1916, was submitted to the General Board at a meeting on June 20th, 1916. It states that the work of the Laboratory has been greatly affected by the war, ordinary research work having to give way to special investigation undertaken for Government departments. Sir Wm. Crookes's term of office as President of the Royal Society having expired in November last, his successor, Sir J. J. Thomson, is now chairman of the General Board. Two members of the staff, Mr. Donald Ewen and Mr. H. E. Barwood, have given their lives for their country, while, on the other hand, Mr. G. H. Millar, taken prisoner at Antwerp, escaped from Döberitz, and has been given a commission. Over 40 members of the staff are serving with the Forces; the remainder have not been permitted to enlist, owing to the demands of the Government on the services of the Laboratory, and owing to the great increase in the work, many temporary additions have been made to the staff. By desire of the Committee of the Privy Council for Scientific and Industrial Research, particulars have been laid before it as to various researches in which the Laboratory can be of assistance to British industries, and during the year help has been given to a number of firms which have undertaken the manufacture of goods formerly obtainable only from German sources. Additional buildings have been erected for aeronautical research.

In the Physics Department (Mr. F. E. Smith), the Electrical Standards Division has been occupied with the investigation of problems in connection with wireless telegraphy. The Division for General Electrical Measurements has continued the research on magnet steels for the I.E.E., and in the Electrotechnics Division Mr. C. C. Paterson has made arrangements for a new branch of test work. Other departments, whilst largely engaged on Government work, have been able to make some progress with their normal duties.

In the Physics Department, in addition to special tests for the Ministry of Munitions, 140 electrical measurements were made, compared with 191 last year and 259 in 1914; under the head of Electrotechnics, 10,444 tests were made, including 3,171 ammeters and 3,136 voltmeters, 1,954 shunts, and 1,224 supply meters, compared with totals of 5,080 last year and 3,828 in 1914; photometric tests numbered 3,053, including 2,324 luminous dials (a new item), compared with 410 and 1,142 in 1915 and 1914.

The accounts show a credit balance of £1,568. The income rose from £39,653 to £51,372, and the expenditure from £39,573 to £49,804. The staff increased from 217 to 337.

Physics Department.—Much of the time of the "Fundamental Units" Section (Mr. F. E. Smith) has been occupied with confidential work; in addition, the improvement of compasses for use in the lifeboats of merchant ships, and the testing of prismatic compasses for Service use, were amongst the matters dealt with. In the section for General Electrical Measurements (Mr. Campbell and Mr. Dye) an inductometer suitable for high frequencies, and having a wide range of self-inductance, has been constructed, and three new sensitive vibration galvanometers have been built. The improvement of methods of testing the magnetic properties of bars has received attention, and a paper communicated to the Institution of Electrical Engineers (Elec. Rev., December 31st, 1915, p. 559) gave a full account of the new methods.

Electrotechnics (Mr. Paterson).—The test work has been mainly of a confidential character, and practically all ordinary research work has been suspended. The setting-up of standards for, and the testing of, self-luminous dials for aeroplane and other instruments for use at night has necessitated the collection of much valuable and interesting information on the behaviour of the luminous compounds and of the completed dials. In the D.C. and resistance measurement section, the amount of work has been more than three times that of the heaviest pre-war year, though the staff is numerically the same as before the war. In the case of large current shunts, the design of the main current terminals has been found to be most important; in one instance, owing to the design of the end connections, a difference of 8 per cent. could be obtained, depending on the method of leading in the current.

*See ELECTRICAL REVIEW, June 16th and 23rd, 1916.

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EXPORT TRADE AND ENEMY INFLUENCES.

It was announced last week that the Foreign Trade Department had just published a consolidating statutory list containing over 1,500 names of firms of enemy origin or association in foreign countries with whom persons in the United Kingdom were forbidden to trade, and that additions to the list would be issued at frequent intervals. Naturally, these lists are primarily intended for the information of British manufacturers and exporters during the period of the war, although they should also be of great advantage on the conclusion of hostilities in the sense of deterring, as far as possible, British firms from resuming trading transactions with these now enemy firms or individuals. Simultaneously with the publication of the new statutory list comes the announcement from Washington that neutral Powers have proposed that the Government of the United States should take the initiative in negotiations for the purpose of the adoption of some form of concerted reprisals against the black-lists. We do not think, however, that the United States will fall into this 'fresh snare' which has obviously been laid by, or at the instance of, German agents, notwithstanding the large Teutonic population in the United States. So extensive, indeed, is the German element in that country, particularly in commercial and financial circles, that it is often difficult for outsiders to determine from names of firms whether they are American, German, or German-American, and it is equally difficult to say offhand whether individuals with German names are really German, or whether they are naturalised citizens of the United States. Similar observations also apply to the South American Republics, and to Holland and the Scandinavian countries in Europe, where German names, and foreign names adopted by Germans in order to disguise their nationality, are to be found in abundance.

It is, however, not our purpose to discuss the question of nationality. We have merely set forth what has preceded in order to emphasise the enormous ramifications of the German element throughout the world, and to show superficially what British manufacturers will still have in front of them in the future period of peace. But, with the assistance of the statutory lists and the information which is being collected by the various committees appointed by the Government to consider the subject of British trade after the war, it should be possible successfully to resist the threatened resumption by the Germans of a great commercial onslaught in the markets of the world in the future. Although the Germans occupy the premier position for mendacity in political matters, and may also hold the same status in commercial and trading affairs, we cannot entirely reject as being totally devoid of foundation the reports emanating from Germany as to the accumulation of stocks, even under present conditions, in readiness for disposal at any prices obtainable in external markets when normal conditions have been restored. Such a state of affairs, however, cannot prevail to any large extent in regard to the German electrical engineering industry, in consequence of the comparative scarcity of copper and other metals which have been requisitioned for war purposes, although we believe that

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(J. A. Berly's.)

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copper is still being produced in the country at the rate of 42,000 tons per annum. At all events, one company, which annually produces 22,000 tons, reported an output of this quantity last year, and the other copper producers may be expected also to have turned out their normal tonnage owing to the pressure of the Army authorities. But this in no way disposes of the fact that all the copper is needed for military requirements, directly or indirectly, and that none can, therefore, be available for the manufacture or construction of plant solely for peace purposes.

The immediate ability of the German electrical firms to dump large quantities of their manufactures in the world markets directly after the war, even if shipping be available for such a purpose, need not be regarded as so threatening a factor as in the case of some other branches of trade, and the official lists of enemy firms should assist us in our efforts to prevent later Teutonic competition from being successful. As we have repeatedly shown, however, much will depend upon the ability of other nations to meet the world's requirements. Our reference to the German influence which is present in parts of the industries of the States, reminds us of some recent comments of the *Electrical World*, in which our contemporary shows that, though the world is thirsting for electrical goods, "American manufacturers have not taken advantage of the opportunity to supply the markets of the world" with them. The export electrical trade of the world in 1913 was, according to the writer, in the neighbourhood of £25,000,000, but in 1915 it was only £10,000,000, first, because Germany was shut in by our blockade; secondly, because there was a certain falling-off in the world's purchasing power; and thirdly, because our factories and our ships were otherwise occupied. Some of these effects were, when war broke out, expected to afford America just that opportunity as an electrical exporter that one would have expected her to desire. But, according to the *Electrical World's* comments, that opportunity has been allowed to pass. Whether the cause be the pre-occupation of American industries with their great prosperity, or whether the German hyphen and the indisposition to enter a market which there might not be a desire to hold after the war had any influence on the situation, the fact remains. We hope that the British electrical manufacturer is fully alive to the necessity for preparing for the production of that greatly increased output and for energetic export-selling propaganda and efforts to enable him to handle a good share of the business that is represented by that accumulated deficit of exports of the war years, much of which will require to be provided in addition to the normal export trade.

Foreign Undertakings in Russia.

ALTHOUGH sequestrations of the property of foreigners in Germany have been numerous during the course of the war, and foreign businesses or companies have been extinguished, the Teutons do not particularly enjoy reciprocal treatment in other countries. The German idea is that if the Teutons establish a company in another country, and under the laws or authority of that country, it becomes a native company, even if most, or all, of the capital is held in Germany. But the allied nations no longer intend to allow this subterfuge to prevail. In the case of Russia, it appears that an Imperial Order was recently issued deciding on the determination of the Kieff Electricity Co., and stipulating that the liquidation should be carried out by a committee appointed by the Government and the Kieff Town Council. If this action should be carried out, a German newspaper remarks that it would represent a contravention of law, as the

company is a Russian concern and, according to its statutes, liquidation can only be brought about by a resolution of the shareholders. But when it is mentioned that all the shares are held by one company—the Berlin Electrical Undertakings Co.—no ground exists for the Teutonic protest, as the elimination of the German element as far as possible now forms one of the definite items in the programme of the allied nations. At the same time, it is impossible to refrain from drawing attention to two other matters in which neutral capital in Russian is mostly concerned, although as the information is derived from another German source its accuracy is open to suspicion, particularly when applied to neutral countries. Both cases refer to Moscow, the Town Council of which has endeavoured to expropriate the local undertaking of the Petrograd Electric Lighting Co. of 1886. The first relates to the Belgian Electric Central Station Co., which sought a concession to compete with the former and lodged a deposit of £100,000. It is now alleged that the Moscow Town Council has declared the contract with the Belgian company to be dissolved, and the deposit forfeited through non-fulfilment of the agreement. In the second case, the Town Council is said to be opposing the prolongation of the concession of the Swedish-Danish-Russian Telephone Co., in which neutral capital is principally interested. It is known that the Germans take pleasure in attempting to sow discord among the Allies, and between the Allies and neutral countries, and the present examples may represent further efforts in this direction. At any rate, if any excess of zeal should be manifested by the Moscow Municipal Council, which has already experienced the steady effects of the Government in regard to the proposed expropriation of the local electricity works, it is probable that the Ministerial Council will only permit of the adoption of such measures as would be justified by the circumstances of each individual case after mature consideration.

Rubber.

WITHIN the last few weeks the price of crude rubber has had frequent and erratic fluctuations, but the outlook remains very much involved. What with political and war uncertainties, and the fact that the manufacturing trades over the summer months are usually in a more subdued condition, while buyers do not care to anticipate their needs far ahead, the future course of the market is rather problematic. In the earlier part of the current month there was no mistaking the prevalent feeling of depression, while considerable quantities of un-sold plantation rubber were awaiting disposal on the spot. Prices fell to about 2s. 2½d. for No. 1 latex, but recovered at one time to nearly 2s. 5d., which has been followed by a renewed break, although the market has latterly shown more staying power, thanks to evidences of an improving demand from the home trade and for export to the Continent. The more recent buying was more centred on smoked sheets, the value of which description has ruled comparatively firmer, and now stands practically on a par with No. 1 crepe. There has been more interest, too, in the lower-priced grades of crepe rubber. The June imports were comparatively small against the same month last year, with the receipts from wild rubber producing countries again disclosing a falling off, and the Liverpool and London stocks showed an appreciable reduction, but recent arrivals have been more liberal, and the supply is seemingly, on the whole, keeping well ahead of the demand, so that there is not a very hopeful feeling as to the stability of the market, although prices are relatively low. Holders of spot rubber seem rather keen to lighten their stocks, and buyers are cautious. The absence of any American revival of inquiries is undoubtedly

being felt, and until buying from that quarter re-asserts itself, unsettled conditions must be expected to continue, though the worst of the depression has credibly been seen, judging from the fact that prices for next year's deliveries remain at a fair premium over the value of spot rubber. Whereas the recent exports to American ports were relatively small, as compared with the abnormally heavy returns in the same period last year; the quantities sent to France and to Russia were of respectable dimensions, and prospects as regards the outlet in these countries are considered pretty good. Home consumers seem more disposed to lay in stocks for future needs at the present level of prices, but trans-Atlantic manufacturers are, apparently, still drawing on their old stocks, as usual, till towards the autumn. There is evidently less anxiety in that quarter as to future supplies, while fairly large quantities are on the way. It is estimated that the Eastern shipments for the past month were about 9,200 tons, making an aggregate of, roughly, 55,000 tons for the first half of this year, comparing with about 6,000 tons and 47,000 tons for the corresponding periods last year. There has been more doing lately in Brazilian descriptions, and the price of hard Para has risen to a rather stiff premium over the value of best plantation rubber. This feature is somewhat puzzling in view of the keen competition of plantation grades, although it is chiefly due to the limited supply available.

Industrial Fatigue.

A FEW months ago we drew attention in these columns to the importance of the study of industrial fatigue, in connection with the conditions of working under high pressure which have been brought about by the war, and to the excellent Memorandum issued by the Health of Munition Workers' Committee on this subject. The report of the Chief Inspector of Factories and Workshops for the year 1915, which was recently issued—a mere shadow of its former self, owing to the exceptional demands upon a depleted staff—contains some interesting references to this matter, showing that there seems to be a more general recognition of the advantages of a week-end rest. Sunday labour has been found to be unsatisfactory; not only has it a detrimental effect upon the physical condition of the worker, it also often results in loss of time on other days of the week, and the Ministry of Munitions considers it preferable to work a moderate amount of overtime during the week, with a break on Sunday, rather than to work on from day to day. Where possible, work is conducted continuously on a system of two or three shifts, though the shortage of skilled labour has necessitated working overtime in some cases; but the Home Office keeps a tight hand on the amount of overtime allowed. It is pleasing to note that, in spite of the long hours and continuous pressure, no evidence has been observed (except in the case of foremen and managers, and some of the older workmen) that the strain has produced any ill-effects upon the workers; there have been indications of fatigue, but this is quickly overcome by a temporary rest from overtime, and the system of watching workers and affording them temporary relief whenever undue signs of fatigue are shown is recommended by the Home Office.

The great improvement in the care devoted to the welfare of the workers, the provision of canteens and mess-rooms, and arrangements for dealing with cases of injury and sickness, are welcomed by the Inspector as most important developments which are likely to remain after the war; as Miss Anderson, the principal lady inspector, remarks, these reforms are partly due to the "general awakening to the dependence of efficient output on the welfare of the human agent." We trust that the lesson will never be forgotten.

NOTES ON ELECTROPLATING.

By S. V. THORP.

(Continued from page 61.)

Vats and Tanks Used in Plating.—The plating-vat may be constructed of either wood or iron. For nickel, silver, gold, brass, copper, or zinc solutions, a wooden vat is used, having an outer casing made of deal or pine of suitable thickness, grooved and feathered and bolted at either end with iron plates. The whole is then lined inside with chemically pure lead, and the joints are burnt, not soldered together, as soldering introduces tin, which will injure the solution, and may set up electrolytic action in combination with the lead. Inside this is a lining of match-boarding, which is fitted in loose to allow for expansion when filled with liquid; otherwise it would burst, due to its swelling. For hot solutions of brass, copper, tin, or zinc, an iron vat is used, in which the solution is kept hot by means of a steam coil placed at the bottom of the tank, the number of convolutions in the coil being arranged according to the steam pressure and size of tanks. When an iron vat is used a wooden frame should be placed on the top, and earthenware insulators are fixed to carry the brass rods, from which are hung the anodes and articles to be plated. The anode plates for the vats are sometimes cast or rolled, but in all cases they must be perfectly pure, and they are hung on the rods with hooks, the shape of the plates and hooks

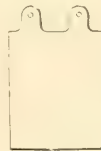


FIG. 1.

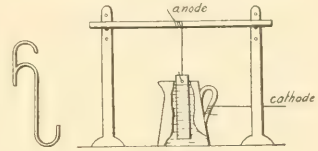


FIG. 2.

being illustrated by fig. 1. The scouring and swilling trough is made of wood, and lined inside with lead, a constant supply of water from a tap or pipe being run into the trough. The dipping pans are usually of stoneware, and vary according to the work. The potash, or cleansing, tank must be made of iron, the best quality being essential, owing to the constant heating required. The sawdust pans are made with a false bottom to contain water, which, while keeping the sawdust hot, prevents it from being burnt.

Cleansing of Articles before Plating.—Before articles are plated, they need to be chemically clean, or the deposited metal will not adhere to them properly. For this reason, after the article is received from the polisher, it is wired and placed in the hot potash tank, and well rubbed with a mop, to ensure all grease being removed, such, for example, as may be due to handling. On being removed from the cleansing solution, the article should be well scoured with pumice powder and water. It can then be placed in the plating vat, but since an almost imperceptible film of oxide may have formed on the surface of the article, it is advisable to dip brass or copper articles for a second or two into a cyanide dipping solution: this ensures the deposit adhering firmly. For iron or steel articles it is better to use a hydrochloric acid dip, and for cast-iron the hydrochloric is replaced by sulphuric acid.

The process of cleaning work preparatory to plating by an electric current has proved successful, and it is being adopted in works which have to deal with large quantities. The solution, which is worked hot, consists of special salts; the anodes consist of carbon, and the resistance board is so constructed that the current may be reversed without removing the articles from the vat. The work is wired as for plating, placed in the vat, and the current adjusted so as to cause a rapid evolution of gas at the work being cleaned, and as this rises to the surface of the solution it will carry with it grease and dirt in the form of a dirty scum. As soon as the work appears discoloured, the current must be reversed, and the work becomes the anode. This reversing of the current removes the oxide

formed on the surface of the work, which will appear quite bright and chemically clean. When removed, the work is well swilled in cold water, dipped for a second or two into one of the acid dips, according to the material of the work cleaned, and then transferred to the plating vat.

Nickel Plating.—Nickel plating is, perhaps, carried out by many methods more than any other plating process in connection with the other processes. Assuming that we have some articles to plate—for instance, the parts of a cycle—as received from the polisher, they will be sure to have a fine film of grease upon the surface. The articles are wired and are then being in boiling caustic potash, well rubbed with a nap, taken out, and well swilled in cold running water. They should then be thoroughly scoured with pumice powder and water; when finished, the water should hang to all parts of the articles in the same way as oil would. The articles in this case being steel, are dipped for a second or so in the hydrochloric acid dip, rinsed thoroughly, and immediately transferred to the vat, with the current on, and left for one to three hours according to the thickness of deposit required. If the solution, which is worked cold, be agitated, the articles will only require to be in the solution half the time required in a stationary solution. Whilst the deposit is going on, the rods should be occasionally lifted or tapped to release the gas which forms on the articles, but where the solution is agitated, the tapping of the rods is not required. The articles are now removed from the vat, swilled well in hot water, then rubbed dry in sawdust, and if the work is properly carried out a rich silvery deposit is the result.

Nickel plating is done directly on iron or steel, but for high-class work and certain special goods it is best to copper-plate the article first. To do this, the article is prepared as for nickel-plating, then placed in the copper vat, and when the desired thickness is obtained, it is taken out, well scoured, rinsed, and placed in the nickel vat. This gives a much better looking deposit, and one that wears better than a nickel deposit direct on the steel or iron. In re-plating, it is always advisable to remove old nickel from iron or steel by polishing, or a much quicker and simpler method is by using a nickel stripping solution, which in a few minutes strips a coat of nickel which may have taken an hour or two to deposit, and, moreover, does not damage the article, as in other processes. In these cases, the work to be stripped is used as the anode, and the cathodes must be of sheet-lead or carbon.

Copper and Brass Plating.—In copper and brass plating the preparation of the articles is the same as for nickel-plating. For coppering there are two well-known solutions, the acid copper solution, which involves the use of copper sulphate crystals, and the copper cyanide solution, in which copper carbonate and potassium cyanide are used. With the acid copper solution, excellent copper can be deposited on copper, brass, lead, or metallised moulding materials such as compounds of wax, but not upon steel, iron, tin, zinc, or metallic alloys which are more electropositive than copper, and for the latter it is necessary, first, to copper-plate in the cyanide bath, afterwards transferring to the acid bath. Although for a given deposit in the cyanide bath more electrical energy is used than in the acid solution, the rate of deposit per ampere-hour is just double. The cyanide bath should be worked hot, about 135° F., as it has an extremely high resistance at ordinary temperatures. By adding zinc carbonate to the copper cyanide bath, a brass deposit of varying colour, depending on the amount of zinc present in the solution, can be obtained. The best results for electro-brassing are obtained by first giving the articles a coat of copper; when well coated, scratch-brush, and place in the brassing vat till the desired thickness of deposit is obtained. In using potassium cyanide or its solutions, great care is needed, as it is a strong poison, and blood-poisoning will probably result if a cut or scratched hand comes in contact with the solution.

Silver and Gold Plating.—For silver plating, the solution consists of silver chloride dissolved in potassium cyanide. The work is prepared as before, only before being placed in the silver vat the articles are dipped in an amalgamating solution composed of mercuric salts, for a few seconds, until they show a whitish appearance, then well swilled in water, and placed in the silver vat. After being in the solution a few minutes, and coated over, they

are taken out, swilled, and scratch-brushed, immersed again in the amalgamating solution, and put in the silver vat till the required thickness is obtained. For gold plating the electrolyte varies greatly, depending on the class of work and the colour desired, &c. Gold baths are usually made by dissolving gold chloride in a potassium cyanide solution. In plating with cheaper metals, the anode surface is large enough to keep the solution up to full strength, but in gold plating this is not always the case, on account of the high cost of the anodes. They are usually much smaller than the article being plated, and the solution is consequently reduced in strength as plating progresses, so it is necessary to watch the bath carefully, and to strengthen the solution from time to time. Some baths are worked hot, and some cold, and the proportion of gold necessary depends on which method is used. With a cold bath the stronger currents give the darker deposit, while in the hot bath the temperature determines the colour, the higher temperature giving the darker colour.

Electroplating with gold requires great skill, because the metal is so valuable that the plater must use every means possible to produce the required results with the least possible amount of metal.

Zinc Plating.—For the electrodeposition of zinc, the solution can be worked hot or cold. Cold electro-zincing or electrogalvanising is perhaps used most, and is specially suitable as an "anti-rust" coat upon articles such as screws, washers, staples, tubes, rods, &c. The deposit is clean and smooth, and if a dull finish is required, the article has an excellent appearance; if a bright finish is wanted, scratch-brushing following the plating gives the required brightness.

Barrel Plating.—The mechanical plating of small articles in a revolving barrel is a great saving in a shop where large quantities of small articles are constantly being plated, as the articles do not need to be wired, which in itself is a great saving in time and labour. The barrels revolve at from 15 to 30 revolutions a minute, depending on the size, shape, and number of articles put into them, but in all cases there must just be a sufficient number of articles to allow them to roll, but not to be carried round with the barrel. The barrels are usually constructed with wooden bottoms and perforated celluloid sides, the perforations being of such a size as not to allow the articles to fall out. The barrel in some types is raised and lowered by means of a rope and pulley block, the articles being emptied into a sieve. A very good arrangement is to have the apparatus so arranged that, after plating, the barrel can be turned right over into a swilling tank and revolved in it by the same shaft, thus preventing all risks of articles becoming stained due to their not being thoroughly rinsed.

While articles are receiving their deposits, the continual rubbing gives them a high polish, and the deposit is also close in grain, due to the constant rubbing, making the deposit more durable.

It is impossible to get articles burnt by this process, and the anode surface should be as large as possible, owing to the large amount of surface of the articles in the barrel. For drying-out purposes, a revolving sawdust barrel is sometimes employed; the barrel is so constructed for the special purpose of keeping the sawdust hot and dry during the whole process of drying-out. It has an inner and outer casing, between which is water to prevent the sawdust from burning.

Method of Plating Inside Metal Vessels.—To plate inside metal vessels, such as jugs, sugar-basins, presentation cups, &c., fig. 2, the article is filled with the solution, and the anode-plate is hung by suitable means inside it. If the edges of the article are defective, as they sometimes are, and to provide for plating at a point not reached by the solution, a method known as "doctoring" may be practised, by which the anode—or a portion of it—is swathed (with a piece of stick to stiffen it) in a few coverings of calico, and attached to the + pole of the generator, while the article to be doctor'd is attached to the — pole. By continually dipping the covered end of the anode in the solution, and gently rubbing over the spot to be covered, a fair coating will result in a short space of time. It is essential that the cloth be kept continually impregnated with fresh solution during the operation,

when, in a few minutes, sufficient metal should be deposited to stand burnishing or finishing, and if care is taken the faulty place should not be discernible.

Parcel Plating and Sand Blasting.—The plating of articles in two or three colours is done by stopping off the part of the article which does not require to be plated. For example, take a copper plate, some part to be left copper colour and the other silver; the part that requires to be left copper is varnished with stopping-off varnish, and when thoroughly dry the article is cleaned and put in the silver vat until the desired thickness of deposit is obtained. It is then swilled and dried out in sawdust in the usual way. When dry, it is placed in turpentine till the varnish is softened, and can be brushed off. It is then well cleaned and dried, when it is ready for burnishing or finishing, as desired. Articles of jewellery are done in a similar manner. For example, if gold flowers are required on a silver brooch, the part which does not require to appear gold is stopped off and treated as just described.

Articles that require a frosted appearance, such as cigar and cigarette cases, match-boxes, &c., are sand-blasted, and if material of suitable size is used, a fine or coarse matt appearance can be obtained.

ELECTRICITY SUPPLY AT HOLMFIRTH.

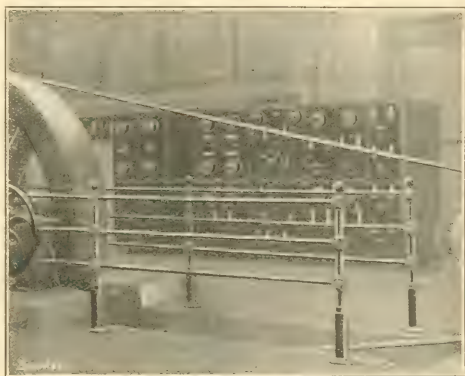
THE official inauguration of the Holmfirth Urban District Council's electricity undertaking took place on Saturday, the 15th inst., when the generating station and equipment were inspected by the Electricity Committee.

The question of lighting the town and district by electricity was publicly considered in 1911, when the ratepayers adopted a resolution to apply for a provisional order, which decision was later confirmed by a plebiscite of the ratepayers.

The provisional order was obtained in August, 1912, and negotiations were opened with the Yorkshire Electric Power Co. with a view to obtaining a supply of electricity "in bulk"; local opposition to the scheme asserted itself, however, and as it seemed probable that the Yorkshire Electric Power Co. would not be in a position to give the

town, and provision has been made for probable extensions in the future; the plant consists of direct-current generators, driven by gas engines supplied with producer gas, working in conjunction with a small battery.

The gas-producing plant is placed in a shed which adjoins the generating station, and consists of two open-hearth suction producers, of Messrs. Crossley Bros.' latest design, having several novel features. One useful feature is the arrangement of pipe connections, by which either engine can be run from either plant merely by closing and opening isolation valves: the gas generator is a



MAIN SWITCHBOARD, HOLMFIRTH.

cylindrical vessel, lined with firebrick, the fuel being supported on a stepped grate, so that the fuel bed is in full view of the operator.

By an ingenious arrangement of water siphon, the amount of steam generated is automatically governed by the load on the engine. The water necessary to generate the steam passes through several gilled tubes in series, receiving an increment of heat from each tube, and finally overflows into a "flash" tube, where it is flashed into steam.

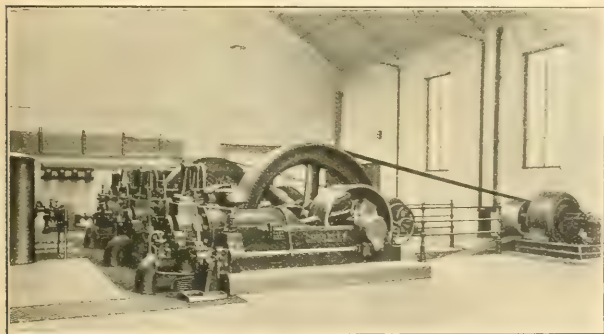
On its way to the scrubber for cooling and cleaning, the hot gas is made to pass through two cascades of water which form the overflow to the scrubber: by this means the heavier impurities are removed before the gas reaches the coke in the scrubber.

The gas engines are of the Crossley horizontal type, developing 190 B.H.P. (maximum) and 95 B.H.P. (maximum) respectively, and both running at 190 R.P.M. The larger one is a double-cylinder engine, while the smaller one has only one cylinder: the cylinders are all of the same size, which obviates the need for holding a large stock of spare parts.

The engine governing is of the "variable admission" type, in which the main inlet valve itself becomes a throttle; impulses are not only given to the engine at each working stroke, but are certain, at any position of the governor.

The electric generators are of Messrs. Broadbent's well-known "D" type, and are belt-driven from the engine fly-wheels. The larger of the two generators has an output of 100 kw. when running at a speed of 625 R.P.M., and the output of the other is 60 kw. when running at a speed of 640 R.P.M. The generators have auxiliary poles, and are each fitted with three bearings of the automatic ring oiling type. We understand that the temperature rises of the windings, taken at the end of the full load test-run, were—in the case of each machine—well below the limits laid down by the "E.S.C."

The three-wire system of distribution is employed, with a declared pressure of 440 volts across the outers, and the neutral earthed. A rotary balancer by Messrs. Broad-



GAS-ENGINE-DRIVEN GENERATORS, HOLMFIRTH ELECTRICITY WORK.

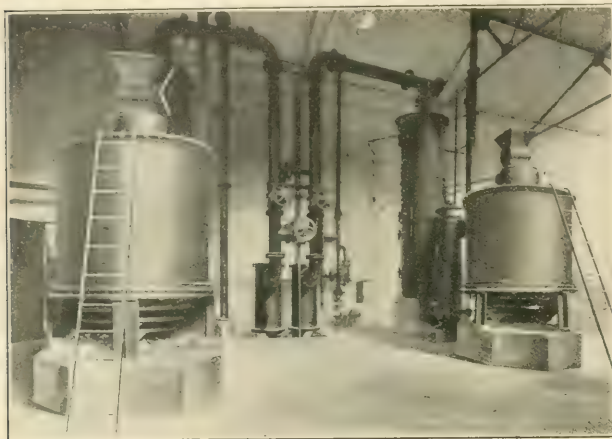
proposed supply for some few years, the original scheme was dropped.

The Council accordingly decided to establish an electricity works of its own in Holmfirth, and, an Electricity Committee having been appointed, tenders for the entire generating equipment and complete installation were called for, to the specification of Mr. A. B. Mountain, and the contract was ultimately awarded to Messrs. T. W. Broadbent, Ltd., of Huddersfield. The Council is to be congratulated on having allotted the work before the recent heavy increase in the costs of all engineering materials took effect, although, as a matter of fact, the formal contract was not prepared until March, 1915.

The electricity works are situated near the centre of the

bent is employed to maintain electrical equilibrium between the two sides of the system, and there is a small Chloride battery to deal with the night load. This battery consists of 250 "HUG 3/5" type cells in glass boxes; sufficient margin has been allowed in the dimensions to meet the possible requirements of additional capacity at some future date. The battery is capable of discharging at the rate of 104 amperes for one hour, or 20 amperes for 10 hours; for charging it, a three-wire motor-driven booster, supplied by Messrs. Broadbent, is employed.

The switchboard consists of eight panels of enamelled slate; three generator panels (one of them being blank at present), one battery panel, one balancer panel, one booster



GAS PRODUCER PLANT HOLMFIRTH ELECTRICITY WORKS.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Lamp-locking Batten Holder.

In response to the very considerable demands of the trade Messrs. LAMLOCK, of 18, Ranelagh Gardens, Hammersmith, W., have now introduced a lamp-locking batten holder, which we illustrate in fig. 1. It will be seen that this fitting consists of a flange piece for fixing on to the batten, with a short-distance piece screwed on to it, while the lampholder is attached to the other end of the distance piece by means of a suitable screwed clamping ring.

The lamp lock is of the makers' well-known "pin" pattern, the pin screwing through the lower flange of the distance piece into

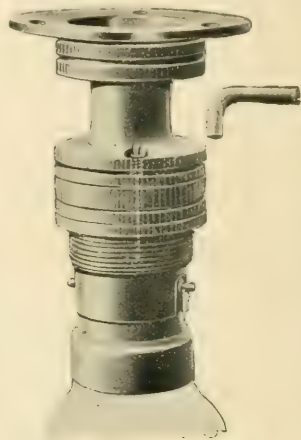


FIG. 1. LAMP-LOCKING BATTEN HOLDER.

panel, four feeder panels, and two street-lighting panels; this also was made throughout by Messrs. Broadbent.

The distribution has been carried out on the three-wire system, by means of overhead mains, on steel poles in the centre of the town and on wooden poles in the outskirts. It may be mentioned in this connection that the arrangement of poles, struts, stays, and brackets has been carried out in a specially-secure manner suited to the peculiarities of Holmfirth, where acute angles and steep hills present problems requiring more than an ordinary amount of thought and attention. The poles also serve as standards for the street-lighting fittings and lamps, the street lamps being controlled by automatic time-switches, which are affixed to the poles when required.

House services are tapped off the overhead wires, and the tappings are taken into the consumer's houses (usually into the upper storey) through porcelain leading-in tubes. The charges for current are 6d. per unit for lighting and 2d. per unit for motive power, heating or cooking; and they are not unreasonable, in view of the present high prices of fuel, &c.

Already there is a fair demand for current for lighting purposes, and if the demand grows as it is expected to, the undertaking should, under the capable management of Mr. A. C. Bott, the engineer to the Council, prove a practical success. The capital charges are not excessive, and it is likely that the ratepayers will in time be rewarded for their enterprise.

We are indebted to Messrs. T. W. Broadbent, Ltd., for the particulars and views here given.

the holder, and pressing on the lamp top, thus preventing the lamp from being lifted in the bayonet socket and removed. The pin is turned by means of a small key, shown in our view.

The batten holder is solidly made in brass and machined all over.

Hand-operated Starting Compensators.

The BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, have issued a new list, No. 5,250, dealing with type N R hand-operated starting compensators, for two and three-phase squirrel cage



FIG. 2. B.T.H. WALL-TYPE STARTING COMPENSATOR.

Patents and Alien Enemies.—Licences have been granted by the Board of Trade to Messrs. Edgar Allen & Co., Ltd., and the Rapid Magnetising Machine Co., Ltd., in respect of Patents Nos. 14,082/08, granted to Ulrich, and 17,139/09, 29,201/11, 29,224/11, 29,230/11, 4,595/13, 14,426/13, 14,427/13, and 24,353/13, granted to Fried. Krupp A.G. Grusonwerk,

induction motors. These are designed to reduce the excessive starting current of such motors without unduly reducing the torque, and consist essentially of an auto-transformer in which a

tapping is taken off the winding at a suitable point to secure the required reduction in voltage.

Such compensators are suitable for 25, 33½, 40, 50 or 60-cycle squirrel cage motors of up to 750 H.P. on pressures of from 95 to 3,300 volts and are built either in wall suspension or floor types, the latter being for large sizes.

The switch handle has three positions "off," "starting" and "running." An automatic low-voltage release is fitted and, if desired, overload relays can be provided as also push-button stops. In order to meet different starting requirements, the starting voltage can be varied by means of the several taps provided on the compensator winding. The compensator and oil switch are enclosed in a C.I. case, with the switch, which is of the oil-immersed type, underneath in the wall pattern and on the top in the floor pattern.

The largest compensators, owing to the currents dealt with, have a separate sheet-iron control panel carrying the switches, ammeter, current and potential transformers, and are provided with steel framework and expanded metal screens.

SEARCHLIGHT CARBONS.

In a lecture delivered at the U.S. Coast Artillery School, last year, Mr. R. B. Chillas dealt with the subject of searchlight carbons; the following is an abstract of his remarks, which were reprinted in the *Journal of the U.S. Artillery*:

The principal considerations governing the choice of the proper carbons for searchlight requirement are that the positive crater of the arc shall be maintained at the focal point of the parabolic mirror, and that the lamp mechanism and the carbons shall be so co-ordinated as to bring about this condition with the minimum of attention on the part of the operator. The essential requirement for this is that the lamp mechanism shall advance the carbons at as nearly as possible the same rate as that at which they are consumed.

The types of lamp mechanisms available are those that have:—

1. A fixed feeding ratio.
2. A variable feed ratio, under control of the operator.
3. A semi-automatic feeding mechanism. (See Beck lamp).

The first type largely predominates, and since this presents the most severe carbon conditions, the discussion will be confined to this type only.

The basis upon which the present work was carried out is that the function of the positive carbon is to produce a light of the maximum efficiency, steadiness, and concentration, while the negative carbon, which is the more important from an electrical standpoint, must maintain a steady arc, cause the least possible sacrifice in the efficiency, and permit the required degree of control of the linear burning ratio of positive to negative.

The desired searchlight arc should excel in the following particulars:—

- (1) Small positive crater, with high current densities, and thus high crater temperature throughout the crater area, which gives high intrinsic brilliancy; (2) small negative carbons; (3) long arc length; (4) uniform mixture of carbon, so as to help evenness of burning.

The present discussion mainly concerns the first three of these. The importance of the last is fully realised by the manufacturer, and need not be taken up at present.

In experimental tests on the present standard sizes it was found that when the arc is on the negative shell, instead of on the core, the arc stream issues from a very small bright spot, apparently as a high velocity blast, in a direction normal to the carbon surface. If this surface is directly facing the positive, the stream is straight, and usually steady; if not, the arc must bend toward the positive, and unsteadiness, hissing, and rapid wanderings of the arc occur, often resulting in an outage (arc break).

For a 200-ampere, 70-volt arc, the diameter of the negative spot is estimated at .07 in. to .10 in. (1.8 to 2.5 mm.), corresponding to a current density of 25,000 to 50,000 amperes per sq. in. (3,900 to 7,800 amperes per sq. cm.). The diameter and the current density of the positive bright spot or arc crater are, respectively, .8 in. (20 mm.), and 400 amperes per sq. in. (62 amperes per sq. cm.).

In operating large negatives, such as the G. E. 36-in. and the foreign 100-ampere 21 mm. or similar larger ones (current densities below 200 amperes per sq. in. or 30 amperes per sq. cm.), the prevailing shape of the tip of the negative is blunt and rounded, or even slightly cupped with cored negatives. With such a shape, periods of marked unsteadiness and troublesome burning are almost certain to occur. The appearance of the positive crater reminds one of an octopus, with many rapidly-moving tentacles. The efficiency at such times is very low, 30 per cent. of normal. The negative finally becomes sufficiently rounded, and the arc becomes steady for 20-30 minutes, to be followed by another spasm of 3-5 minutes of poor burning; this cycle repeats through the life of a trim. The operator can do very little to overcome such trouble; it appears to be due mainly to a faulty choice of sizes.

It was noticed that very good steady arcs occurred provided a favourably-shaped point was obtained, on which the tendency to wander was diminished; that the core in the negative is non-essential; that such a carbon would probably be of small diameter, and this, if true, would give an added advantage in that the shadow region, due to the negative, would be decreased. Some heavily copper-coated solid carbons, with diameters ¾, 1, and 1½ in.

(13, 16, and 19 mm.), were tried on the 60-in. lamp at 200 amperes. These indicated the value of the small negative.

With a properly-chosen grade of carbon, the negative bright spot scarcely wanders from the tip of the carbon; in fact, a small graphitised "wart" about 0.10 in. in diameter forms on the end of the carbon, and the arc persistently stays on this tip.

On the G. E. 60-in. lamp, using 2-in. diameter positive and 1½-in. negative, at 175 or 200 amperes, the arc on the positive wanders sufficiently to keep a fairly well-formed carbon crater, though the actual arc crater or hot spot does not nearly cover the end of the carbon. This necessarily leads to unsteadiness and poor efficiency in the searchlight beams.

With a negative as above described, the arc stream is directed steadily at a spot on the positive, where a bright, sharply-defined arc crater appears, and a very deep crater may form (if the positive is large), until finally the tip of the negative is within the crater, and the arc burns against the sides, tending to give a somewhat spherical hole within the positive.

A material improvement could be made by decreasing the size of the positive. An interesting series of observations was obtained on crater formations under different conditions, using high-grade positive carbons with a small 418-C core and ½-in. copper-coated coke solid negative, at a current of 200 amperes and 68-70 volts.

Carbon diameter, in.	Crater characteristics.	Steadiness.
1.0.	Rounded end of carbon, arc crater overlapped end, hissed badly.	Very poor.
1.125-1.25.	Nearly flat crater, sharp edges.	Fair.
1.375.	Good cup-shaped crater, sharp edges, arc crater nearly covered the carbon crater. Best general condition.	Excellent.
1.50-1.625.	Deeper crater, outer edges slightly rounded, good general condition.	Good.
1.75-2.00.	Crater very deep, with nearly parallel sides. May be wider at bottom than at mouth. Negative tip within crater, very noisy, outer edges more rounded.	Erratic, good, or very poor.

As the diameter increases, spindling and the rate of consumption decreases.

Another series of tests with 1½-in. positives and ½-in. copper covered negatives, and varying the current and voltage slightly, gave the following:—

Current.	Arc voltage.	Crater formation.
Normal — 200 amps.	Normal — 68 volts	Normal
Normal — 200 "	Lowered — 66 "	Tends to deepen
Normal — 200 "	Raised — 70 "	Tends to flatten
Raised — 210 "	Normal — 68 "	Tends to flatten
Lowered — 190 "	Normal — 68 "	Tends to deepen
Raised — 210 "	Raised — 70 "	Flat, unsteady
Lowered — 190 "	Lowered — 66 "	Rapidly deepens

While the crater formation is controlled principally by the carbon size, the influence of the texture of the carbon must be considered at the same time. The first question that enters with changes in texture is that of spindling. A carbon of sufficient size must be selected such that when it has spindled to its natural shape the end will be large enough for the crater.

The arc crater should almost wholly occupy or cover the end of the positive carbon, so as to form a symmetrical cup-shaped carbon crater. This gives a sharply defined beam of high efficiency, since there is no low temperature radiating surface facing the mirror at the focus. Furthermore, the crater being definitely located on the end of the carbon, it cannot wander laterally out of focus, and hence there results a steadier beam.

A further improvement has also been made by cutting down the size of the core hole in the positive. With the new steady negatives, the positive core areas have been reduced to 25-30 per cent. of the former sizes.

The negative carbon is the more important from electrical considerations. The maximum operating arc voltage with a given line voltage is measured by the permissible number of outages, or arc breaks, within a given time.

In tests to determine the proper size, it was found possible to choose a plain negative, which will have the capacity to carry continuously such a current as will give a positive crater covering the tip. A carbon of this size, however, will tend to burn blunt, and hence is unsteady. This statement applies more particularly in the case of currents above 75 amperes for reasons which will be discussed below. Smaller carbons tend to spindle excessively, but the steadiness usually improves as the tip becomes pointed. For 100-110 amperes a 1-in. diameter carbon is about at full load, and spindles approximately 3 in. Increased current carrying capacity is therefore required, and may be secured as follows:—

1. By increased diameter. This is in the direction away from steadiness, as shown above.

2. By changes in mix. This is also expensive and of very limited range, as shown by years of almost vain efforts to get satisfactory results with the present sizes.

3. By copper coating. This is by far the simplest and offers a much wider range of control and better burning conditions than any of the above.

With positives chosen as above described, it has been found that by successively decreasing the size of the negative and at the same time increasing the amount of copper coat, the necessary current carrying capacity can be maintained and a tip shape increasingly favourable to steadiness is obtained.

It has been found that beyond a certain point further increases in the amount of copper give a relatively small decrease in resistance.

The best negative carbon craters are, therefore, require somewhat less than the positive to give satisfactory combustion operation.

There is, therefore, a large margin may be made in the rate of consumption of the positive carbon, the amount of copper or by slight changes in diameter from that which gives the test steadiness.

It has been found that the positives and negatives selected as above described, 1.5-1.6, and burning ratio, while increasing as the size of carbon craters, it can be seen to be essentially 1 to 1 for a large number of the usual sizes, with but little or no sacrifice in efficiency.

This feeding ratio appears to be quite generally standard among the principal lamp makers, except that one large American manufacturer who has supplied a number of lamps to each the Army and Navy, has used a 1.65 to 1 ratio for a number of years.

Various figures from tests on the present G.E. mechanism show the following burning ratio results:

Size in inches

60-in. 18" x 12" Pos.	12 Neg.	3.00-3.75 Hrs.
36-in. 14" x 10" "	8" x 9" "	2.75-3.50 "
24-in. 10" x 10" "	6" x 9" "	3.00-3.50 "
Small lamps, 18", 13", and 9-in.		3.00-3.50 "

The advantages in operation greatly outweigh the somewhat short life.

An important feature is that a larger volume of positive carbon is consumed for a given volume of negative carbon in the larger sizes than in the smaller ones.

It has been found that the cross section of a copper coated negative which will burn with a well pointed tip and which lies in the region of the best control of the copper coat, is proportional to the current plus a constant.

With positives selected to have a crater covering the tip, it is found that the current density increases as size increases. Since the radiating surface per unit volume decreases, and the wattage per unit volume when the carbon has burned to shape rapidly increases with increase in diameter, the operating temperature of the tip tends to rise, and therefore the rate of consumption of the positive increases at a rate more than proportional to the current.

If it is desired to maintain a given lamp feeding ratio, the diameter of the positive must increase faster than the current, in order to keep the crater at the focus.

The 1-1 lamp feeding ratio chosen most nearly fulfils the requirements of good burning, for normal grades of carbon in the range of currents between 70 and 125 amperes. The sizes of positive to give 1-1 burning ratio at 150 and 200 amperes are too large for the best burning conditions, but since the 150-ampere size is not much used in American practice, though quite common abroad, the 1-1 ratio has been adhered to for this trim.

For the 200 ampere size, 6.8-7.0 are volts, the best positive is about 35 mm. (1½ in.), and with a 16-mm. (¾ in.) negative, the burning ratio is about 1.35 to 1. For 1-1 burning the positive must be 40-41 mm. (1½ in.) in diameter. The smaller size is preferred.

For currents less than 50 amperes and a 1-1 ratio lamp, the positive must be smaller than that required by the crater conditions. Decreasing the negative leads to short life, since the available burning length is ordinarily rather small. Hence a slightly faster burning positive has been chosen for these smaller sizes.

In connection with the above discussion, it has been found that a 10 per cent. variation either side of the rated current may be made without appreciably affecting the burning ratio.

The preceding discussion has been based on steady operation.

If the operation of the lamp is intermittent, the net result is that the rate of consumption of the negative is decreased, giving an increase ratio and a tendency towards a positive crater movement.

It should be noted here that the effect of intermittent operation is different with different classes of carbons.

A few notes concerning the use of the flame arc for searchlight purposes may be of interest.

It has been found that the positive arc crater on an impregnated flame carbon is of decidedly smaller area than the crater on a pure carbon. The carbons for this work are of special design, using a pure carbon shell with an impregnated flame carbon core. Only a very short length of carbon actually carries the current, and this is wholly within the cooling chamber of the carbon holder.

It should be borne in mind that the current carrying capacity of a (metallic) conductor is limited mainly by the operating temperature, so that the current can be raised, provided that adequate cooling methods are used.

The negative carbon is also of small diameter, and is properly cooled. For example, the carbons now under test in a 150-ampere lamp are a 16-mm. (¾ in.) flame-cored positive, and a 11-mm. (⅞ in.) cored negative. The actual positive crater is about 14 mm. in diameter. In operation, the negative carbon is inclined at an angle of about 20° below the axis, and in such a position that the central tongue in the negative arc flame strikes about on the upper edge of the positive crater. The positive carbon is continuously rotated and fed forward, and forms a symmetrical crater about 10 mm. deep, filled with the highly luminous gas of the flame arc. This gives an extremely concentrated light source of high candle-power, which is practically ideal for searchlight requirements.

A comparison of the Beck and the Sperry lamps shows the following essential differences: The Beck lamp makes use of a spray of alcohol, or other similar hydrocarbon, against the hot tips of the carbons. The alcohol ignites, but the temperature of its flame is said to be sufficiently below the operating temperature of the tips to act virtually as a cooling agent. In addition, the products of combustion act as a protective sheath, to prevent undue oxidation. Since alcohol is not permitted aboard warships, it will probably be necessary to use some other material. In the Sperry

lamp cooling is accomplished, and spindling prevented by means of an air-cooled copper radiator, which surrounds the positive nearly up to the tip. Immediately in front of this radiator is a short-fused silica tube, out of which about ½ in. to ¾ in. of carbon is allowed to project. Air is supplied by a small motor-driven blower to this radiator, and also to the negative holder.

Two methods have been used for candle-power measurements, the first being the "point by point" method, which is both tedious and unsatisfactory; the second is a method developed in this laboratory using the integrating sphere, which, it is believed, will prove generally useful for this type of work.

LEGAL.

LADY CHEMISTS AND AN ELECTROLYTIC PROCESS.

An electrolytic process for the production of caustic potash was the subject of an application by two ladies in the Patents Court on Thursday last week.

Miss E. J. Smith, principal of the Chemical Works, Disraeli Road, Willesden, applied for a Board of Trade licence to use Patent 11,639, of 1910, in the name of Dr. Jean Billiter, of Vienna. Miss Smith was accompanied by her chief chemist, Miss Markham.

The Chemical Works, Willesden, is said to be the only chemical factory in England run by ladies. Miss Smith has considerable electrical experience. She passed at Edinburgh University through Prof. Bailey's class in Electrical Engineering, and, indeed, all the engineering classes at that University for the B.Sc. (Engineering), besides gaining distinctions in the Senior Engineering Class. Miss Markham is a Distinguished Honours student from the Chemical Department of Oxford University.

The process is for electrolysing liquids with cathodes arranged in strips, which are provided with covers for carrying away gas and permeable to current, the cover enclosing the cathode on all sides like a sack. Modifications provide for membranes completely surrounding the cathodes in the form of tubes, so that the cathode product escapes only by diffusion or electro-diffusion; tubes of asbestos fibre; and a membrane, permeable to current, stretched over the electrodes by weighting with heavy bodies, or rendering the cathodes resilient by springs, or other means, to prevent the formation of detrimental alterations of shape, or detrimental gas spaces. It is claimed that with the new diaphragm processes for the electrolysis of alkali chlorides it is now possible to obtain concentrated alkali solutions with a very good electrolytic efficiency at a comparatively low pressure. That progress was led up to by either a rational stratification and circulation, or a quick removal of the cathode product out of each of the current lines. This type of process, however, has the disadvantage that the anode chamber is completely closed by a diaphragm, through which the feed solution passes into the cathode chamber. For undisturbed working the speed of flow has to be regulated, as the permeability of the diaphragm gradually becomes lessened, and the diaphragms require cleaning or renewal, necessitating the opening of the baths. On the other hand, in the Aussig bell process of electrolysis without diaphragms, the working can go on for years without interruption, but the current density is low, so that the apparatus is rendered larger, and as only small units can be produced it is difficult to watch them. The distribution of the feed solution in numerous small cells is complicated, and both the concentrations of lye and the electrolytic efficiency are lower.

The patent aims to combine the advantages of both processes and to eliminate their disadvantages. The anode chamber is not separated from the cathode chamber by any cohesive diaphragm, the cleansing and renewal are avoided, and yet the work can be carried on with high current densities and good electrolytic efficiency.

Miss Smith conducted her own case without counsel, and treated the Court to technical descriptions; Mr. W. J. Tennant, chartered patent agent, appeared for the patentee, explaining that the patent was applied for through his office, and he was present by the kindness of the Controller of Patents, Mr. Temple Franks (who heard the application), but he was entirely without instructions in the matter.

Miss Smith said she desired to produce caustic potash electrolytically, as a stage in the manufacture of potassium permanganate. She expected to manufacture without difficulty, though her work up to the present in this direction had been principally experimental. She did not propose to put caustic potash on the market. She wished to use the Billiter cell to manufacture at her factory potassium permanganate, and the cells would work for common salt electrolysis or, without any change, for the electrolysis of potassium chloride. There was a large sale for potassium permanganate, and the Government, when they required it, issued orders for 20 tons at a time. It was used in the trenches and all the military hospitals as a disinfectant, and was, she believed, used to refine oil for aeroplanes. She purposed starting with a manufacture of half a ton per week, and would install a 2-kw. dynamo and a 4½-h.p. gas engine.

THE CONTROLLER: And the basis of royalty? Have you considered that?

Miss Smith thought the patentee had not afforded her any too precise details in his specification, and she did not think that anything but a small royalty should be paid. There would be a considerable amount of experimenting to be done. The dynamo,

gas engine, and accessories would probably cost £130. The price of potassium permanganate was fluctuating. At the moment on the market it was 8s. a lb., but it might come down to 6½d., as it was before the war. She did not propose to use the dynamo for anything else. She offered a royalty of 1 per cent.

SIR CORNELIUS DALTON pointed out that the figure could be revised after the war, and in the meantime the royalty would be to the Public Trustee. The Controller then announced that he would report favourably to the Board of Trade on the application.

MONOMETER MANUFACTURING CO., LTD., v. ELEPHANT AND ORDNANCE ACCESSORIES CO., LTD.

WITH reference to this case, in which judgment was given, as already reported, for the plaintiffs on the claim, defendants' counter-claim being dismissed, we understand that a misprint occurred in our issue of June 30th, page 731, fourth line from the bottom, where, instead of 600 lb., 1,000 lb. should have appeared. In our report of the case we omitted to state that the plaintiffs, in presenting their case at Birmingham, said that the furnaces supplied were precisely the same as those supplied by them to the Government.

MUNITION COURT CASES.

DAVID EDWARD JONES, fitter, summoned the Newport Corporation electricity department, at the Munition Tribunal, for unreasonably refusing a leaving certificate. Mr. Nichols Moore, the borough electrical engineer, attended. Complainant stated that he was employed in the power station, and he gave a week's notice. He was influenced by the increased cost of living; his health was sometimes impaired, and his wife was an invalid. He could get higher wages in the repairing shops. The Clerk: Is the place controlled? Complainant: I believe so. Mr. Nichols Moore: It is a certified undertaking. The Tribunal thought that it would be better for the complainant to remain at a permanent place, considering that he was 60 years of age, than to go to a casual job. The Corporation, too, were supplying electricity to other important industries, and that was a factor that had to be kept in view at this time. They declined to grant an order for a leaving certificate.—*South Wales Argus.*

WAR ITEMS.

Exports to China.—In the "London Gazette" for July 25th a further list appears of persons and bodies in China to whom exports may be consigned.

Enemy Companies.—Mr. George Terrell asked the President of the Board of Trade the other day when the promised report as to the progress of the Committee on Enemy Companies and Shareholders would be ready. In reply, Mr. Harcourt stated that a summary of cases dealt with by the Advisory Committee up to June 2nd had been prepared and would shortly be circulated.

German Firms to be Suppressed in Russia.—The following concerns are listed in a proposal of the Minister of Trade and Industry to alienate right of exploitation from a considerable number of enemy firms still operating in Russia:—The Gas & Electricity Co.; the Electricity (formerly Lahmeyer, Frankfurt-on-Main) Co.; the Electricity Contracts Co.; the Westphalian Wire Co., of Hamma.

Edmundson's Roll of Service.—We have received from Edmundson's Electricity Corporation, Ltd., a fine "Roll of Service," giving the names, and their positions with the Corporation, of 363 of their employes who have joined the Colours. Fifty per cent. of the men have already seen service in some form or other. We regret to note that 11 of the staff have lost their lives. Mr. J. Summers, of the Hamilton branch, has been awarded the Military Medal, and Mr. J. C. Knight, of Frome, the D.S.M.

To be Wound up.—The Board of Trade has ordered the following to be wound up, under the Trading with the Enemy Amendment Act:—

Balcke & Co., Ltd., London, S. W., water cooling engineers. Controller: J. W. Barratt, 19a, Coleman Street, London, E.C. F. M. Frye & Co., 46, Upper Thames Street, London, E.C., hardware merchants and tool makers and merchants. Controller: C. W. M. Kemp, 36, Wallbrook, E.C.

M. C. Wedekind & Co., Ltd., 6, Lloyd's Avenue, London, E.C., dealers in old iron and steel. Controller: F. H. Finlaison, 45, London Wall, E.C.

London Electrical Engineers at Plymouth.—On July 14th the Company of London Electrical Engineers which is stationed at Plymouth spent a pleasant evening in celebrating the completion of "a certain course of military enterprise." Major W. H. Merrett, T.D., who presided over the function as O.C. of the Company, spoke enthusiastically of the manner in which the special work undertaken by the Company during the recent period had been carried out. He was proud to be in charge of such well qualified men. Major K. W. Edgcombe then spoke in high praise of the attainments of the London unit, duties of an onerous nature which he had entrusted to them having been attended to with both zeal and skill.—*Western Daily Mercury.*

War Wages at Johannesburg.—The Town Council has granted an increase of 4d. per hour (from 2s. 6d. to 2s. 10d.) to all skilled mechanics and electricians in its employ, as well as a war bonus of 25s. per month to all employes drawing £240 per annum or less, except unskilled persons.

Exemption Applications.—Last week the Jarrow Tribunal heard an application by the Palmer Shipbuilding & Iron Co., Ltd., in respect of 15 unbanded workmen. One was an electrician, and the Clerk remarked that the electricians who came before the Tribunal were all from the South. "That means," observed the Mayor, "that ours have gone somewhere else." "To France," added the Clerk, whereupon the Mayor went on: "They go wherever their services are required."

At Bermondsey Tribunal, Frank Morton, of Isaria, Ltd., electrical engineers, of Tower Bridge Road, S.E., applied for a short temporary exemption in order to complete his arrangements to obtain a commission. He informed the Tribunal that a month would be sufficient time, and this extension was granted him.

During the hearing of appeals at Denton for three employes of the Oldham, Ashton & Hyde Electric Tramway Co., it was stated that 46 per cent. of the employes of the company had joined the Forces, and, although they had a considerably depleted staff, nearly 200,000 more passengers had been carried during the past half-year compared with last year. Two men were granted conditional exemption, and the appeal for the third man, who was single, was disallowed.

A personal appeal was presented at Accrington last Thursday by a Corporation car driver with four children, who was not appealed for by the tramways manager, because he had not attested. It was stated that the man would be 41 in November, and so many men had gone away that the tramways manager would be glad to retain him. He was granted conditional exemption.

At Failsforth, four instrument makers and one meter assembler, employed by Messrs. Ferranti, Ltd., of Hollinwood, were granted temporary exemption until September 1st. Lieutenant Pool (Military representative) in one case remarked that many of the firm's men had been unbanded, and he could not say whether the man now appealing was one of them or not. He thought the firm ought to appeal for the men on business grounds.

At Oldham, the Corporation tramways manager (Mr. Priestley) appealed for a turner, who was granted conditional exemption as being in a reserved occupation, and for an apprentice fitter, who was granted temporary exemption until November.

The Chadderton Tribunal last week heard an appeal by a man (aged 38, married), employed in the insulating and connecting of coils at the works of Messrs. Ferranti, Ltd., Hollinwood. He was granted conditional exemption, being in a reserved trade, and advised to join the Volunteer Training Regiment.

At Rochdale, an appeal by Messrs. Jacksons, of the Hippodrome, for Harry Butterworth (32), electrician, was disallowed.

At Stretford, a cable company appealed for two members of the staff. One was granted conditional exemption, and the appeal for the other was disallowed.

A conscientious objection was lodged at Stretford by a switchboard attendant, aged 28, and married. He said he could not take the military oath either for combatant or non-combatant service. He had been a switchboard attendant for 18 months, and he repudiated a suggestion that he had entered this employment to try to escape military service. The appeal was disallowed.

Cookham (Berks) Tribunal has given exemption until September 1st to C. F. Bingley, electrician.

Bexley Tribunal has conditionally exempted John Hudson, electrician to Mr. W. A. Smith.

At Walthamstow, the Fuller Electric & Manufacturing Co. appealed for 20 employes. Mr. Fuller stated that of the 40 employes, 16 had enlisted and 11 had attested. Seven were given six months each, four three months each, and the other appeals were refused.

On the appeal of the U.D.C., Aylesbury Tribunal has given three months' exemption to the driver of a Diesel engine at the electricity works, the man being a time-expired soldier, aged 36, and single. Three months each were also conceded to an electrician and a confidential clerk employed by a local firm of electrical engineers.

At Bourne (Lincs.), Messrs. Pidcock & Co. appealed for their electrician, Chas. Lilley, and a final month was given, he having already been temporarily exempted until July 1st.

Grantham Tribunal has given exemption until November 1st to Fredk. Ingall (37), electrician at the Empire Theatre.

Hastings Tribunal has given exemption, on condition that he undertakes some public work, to Mr. F. Wordley (36), electric wiring contractor and engineer, of St. Leonard's, who has charge of the X-ray apparatus at the East Sussex Hospital. The same Tribunal has conditionally exempted for three months Mr. R. Chapman (29), electrician with Messrs. Bruce & Co.

East Ham Tribunal has granted three months' exemption to J. W. Collis, electrician.

At Tunbridge Wells, A. E. Heskett, electrical wireman, appealed on business grounds, and also as a conscientious objector. The appeal was rejected.

Eastbourne Tribunal has granted a final six weeks' exemption to an electrician at the Pier, who has charge of the installation.

At Romsey, Major Fraser appealed for the superintendent of his electric plant, and stated that the man would be 41 in a day or two. Exemption was given until the end of September.

Mr. J. Connare (37), electrician, in business in Watford, has been granted conditional exemption by the local Tribunal. The West Kent Appeal Court has given exemption until September 1st to Mr. A. Lynch (30), electrician, of Trosley, near Maidstone.

The East Kent Appeal Court has given exemption until October 11th to Mr. A. E. Coupley (37), electrical attendant on the estate of Major Galway, at Sellindge. The local Tribunal had refused any exemption.

The Blandford Tribunal, on July 20th, considered an appeal by Mr. C. H. Wellman, electrical engineer, of Milton Abbas, and he was given until September 30th. Appellant retorted that he would go at once.

At Stratford-on-Avon, on July 18th, the Electricity Co. appealed for their manager, Mr. J. E. Rendell-Baker (35). The company, it was stated, supplied three hospitals, and power for munition works, besides public and private supplies. The pre-war staff of 11 had been reduced to five. Mr. Rendell-Baker was given conditional exemption.—The same decision was arrived at in an appeal for a fitter at the generating station; and five weeks, with no further appeal without leave, were allowed Mr. A. R. Bailey (24), the company's secretary.

Mr. A. O. Game, engaged with a Catford firm of electrical engineers, the only one left capable of undertaking certain work, has been exempted until November 1st, on condition that he joins the Volunteer Training Corps.

At Carlisle, on July 19th, the Tramway Co. appealed for six married employees, and it was stated that the staff had been so depleted that Mr. McCulloch had had to go driving himself. When the war broke out there were 37 employees; 26 had joined the Army, and they now had only six men of military age, none being under 32, and all being absolutely necessary for the service. In each case conditional exemption was allowed.

At Witney, the U.D.C. applied for extended exemption for Victor Brice (19), station electrician. The manager of the electricity works (Mr. Curel) said that since the last exemption he had advertised for a successor, and had had three or four replies, but none of the applicants were satisfactory. Giving two months, with leave to apply again, the Chairman expressed the hope that another appeal would not be necessary. Mr. Curel replied that he would make every effort to get a substitute.

Ilford Tribunal has given three months' final exemption to Wm. John Hayden (18), an apprentice electrician, enabling him to complete his indentures.

At Bexhill-on-Sea, Messrs. Squirrel & Co., Ltd., of Station Road, appealed for their electrician, J. F. Gibbs (38), who was needed to assist with contract work. Three months were allowed.

CORRESPONDENCE.

Letters received by us after 5 P.M. on TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Neglect of Science.

At the last meeting of the Committee on the Neglect of Science, it was decided to collect well-authenticated cases in which the neglect of science by officials, firms or individuals had caused loss or damage to the nation, firms or persons. If you and your readers can assist in this matter it will be much appreciated. Precise information is required, as it is desired to quote "chapter and verse" in each case.

This, naturally, makes it difficult to obtain the required information, but it will readily be seen that without such full particulars the example would be of little value.

Alfred S. E. Ackermann,
Hon. Treasurer.

Westminster, July 20th, 1916.

P.S.—The Simpson Lever Chain is a case in point!

[We should think that numerous instances will be forthcoming. The collection of such data should be of the greatest value in view of the campaign in favour of reform in the teaching of science which is now in progress.—EDS. ELEC. REV.]

Electric Fans for Military Hospitals.

I was interested to see a letter on this subject in your issue of the 14th from Mr. Falslaw, an old acquaintance.

I have just returned to this country from India, where I have been engaged in electrical contracting work for the past 15 years, in which time I have had some thousands of ceiling

fans through my hands. When I came away, at the end of 1915, the Indian Government was busy buying fans for the Persian Gulf Forces, of the standard patterns used in India.

Probably 80 per cent. of the Indian fans are direct-current 225 volts, as this voltage is almost standard for the country, and is in use in Calcutta, Bombay, Barrackpur, Darjiling, Madras, Dacca, Lahore, &c., and a settled thing for many schemes now in course of execution.

Mr. Falslaw did quite the best thing he could have done in advising his friend to have the fans sent from Bombay, and I hope he has got delivery all right.

Edw. Vickers.

Warwick, July 18th, 1916.

Declaration of Origin of British Goods.

The writer would be pleased if you would inform the electrical trade, through the medium of your paper, of the neglect of British manufacturers and merchants in omitting to attach to invoices declaration of origin. The Customs of South Africa demand a properly worded declaration on British goods, and not merely the words at the foot of invoice "British manufacture." Foreign goods to have the usual pink form of declaration, signed by the Consul and stamp cancelled. Goods of enemy origin that have been in stock prior to the war to have pink forms, signed by a Justice of the Peace.

Of late, several merchants are receiving documents without the necessary declaration; the result is the Customs refuse to release, and demand a deposit of three times the value of the shipment, pending receipt of the necessary document. Furthermore, a fine of £500 can be levied by the authorities should they look upon the shipment suspiciously.

British Agencies, Ltd. (H. BARDEY)

Johannesburg, June 25th, 1916.

[We trust our readers will appreciate the great importance of this communication. Not only in the future, but already in the present, the clearest and most indubitable proofs of the British origin of genuine British manufactures must be furnished upon entry into our overseas Dominions and Colonies, and should be furnished also with exports to allied and neutral countries. British goods should be sharply distinguished from goods of enemy origin.—EDS. ELEC. REV.]

BUSINESS NOTES.

Thermit, Ltd.—MESSRS. THERMIT, LTD., have received official notification from the Public Trustee to the effect that he has entered into an agreement to sell the whole of the enemy shareholding in that company to the Birmingham Metal and Munition Co., Ltd., Birmingham. Messrs. Thermit, Ltd., will continue to trade in exactly the same way as hitherto.

Board of Trade Inquiries.—The Board of Trade Commercial Intelligence Branch has received inquiries from firms at home for the names of British makers of the following—

Batteries for pocket flash lamps.
Cases for pocket flash lamps.
Electrolytic iron.
Fibre, vulcanised red.
Arc-lamp globes (inner and outer).
Lamps, pocket flash.
Magnets, tungsten steel, permanent.
Electric steel castings.

H.M. Minister at Bogota states that the provincial towns in the Republic of Colombia are gradually being supplied with electric lighting installations, for which cheap fittings are required.

H.M. Consul at Lyons reports that a local firm desires to purchase from, or to represent on a commission basis, British manufacturers of supplies and apparatus for the electrical and engineering industries. Applications to the Board of Trade Commercial Intelligence Branch (Reference No. 228).

Bankruptcy Proceedings.—F. BROWN, electrician (formerly partner in the firm of Huoh Bros. & Brown), 8 Stafford Street, Llanelly.—First meeting, August 1st, at Official Receiver's Office, Carmarthen; public examination, August 1st, at the Guildhall, Carmarthen.

C. P. PEARSON (Pearson & Co. and the B.O.A. Engineering Co.), electrical, mechanical and sanitary engineer, decorator and plumber, Manchester.—Trustee (Mr. A. Yearsley) released June 16th, 1916.

G. E. BONNER, electrical agent, Palmer's Green.—First and final dividend, 2s. 2d. in the £, payable July 27th, at 14, Bedford Row, W.C.

For Sale.—The borough of Salford electricity department has for disposal two Browett-Lindley six cylinder compound engines, direct-coupled to Mather & Platt D.C. generators, and one Bailey-Davidson and one Hall vertical steam pump. For further particulars see our advertisement pages to-day.

Trade Announcement.—MR. CHAS. WM. OWENS has taken over the business of Messrs. W. T. OWENS & SONS electrical engineers, of Pontardawe, Mr. Fredk. Wm. Owens having retired.

Dissolutions and Liquidations.—**FUEL GAS, LTD.**—A meeting is called for August 25th at 6, East Parade, Sheffield, to hear an account of the winding-up from the liquidator, Mr. B. C. Davies.

THE CONSTANT VACUUM CARBIDE LIGHT SYNDICATE, LTD.—This company is winding up voluntarily with Mr. A. W. Hoad, of 26 and 91, Queen Street, E.C., as liquidator.

THE SHERARDISING SYNDICATE, LTD.—This company is winding up voluntarily, with Mr. R. J. R. Warner, of 34, Ebony Street, S.W., and Mr. C. J. Jones, of 24, Wood Vale, Forest Hill, S.E., as liquidators. A meeting of creditors is called for July 26th, at 70, Chancery Lane, W.C.

EXCELSIOR ALUMINIUM SOLDER CO. LTD.—A meeting will be held at 14, St. Ann's Square, Manchester, on September 1st, to hear an account of the winding-up from the liquidator, Mr. J. R. Atkins.

E. M. BRINCKMAN & Co. and the **FLEISCHACHER BRITISH LAMP CO.**, London. Creditors of these businesses carried on by Max Brinckmann, at 99, Redcross Street, London, S.E., an enemy subject, must send particulars of their claims, &c., to the Controller, Mr. K. C. Fox, 45, London Wall, E.C., by August 24th.

DONNISON, SILLEM & Co., electrical engineers and contractors, 116, Great Portland Street, W.—Messrs. F. A. Donnison and W. Sillem have dissolved partnership by mutual consent.

An Inquiry from India.—**MR. SUNDERRAO MORESHWAR**, electrical engineer, Girgaum, Bombay, asks for names of firms dealing in machinery for repairing electric fans of all makes, armature winding, &c.; also for catalogues containing description of, and working instructions for, such machinery.

Royal Assent. The following Acts have received the Royal Assent:

Electric Lighting Order Confirmation Act.
Metropolitan Electric Tramways Act.

Catalogues and Lists.—**MESSRS. ALFRED HERBERT, LTD.**, Coventry.—Postal card describing a convenient rubbish destructor for engineering works.

MESSRS. J. H. HEATHMAN & Co., Parson's Green, Fulham, S.W.—Leaflet describing the "Salisbury" truck and "Cleveland" trolley.

MESSRS. QCEAD, LTD., 47-57, Marylebone Lane, Oxford Street, W.—Catalogue of "Quead" electric fires for 1916-17, showing a number of new patterns, with two-colour printing, giving a red-hot appearance to the elements.

THE WESTINGHOUSE COOPER HEWITT CO. LTD., 80, York Road, King's Cross, N.—Pamphlet describing blue-printing apparatus with Cooper Hewitt lamps; a new machine washes, dries, and irons all classes of photo prints "while you wait."

THE IGRANIC ELECTRIC CO. LTD., 147, Queen Victoria Street, E.C.—Leaflet No. 1,621, describing magnetic couplings, clutches, and brakes, for torques from 34 to 51,400 lb. ft.

SEN ELECTRICAL CO. LTD., 118/120, Charing Cross Road, London, W.C.—Two new lists: No. 275 gives illustrated particulars and prices of portable electric tools (grinders, drills and buffers); and No. 276 deals similarly with electric fans (table or desk, oscillating, ventilating ring and ceiling types, ventilating fan motors for large volumes and powers, &c.). Large numbers of the tools and fans included in these lists have been supplied to Government works in connection with the war.

MESSRS. HIGGS BROS., Sherbourne Road, Balsall Heath, Birmingham.—Eight pages for addition to their catalogue. They give tabulated speeds, prices, code-words, running instructions and dimensions, for their shunt-wound ventilated motors, also an efficiency curve.

Book Notices.—The third number of the "*Journal of the British Science Guild*" has now appeared. Copies, price 6d. each, may be obtained on application to the Secretary, British Science Guild, 199, Piccadilly, London, W.

The Russian Press.—From Messrs. Neyroud & Sons, Ltd., of Regent House, Kingsway, we have received a booklet giving a list of the more important Russian newspapers, periodicals and trade journals, the populations and industries of the towns in which they appear, and a word or two regarding the class of publication.

LIGHTING AND POWER NOTES.

Aylesbury.—The U.D.C. has decided to offer a supply of current to the Dominion Dairy Co., Ltd., at 1½d. per unit when oil is £8 per ton, and for every increase or reduction of 5s. per ton on that price an increase or reduction of '02d. per unit, the charge to be reconsidered if the price of oil goes beyond £10, or falls below £6 per ton. A previous quotation by the Council was declined by the company.

Bath.—**DIESEL ENGINE REPORT.**—The city electrical engineer, reporting on the cost of putting the Diesel engine into satisfactory working condition, points out that this was originally estimated at £150, but had actually amounted to £451. This was due largely to the conditions brought about by the war, but also to other repairs found necessary while the work was in progress. The first contract price for the plant based on 450 kW. was £5,451; the second, based on 340 kW., was £4,240; the amount

paid to the makers at settlement was £1,575, so that the actual cost of the plant (taken as 300 kW.) amounted to £2,026. Recent tests have shown a fuel cost of '29d. per unit generated, with fuel at 75s. per ton, which compares with average coal costs for the steam plant of '55d. It is expected that lubricating oil costs will be reduced to '06d. per unit generated. Owing to the cost of oil fuel being about £9 per ton now, it is only intended to run the set occasionally on the existing fuel stock. The repairs included re-leveling and bedding the crankshaft, and alterations to the compressor, air bottles, fittings, valves and governor gear, and were carried out by Messrs. Belliss & Morcom on a time and material basis.

Bexhill.—**PRICE INCREASE.**—The Electric Light Committee recommends a further advance in the price of electricity of 5 per cent., making a total advance of 15 per cent. since the commencement of the war. The Committee states that a preliminary report for the year ended March last shows a very substantial loss, although the 10 per cent. price increase was partially in operation. The cause is the continued advance in the price of coal, and is in no way associated with the reduction of hours of lighting consequent on the Summer Time Act.

Bishop's Castle.—**WORKHOUSE LIGHTING.**—The Board of Guardians has agreed to a recommendation to adopt a scheme for the installation of electric light at its institution, at a cost of £20 10s. for 41 lights and £1 5s. for dimmer lights in the sick wards, the supply to be by meter at the rate of 6d. per unit.

Blackpool.—The output of the electricity works during June was 381,205 units, an increase of 34,508. Private lighting showed the enormous decrease of 10,674 units and public lighting of 4,000 units, while the tramways used 44,830 units more. An average daily increase of about £90 in receipts on the tramways was also shown for the 24 days from June 19th.

Bradford.—**LOANS.**—The Corporation has received a communication from the L.G.B., stating that the latter is not prepared to sanction at present a loan of £100,000 for the extension of plant at the electricity works, in view of the fact that such extension would not be required for national purposes. The Board is willing that extensions of mains shall proceed as at present, without the necessity of submitting a special resolution in each case. The Electricity Committee has decided to invite the three sitting members of Parliament and member of the Shipley division to meet a Committee to consider the position, with a view to an interview being sought with the Minister of Munitions on the question.

Cardiff.—**RESTRICTED LIGHTING.**—At the last meeting of the Electric Lighting Committee, Mr. A. Ellis, the city electrical engineer and manager, reported that the restricted lighting order would have a serious effect on income, reducing the revenue by about £20,000 to £25,000. Street lighting had been discontinued; in the year ended March, 1916, the income from such lighting was £9,798; it was now estimated at £881, including all charges, and the loan charges of £902 therefore exceeded the estimated income. —*Western Mail.*

Croydon.—**YEAR'S WORKING.**—The report of Mr. Alex. C. Cramb (borough electrical engineer) on the year's working of the electricity undertaking to March last, showed that the output for public lighting had decreased by 50 per cent. as compared with pre-war times. The decrease on private lighting over the previous year was 189,865 units, or 405,861 as compared with pre-war conditions. The coal bill showed an increase of £9,457, and it was anticipated that the present year would see a further increase of £7,000. On the revenue account a gross surplus of £24,817 was shown after allowing for working expenses, or 64 per cent. on the capital expenditure. Sinking fund, interest and income-tax absorbed £26,785, so that after allowing for £1,651 tax deducted from interest on stock, the deficit on the year's working was £316. Since, however, £4,244 was spent in new services, extensions and conduits, there was actually no loss for the 12 months. During the last four years the reserve and renewals fund has been reduced from £39,000 to £24,469. The Summer Time Act. was likely to produce a loss in residential districts during the summer months of not less than 10 per cent. of supply, increasing to over 20 per cent. in the important shopping areas.

Derby.—**PROPOSED LOAN.**—The Electricity Committee has decided to apply to the L.G.B. for sanction to a loan of £9,000 for mains and motors.

Edinburgh.—**ANNUAL ESTIMATES.**—The estimated expenditure of the electricity department for the year 1916-17 is £92,000, as against £84,650 estimated last year, and an actual expenditure of £84,000. Revenue is estimated at £149,920, as against last year's estimate of £148,860, and an actual income of £147,212.

The Electric Lighting Committee recommends the acceptance of the estimate for additions to McDonald Road power station, amounting to over £1,800. The additions have been necessary owing to the increased heavy output.

Glasgow.—**YEAR'S WORKING.**—At a meeting of the Electricity Committee on Tuesday (July 25th), the annual accounts and report on the working of the department for the year—some of the principal items of which have already been published in the REVIEW—were submitted. It was reported that the gross revenue amounted to £530,720, an increase of 30 per cent., as compared with the year 1915-16. The working expenditure amounted to £322,451, an increase of 47 per cent. The gross balance was

£29,008, from which was deducted interest on loans £72,233, sinking fund £7,111, and depreciation £5,195, leaving a surplus of £1,000,000 of £1,000,000. The Committee has been successful in securing at a considerable margin over last year's prices for materials that the rates of charge be the same as last year. The number of consumers at May 31st, 1916, was 1,000,000. At May 31st, 1915, the quantity of electricity sold to private consumers during the past year was 11,472,000 units at a price of 24.769 p.d. 29,358,900 units were sold for lighting and realised £221,973 and 90,129,716 units for power and heating from which a sum of £255,249 was derived. The number of motors in use was 11,472 of a total H.P. of 84,744. The number of electric street lamps was 1,856, of which 1,372 were arc lamps, and 384 pillars with metal-filament lamps. In compliance with the regulations regarding street lighting, most of the arc lamps had been substituted by metal-filament lamps. The total contracted load was 19,050 kW. The maximum load was 15,880 kW.

Grimsby.—**UNPAID LIGHTING.**—Since the Summer Time Act came into operation there has been a saving of 12 per cent. on the amount of electric current consumed for lighting.

Hampton.—**PRICE INCREASE.**—The Electric Supply Co. has petitioned the L.C.C. that the charges for current for all purposes have been further increased by 10 per cent., making a total of 29 per cent.

High Wycombe.—**STREET LIGHTING.**—With reference to the settlement of charges for street lighting, which was deferred pending the result of the action between the Leiston Gas Co. and U.D.C., the T.C. has decided to offer the electricity company, without prejudice, (1) 4.000 per quarter, and proportionate for any less period; (2) 15s. per lamp per quarter, and proportionate for any less period for each lamp lighted. The Electricity Light Committee is of opinion that the claim of the company against the Council is not identical with the facts in the Leiston case.

Hull.—The B. of T. has extended the Kingston-upon-Hull Electric Lighting (Extension) Orders, 1914, for one year.

Llandrindod Wells.—**PRICE INCREASE.**—Owing to the proposal to increase the price of electricity from 6d. to 7d. per unit, the U.D.C. has discussed the matter with the electric light company, and the ratepayers are now to be consulted on the subject.

Llandudno.—**PRICE INCREASE.**—The Council has decided to increase the price of electricity.

The Electricity Committee has decided that, as there had been transferred from electricity profits towards the relief of the rates nearly £4,000, a contribution should now be allocated from the rate fund towards the deficiency on the undertaking, and that the loss of £1,499 be met by transferring £1,225 from the reserve fund and £274 from the rate fund, the latter sum being required to cover the cost of loan charges applicable to public lighting. It has been also decided that no further profits from the electricity undertaking be allocated towards the relief of the rates, until the reserve fund has been placed on a firm footing.

The light railway company is to be asked to discuss the question of cancelling the existing contract for the supply of current for working the light railway, and of entering into a new contract for a term of years.

London.—**HACKNEY.**—**ELECTRICITY CHARGES AND GAS CO.**—The Electricity Committee reports that it has considered a communication from the Gas Light and Coke Co., with reference particularly to the reduced charges for electricity for lighting, to consumers who use electricity for power purposes; the Gas Co. quotes counsel's opinion that the reduced charge constitutes "undue preference," and is a breach of the Lighting Act and therefore illegal.

The Committee has referred the matter to counsel, and is advised that there is no undue preference, and the company was notified to this effect.

The company's solicitors having written stating that unless the charge is discontinued proceedings will be instituted, the Committee has caused representations to be made, that the present is not an opportune time for litigation upon a subject which had remained unchallenged and undisturbed for so long, suggesting that the matter should remain in abeyance until after the conclusion of the war, but that if proceedings were now commenced the Committee would immediately apply under the circumstances for a "stay."

In reply to the above representations, the solicitors to the company intimate that it is only prepared to delay proceedings upon an undertaking from the Council not to offer during the continuance of the war to further consumers the scale of charges to which objection is taken.

The Committee does not see its way to recommend that any such undertaking should be given, and, therefore, recommends that, in the event of legal proceedings being taken against the Council by the Gas Light and Coke Co., the Committee be authorised to take all necessary steps to defend the action on behalf of the Council.

Shoreditch.—**YEAR'S WORKING.**—The report of the year's working of the electricity department to March 31st last shows a gross profit amounting to £14,682; after payment of interest and sinking fund charges, and war allowances, there was a deficiency of £7,851, which will be met out of the reserve fund.

POPULAR.—The B.C. is to make application to the L.C.C. for sanction to a loan of £4,512 for mains extensions necessitated by the increasing load in the central area of the borough. The Committee has agreed to the extensions being carried out, and proposes to purchase a site in the neighbourhood of High Street for the provision of a new sub-station, the necessity for which will shortly arise. The Committee is advised by the engineer that plant extensions will be necessary to meet the demands of the winter load in 1917-18.

ISLINGTON.—**LINKING-UP PROPOSAL.**—The Lighting Committee of the B.C. is suggesting to the St. Pancras B.C. the preparation of a linking-up scheme by the engineers of both authorities. The electrical engineer requires a supply of switchgear in connection with certain mains extensions which he has been authorised to carry out, and is proposing to invite quotations from certain firms.

MAVERLEIGH.—A serious breakdown of a trunk feeder occurred on the 11th inst., in Aybrook and Blandford Streets, and certain rearrangements are to be made, at a cost of £1,100, to avoid future risks.

HAMMERSMITH.—The Electricity Committee reports that the working of the electricity undertaking for the year ended March 31st last showed a net profit of approximately £600. No increase whatever has been made in the charge to general consumers for current supplied during the period under review. The Committee is in communication with Battersea and Fulham B.C.'s, with a view to carrying out the linking-up scheme approved in 1915.

SOUTHWARK.—As a result of conferences between Sub-Committees of the Southwark and Bermondsey Councils, arising from an invitation from the latter asking for terms for a bulk supply, the Southwark Committee has decided that it is not practicable to give the suggested supply, and it is understood that it will be given by one of the companies. The question of linking up the two undertakings is to be considered later. The last year's working of the Southwark undertaking resulted in a net loss of £6,678, and the borough treasurer comments on the increased cost of coal and heavy capital charges on plant which there has been little opportunity of using.

Luton.—**PROPOSED LOAN.**—It is proposed to apply for L.G.B. sanction to £900 excess expenditure on electrical plant. The connections now consist of 73,217 8-C.P. lamps, 6,834 H.P. of motors, and 1,646 kW. of heating.

Manchester.—It is reported that steps are being taken to prepare a petition to the Electricity Committee, urging the Committee to reduce the present minimum charge for current.

Mansfield.—**YEAR'S WORKING.**—The annual report on the electricity undertaking, for 1915-16, shows a gross profit of £7,934, as compared with £6,589 in the previous year, and after payment of interest, £2,979, and contributions to sinking fund, £2,239, a net profit remained of £2,718, as against £1,941 in 1914-15, although the cost of materials and labour had greatly increased. The total units sold were 1,914,754, compared with 1,635,069. Out of the profits it was recommended to pay over to the relief of the rates £1,500, and appropriate the balance of £1,218 to the reserve fund.

Mexborough.—**PRICE INCREASE.**—The Council last week approved an advance in electricity charges to 4d. per unit for lighting, as from June 30th, and revised meter rents.

Norwich.—**ANNUAL REPORT.**—The result of the year's working of the Corporation electricity department, to March 31st last, shows gross receipts amounting to £57,487, and working expenses to £32,611, leaving a gross profit of £24,876; interest and sinking fund charges absorbed £20,373, and the balance of £4,503 is carried to the appropriation account. From the balance £416 is to be expended on a workshop, £2,023 added to the depreciation fund, and the remainder carried forward. The Electricity Committee reported that the figures for the output, as compared with the previous year, show an increase of 3.3 per cent. While nothing has been used for public lighting, the amount of 650,125 units supplied for this purpose in the previous year has been more than made up for by the increased output for power, which shows an advance of 19 per cent.; substantial progress has been made in other directions, principally in the use of electricity for radiators and electric fires, both for private and business premises. The depreciation fund now amounts to £8,000. The report states that the 2,000-kw. generating set, due for completion in 1912, still remains in an unsatisfactory condition, and that the 3,000-kw. set had been operating at reduced efficiency, owing to a breakdown which could not be rectified for some time, due to prevailing conditions.

Poole.—The Bournemouth and Poole Electricity Supply Co. has sent to the Harbour Commissioners six months' notice to terminate an agreement with reference to the lighting of the harbour. A fresh agreement was enclosed, but the Commissioners decided not to sign it at present, but to make inquiries as to the method and cost of lighting the harbour.

Rawtenstall.—**STREET LIGHTING.**—The T.C. has decided that the charges for electric lighting in the main streets should be as follows:—For 50-c.p. lamps, £1 18s. 9d. per year of 2,500 hours; for 100-c.p. lamps, £2s. 5s. 9d. per year of 2,500 hours; these charges to include maintenance. It was also agreed that the following amount shall be allowed or charged for every hour under and over the 2,500 hours:—For 50-c.p. lamps, 0.5d. per hour; for 100-c.p. lamps, 0.9d. per hour.

Southampton.—In view of the loss sustained on the past year's working of the electricity undertaking, the Electricity Committee has resolved to charge an additional 10 per cent. to all consumers, making in all 20 per cent. and that the administration of the undertaking be investigated.

South Wales.—The B. of T. has extended the Cowbridge and Penybont E.L. Order, 1914 (South Wales Electrical Power Distribution Co.), for one year.

South Yorkshire.—ELECTRIC WINDER.—At the new accommodation shaft of Messrs. Newton, Chambers & Co., near Wentworth station, an electrical winding plant has been started up. The winder has two 10-ft. diameter drums, driven by a 330 H.P. Westinghouse slip-ring motor.

Tasmania.—GREAT LAKE SCHEME.—The Government hydro-electric power scheme was officially inaugurated in May, by the Governor-General. It is estimated that the Great Lake will give 35,000 H.P., and the River Ouse a similar amount. The scheme was originally initiated by the Complex Ores, Ltd., a Melbourne company, which later disposed of its concession to the State. The Great Lake is situated near the centre of Tasmania, at an elevation of 3,250 ft., and discharges into the River Shannon, which, at a point 5 miles south of the lake, is about 1,300 ft. above the adjacent River Ouse. By constructing a dam 11 ft. of water has been added over the 50 sq. miles of the Great Lake, and 5 miles down the Shannon a diversion weir has been constructed, turning the water through a canal $3\frac{1}{2}$ miles, into a reservoir 380 acres in extent. From the latter a 4-ft. diameter wood stave pipe runs 5,660 ft., and eventually connects to two steel pipes leading to two 4,900-H.P. water turbines in the power station. Power is transmitted to Hobart, a distance of 62½ miles, at a pressure of 88,000 volts, the two three-phase lines being supported on steel towers spaced about 660 ft. apart. Copper transmission lines are used, carried on suspension insulators. At Hobart a sub-station at the New Town, steps down the pressure to 6,600 volts for distribution to the various sub-stations. *Con. Engineer.*

Thornton.—The B. of T. has extended the period of the Thornton Electric Lighting Order, 1914, by one year.

Tottenham.—STREET LIGHTING.—The North Metropolitan E.P. Supply Co. has declined to make the U.D.C. any allowance on the account for public lighting for the December quarter last.

U.S.A.—According to the *Electrical World*, a campaign is in progress with a view to inducing Congress to increase the Niagara water diversion from 15,000 to 20,000 cu. ft. per second, the maximum fixed by International Treaty. The additional water would generate 80,000 H.P.

A denial is given to the report that the Canadian Niagara Co., if it does not supply the requirements of the Ontario Hydro-Electric Commission, may have its licence to export power to the States revoked.

The Commission wants 50,000 H.P. by December, and the company is said to have offered 32,000 H.P. now, while with new plant being installed, it is said that 75,000 H.P. will be ready in December. The Canadian Niagara Co. exports 75,000 H.P., mostly to Buffalo, 25 miles away.

Walthamstow.—LOAN SANCTION.—The L.G.B. has sanctioned the borrowing of £2,635 for control switches, &c., for the street lamps.

Warrington.—PRICE INCREASE.—The Corporation has decided to increase the charges for electric current, as from August 1st next, by 5 per cent., except in cases provided for, in which the charges for current are regulated by a coal clause.

West Ham.—ANNUAL REPORT.—The year's working of the Corporation electricity department, to March 31st last, shows a total income of £143,611, as compared with £134,074 in 1914-15, an increase of £9,537. The working expenses were £120,066, as against £96,350, an increase of £23,435, principally due to the extra cost of coal. The gross profit amounted to £23,545, as against £37,443, a decrease of £13,897. After deducting interest, sinking fund, war allowances (£4,216), there is a deficit on the year's working of £26,202. The total number of units generated, 41,024,200, was an increase of 1,528,919 units; of this, power consumers accounted for 27,205,384 units; tramways for 5,129,098 units; and private lighting, 2,725,204 units; the total maximum demand was 12,225 kw. As regards the deficiency, £20,300 is provided for in the rates estimate for the current year, and the balance of £5,902 is to be included by the Electricity Committee in the supplemental estimates in September.

Willesden.—PROPOSED LOAN.—The Council is recommended to apply for sanction to borrow £828 for H.T. mains.

York.—The B. of T. has extended the period of the York Electric Lighting (Extension) Order, 1914, by one year.

TRAMWAY and RAILWAY NOTES.

Bristol.—TRAMWAY PURCHASE.—The Tramways Option Committee reports that since its appointment in February, 1913, to consider the question of purchasing the Bristol tramways, the cost incurred has been £8,068, of which £2,946 was directly incurred by the Committee in obtaining information, while the remainder represents the costs of obtaining the Bristol Corporation Tramways Act, 1914.

Croydon.—YEAR'S WORKING, &c. The special report of the Tramways Committee upon the recent strike, which it was claimed had involved no loss upon the working, again came before the Council on Monday. The Committee recommended increased wages and improved conditions, and that this cost should be met by a shortening of the fare stages. On the penny fares the proposals represented an increase of 30 per cent. A sharp discussion was closed, and the report was adopted in its entirety by 36 votes to 15. The 'bus companies, it was said, were ready to fall into line with the new fares.

At the same meeting it was decided to revise the existing fares for through running with the S.M.T. Penge and Upper Norwood system.

The annual report of the tramway manager (Mr. T. B. Goodyer) was received. Covering the year ended March 31st, it showed total receipts of £94,416, and after deducting working expenses, £72,509, and war allowances, £4,982, and bank interest on income-tax on stock, there remained a gross balance of £18,278. Interest charges, sinking fund, and taxes reduced this to a net surplus of £844, which was carried to the renewals fund. Despite the strike, the receipts showed an increase over the previous year of £5,801. The passengers carried numbered 21 millions.

Edinburgh.—TRAMWAY REPORT.—In view of the expiry of the lease in 1919 in favour of the Edinburgh and District Tramway Co., the Corporation recently instructed its engineer, with Mr. J. B. Hamilton (Leeds) and Mr. Brodie (Liverpool), to report on the methods of traction which might be adopted. They express the view that it is possible to arrange for an electrical system to be installed without interfering with the cable cars up to the expiry of the lease. The Corporation, accordingly, may proceed with its arrangements for the new system independently of the tramway company. They also state that they consider it is desirable to have only one system throughout the city, and that, while it would be possible to operate the electric system in such a way that there would be no overhead wires in the central parts of the city, it could not be put into operation immediately on the expiry of the lease. What is suggested as a possibility is that the overhead system might be introduced all over, so that there would be no delay in securing a sufficient service, the construction of underground electrical sections being proceeded with later, if that were desired. The report is an interim one only, and the advisers state to the Tramway Committee that they cannot submit their full report until September. Meanwhile, the Council will consider the report; the prevailing feeling is that electric traction should be introduced at the earliest possible moment.

London.—On Monday last an L.C.C. car was descending a hill at Abbey Wood, when the brakes failing to act, it left the track on a curve at the bottom of the hill, ran on to the pavement and overturned, a number of passengers being more or less seriously injured.

Manchester.—WAGES AWARD.—The Committee on Production has issued its award on the application of the Tramway and Vehicle Workers' Union for an additional war bonus of 5s. per week. Juniors from 18 to 21 years of age are to have a further increase of 1s. per week (making 2s. with the previous bonus), and seniors an increase of 2s. (making 4s.), the maximum wage being 42s. No additional war bonus is granted to women workers. Drivers, conductors, timekeepers, ticket and motor inspectors, depot clerks, shed men, freight van drivers, overhead motor van and wagon drivers, and parcel dispatchers are included in the grades to receive the additional advances.

Rawtenstall.—FARE REVISION.—At the Council meeting on the 21st inst., the chairman of the Tramways Committee mentioned, in regard to the proposal to increase the fares, that since the tramways started they had made a heavy loss, involving the rates to the extent of £11,954. At present a person could ride nearly half as far again in Bacup for 1d. as in Rawtenstall, and it was proposed by Rawtenstall (which runs the tramways) to equalise the distances from Bacup to Rawtenstall. They were not making a profit out of Bacup, the best paying lines being from Rawtenstall to Waterfoot and Rawtenstall to Lockgate. He said the only way they could settle the matter would be by arbitration, and they would have to apply to the Board of Trade to appoint an arbitrator, who would come down and decide what should be done.

Southampton.—YEAR'S WORKING.—The report of Mr. W. T. Robson, general manager, on the working of the Corporation tramways for the year ended March 31st last, shows record receipts amounting to £79,828, and a gross profit of £26,854, which, besides providing for interest and sinking fund charges, allowed of £4,460 being contributed to renewals, £5,000 in aid of rates, and other expenditure amounting to over £1,900. Some £8,668 capital expenditure has been met from revenue, and £13,160 credited to renewals. The passengers carried numbered 15,494,366, an increase of 2,228,651, and the mileage run was 1,636,103, a decrease of 67,000 miles. Mr. Robson draws attention to prospective renewals

expenditure of £1,000, and suggests ample provision for this fund in future. One of the female construction and night girl clerks are empowered now owing to the deficiency of male labour. The report is a comprehensive one, containing paragraphs headed "social club," "bulb show," and "concerts." We note that the Edison accumulator tower wagon has given much satisfaction, and mention is made of the great advantage of having electric light available for night repairs even when the wires are not alive. An interesting paragraph deals with the future, in connection with which Mr. Robson mentions the necessity of finding means to avoid the great obstruction caused by the Bargeate, the evil influence of which has apparently extended to the cars which we gather are of a peculiarly uncomfortable type, presumably owing to space restrictions. He suggests that commodious top-covered cars, and open toast-rack cars for summer use, be adopted in future on various routes which presumably avoid the objectionable Bargeate.

South Shields.—**YEAR'S WORKING.**—The annual report on the working of the Corporation tramway during 1915-16 shows a total revenue of £11,826, an increase of £1,381 on the previous year; the gross profit amounted to £15,509, and after deducting interest, sinking fund, and other charges, the balance, £6,504, was appropriated as follows:—£2,400 to the relief of rates, and £4,104 to the reserve fund. During the year, 11,163,378 passengers were carried, as against 10,479,421 in the previous year; the average traffic receipts amounted to 12s 237d per car-mile. The cars ran 824,887 miles, a decrease of 102,811 miles as compared with 1914-15. The passengers carried show an increase of 20 per cent., not including 15,900 soldiers carried free whilst on duty.

West Ham.—**YEAR'S WORKING.**—The expenditure on revenue account of the tramway undertaking, for the year ended March 31st last, shows an increase of £4,990 as compared with the previous 12 months, the figures being £124,926 and £119,935 respectively. Allowances to men on active service amounted to £13,318, against £6,031 in the previous year. The total income amounts to £164,119, as against £152,212 in 1914-15, an increase of £11,898. The above result leaves a gross profit of £39,184, as against £32,276 for the previous year, an increase of £6,908, or, after including allowance to men on active service, a decrease of £378, carried to net revenue account. After allowing for various charges on this account, there remains a net profit on the year of £2,855, but if the allowance of £13,318 to men on active service is included, there is a deficit of £10,462. The Tramways Committee recommends that the surplus should be carried forward towards special expenditure already incurred.

TELEGRAPH and TELEPHONE NOTES.

A Transcaspien Telegraph Cable.—A project is now being worked out in Tiflis for laying a telegraph cable across the Caspian Sea from Baku to Krasnovodsk. The Baku says that this cable will serve as a link of the new telegraph line connecting the Central Asian Dependencies of the Empire with the centre. At present this service is effected exclusively through Samara, which route is much overloaded. The new cable is expected to be very beneficial to Baku and district, for the scheme includes an overhead line between Baku and Petrograd to ensure direct communication between these two points. Till now Baku has communicated with Petrograd through Rostoff on the Don, and Moscow. The execution of the project is expected to cost four million roubles, one million of which will be for the cable, and three millions for the overhead line in two directions—Baku-Petrograd and Krasnovodsk-Tashkent. Notwithstanding the state of war, the scheme is expected to take effect in 1917.

Australia.—Troops are to be raised to reinforce a Wireless Signal Squadron that has been organised for service under the Government of India.

An engineer named H. A. Livermore has been fined £10, with five guineas costs, for being the possessor of wireless apparatus without a licence. The apparatus was of small power, such as would be set up by an ordinary amateur; there were no aerials or detectors, and the apparatus would not receive signals.

A report has been received from Mr. Basilille, the consulting expert on wireless telegraphy, who has been conducting experiments for some weeks at Bookaloo with the object of bringing about the artificial precipitation of moisture from the atmosphere. He has made eight experiments with charged elevated conductors, and it would appear that certain rainfall has resulted, but he is unable to prove it at present.

Hull.—The accounts of the first year's working of the Hull Corporation telephones since the Corporation took over the Post Office telephone service show that the income on revenue account for the year amounted to £36,228, and the expenditure was £32,978. The gross profit amounted to £23,250, compared with £24,000, the amount estimated at the time of the purchase. The expenditure includes a war bonus of £1,324 granted to the staff, and special charges of £267 for works of protection. Loan charges amounting to £18,879 have been met, and a sum of £726 has been allowed for income-tax. The balance on net revenue account is £3,645. *Leeds Mercury.*

Petrograd.—The telephone business in Petrograd is becoming disorganised in every direction, says a note in the *Norvika Vrenga*. It has been found impossible to reduce the interior

administration to order, and as to the business of the concern, up to 1,000 new subscribers cannot be connected to the main system because there is no apparatus. The only contractor for telephone apparatus, "Heissler," fails to execute orders, pleading work for the national defence. On May 27th (o.s.) the Ministers of the Interior and War were appealed to by the city governor to lend their assistance to the execution of the orders.

Railway Telegraphs. Before the Railway and Canal Commission on Monday, an agreement between the Metropolitan Railway Co. and the P.M.G. was under consideration. According to the *Times* report, the agreement provided for the free carriage of men and stores for the maintenance of the "lines of telegraph of the Postmaster-General"; the company contended that the clause in question only related to the telegraphs along the particular railway (Aylesbury and Buckingham) concerned, whereas the P.M.G. claimed that it related to all his telegraph lines. Judgment was given in favour of the railway company.

Telegraph Bill.—A Telegraph (Construction) Bill has been introduced into the House of Commons to amend the Telegraph Acts, 1863 to 1915, with respect to the construction and maintenance of telegraph lines.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—August 16th. P.M.G. Distilling apparatus (Schedule 502), telegraph and measuring instruments (Schedule 498). See "Official Notices" June 16th.

SYDNEY.—August 17th. Portable internal-combustion engine and dynamo (24 kW.) for the Departmental Stores, Sydney, for P.M.G.*

August 24th. P.M.G. Automatic switchboard and apparatus for North Sydney Exchange. Schedule No. 511.*

PERTH.—October 4th. Deputy P.M.G. Telegraph and telephone measuring instruments and parts. Schedule 501 W.A.*

Barking.—August 15th. Electricity and Tramways Committee. Cables, switchgear, and transformers. See "Official Notices" to-day.

Basingstoke. July 28th. Wiring the Conservative Club for electric light. Mr. A. E. Grant, Secretary.

New Zealand.—**INVERCARGILL.**—September 28th. Borough Council. Steam turbo-alternator, condensing plant, and switchgear. Specifications from the Tramway Office. Contract No. 40.*

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Argentina.—An order (£70,000) has just been placed by the Buenos Aires Western Railway with the Leeds Forge Co. for under-frames and bogies for motor coaches, and bogies for trailer coaches. These are for rolling-stock now being built in England in view of the electrification of a portion of the Western Railway's system. *Times.*

Cape Town.—Electric Utility Co., wiring for electric lighting, telephones and bells, of the residence at Newlands of Mr. A. L. Chiappini, £320.

Government Contracts.—The following tenders have been accepted during June, 1916:

WAR OFFICE.

New apparatus.—F. R. Burt & Co., Ltd.
Electric cable and wire.—W. T. Henley's Telegraph Works Co., Ltd.; Midland Electric Wire Co., Ltd.; Ward & Goldstone, Western Electric Co., Ltd.
Electric cells.—Siemens Bros. & Co., Ltd.
Electric generators and motors.—General Electric Co.
Electric lamps.—C. Collins, Ltd.; Elandem Co., Ltd.; J. & R. Oldfield, Ltd.
Telephone switchboards.—Automatic Telephone Mfg. Co., Ltd.
Tungsten tubes.—F. R. Burt & Co., Ltd.; A. E. Dean.
Works services.—Electric light installation at Rendcombe; Edmundson's Electricity Corporation. Electric lighting at Wye: H. J. Cash & Co., Ltd.

POST OFFICE.

Telegraph apparatus.—Gill Telegraphic Appliances Syndicate.
Telephone apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; Peel-Conner Telephone Works Co., Ltd.; Western Electric Co., Ltd.
Iron arms.—Siemens Bros. & Co., Ltd.
Telegraph cable.—Telegraph Construction & Maintenance Co., Ltd.
Telephone cable.—B.I. & Helsby Cables, Ltd.; W. T. Glover & Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Telephone cords.—London Electric Wire Co. & Smiths, Ltd.; Phonix Telephone & Electric Works, Ltd.
Telephone mouthpieces.—North British Rubber Co., Ltd.
Cable distribution plugs.—B.I. & Helsby Cables, Ltd.
Bronze insulated wire.—Siemens Bros. & Co., Ltd.
Galvanised iron wire.—Dorman, Long & Co., Ltd.; Johnson & Nephew, Ltd.; Rylands Bros., Ltd.
Battery zinc.—Eyre Smelting Co., Ltd.; Siemens Bros. & Co., Ltd.

London.—HAMMERSMITH.—Electricity Committee. Contract with the British Electric Transformer Co. for 12 months' supply of transformers. It is proposed to purchase five 200-kw. transformers immediately for £840.

MARYLEBONE.—E.C. Electricity Supply Committee. Alfred Blackmore & Co., 6,000 tons. Low Lathes Yorkshire washed pipes and 4,000 tons 14-in. Yorks. and/or Derby nutty slack, to be delivered over 12 months. Charrington, Sells, Dale & Co., 2,000 tons 14 in. Langwith nutty slack, for delivery from October to February.

New Zealand.—DUNEDIN.—In view of the present unsatisfactory conditions as regards prices and shipment of material, none of the tenders received for six electric tramcars for the City Council has been accepted. "Imperial Trade Correspondent."

Southampton.—T.C. Education Committee. Accepted tender: H. C. Taplin, at £251, for installing electric light at the Eastern District School. Mr. A. Kingman quoted £372.

Spain.—La Sociedad Española de Electricidad, of Madrid, has lately secured a contract from the Sociedad Metalurgica Duro-Felguera for the electrical equipment of a large rolling mill. The latter will be driven by a direct-coupled electric motor of 2,000 H.P.

NOTES.

Decimal Coinage and the Metric System.—At a meeting on July 20th the Court of Common Council of the City of London resolved that, in view of the great advantages which would accrue to British commerce in foreign markets by the use of a decimal system of coinage and weights and measures, it was desirable that steps should be taken to ensure its immediate introduction, so that it might be already in operation at the conclusion of the war. A copy of the resolution was forwarded to the Prime Minister and the President of the Board of Trade.

In the course of his valedictory address as retiring President of the S.A. Institute of Engineers, Mr. W. Ingham expressed the view that South Africa should seriously consider whether the time was not opportune for introducing the metric system of weights and measures, and decimal coinage. After studying the subject for over 20 years, he had come to a conclusion favourable to the system.

Russian Electrical Municipalisation.—A note in the *Nivne Vremya* says that the preceding Duma devoted much time and trouble to considering a project for the municipalisation of electrical enterprises. In the estimates for 1916 for the furtherance of this project, amongst others, there was set down 548,195 roubles. At the sitting of the Duma on May 4th, Chief Engineer Smirnov, who built the first electrical station in Petrograd for public use, made a declaration on the decision of the Duma regarding the purchase of electrical concerns, and on the cessation at present of progress in this direction. In deciding on the purchase, the Duma had in view reduction in the cost of using electrical energy and the extension of such use; but at present, and even in the near future, for want of means, the project cannot be carried out, whilst owners, under the pretence of a rapid transfer, are all limiting the output of their stations, which may have a bad effect on work that is being carried out for national defence. In view of all this, Mr. Smirnov asked a reduced credit in the estimates for 1916 for preparing the project. This proposal will be examined by the Executive Committee.

I.E.E. Wiring Rules, Seventh Edition.—We have been asked to publish the following corrections:—

Rule 117 (b), line 1, for "Fitted with" read "Controlled by."

Rule 121 (b) applies to lighting circuits only.

Page 42, line 30, for "Decks" read "Desks."

Gravitation and Electrical Action.—The following interesting letter appears in *Science* for July 7th:—"In a paper to be published by the Academy of Science of St. Louis, evidence will be presented which appears to show conclusively, that gravitational attraction is diminished by electrical charges on the acting masses. The suspended masses of the Cavendish experiment are wholly enclosed in a shield of sheet metal. The small observation window is covered with wire gauze. When a knob terminal connected with the influence machine is moved towards or away from a knob terminal connected with the large attracting masses, the suspended masses slowly move to and fro around the vertical line of suspension. No disruptive discharges occur. It is found that gravitational attraction is decreased by either positive or negative electrification. By the to-and-fro movement of the knob terminal, the amplitude of vibration can be gradually increased from 25 minutes of arc to 50 minutes. It has been established by experimental methods that these results are not due to heat effects.

—FRANCIS E. NIPHER."

A New Electro-Textile Machine.—A recent issue of the *Textile Recorder* contained a description of an improved "reaching" machine (by Messrs. Moore & Avery, Blackburn). The machine selects and hands over the threads of warp to the drawbar, who draws them through the heads and reeds in preparation for the after process of weaving. It is interesting to note that the thread selecting mechanism consists of a 1/30-H.P. electric motor with automatic switchgear mounted on a travelling carriage to enable it to move across the width of the head, and that it if

selects the threads faster than the operative can deal with them, the motor is automatically stopped, until threads are taken from the feeding wheel, when it automatically starts again.

How to Treat Stored Accumulators.—Bearing in mind that the result desired is always the preservation of the accumulator plates, the advice always depends upon whether the owner desires to keep his accumulator in good condition with as little disturbance as possible of its working state, or whether he desires to store it for a long period of time, and does not object to the trouble involved in removing the acid and refilling when the battery is to be put in use again.

There are two methods—the dry system and the liquid system—the former being the better. For the dry system give the battery a thoroughly good charge, in order to bring all the plates into a satisfactory state. Then remove the acid, fill up again with pure water, discharge the battery for a few hours until the voltage has fallen by 10 per cent., and then immediately empty out the water, let the cells drain as much as possible, remove the terminals, wash away any traces of acid on the top covers, put a little vaseline on the terminal stems and all connections, and store in a place free from dust.

The object of discharging after the water has been added is to avoid heating of the negative plates when the cells are dry. The object of putting water in the cells for the discharge is for the purpose of thoroughly removing the acid in the pores of the plates. On no account leave the water in the cells, whether charged or discharged, as they will rapidly sulphate if you do. Advice is sometimes given to fill cells with water, and leave it in. This is absolutely wrong.

The liquid system is as follows:—See that the plates are well covered with acid, but keep it below the lead connecting-bars inside the cells. Charge up the battery until it is thoroughly well charged. Remove the terminals and vents, carefully clean the tops of cells, vaseline all metal parts, and store in the dark, with protection from dust. A periodical charge is beneficial, but not always necessary: this depends upon the condition of the battery when stored, the type of plates, and the amount of loose sediment there may be in the cells. If the voltage is found to be low after a few weeks, it is a sign that the battery requires attention.—*The Motor*.

Tender Memories.—The following comes to hand described as "a (more or less) poetic effusion," from a Manchester Corporation electricity works employé, at present on active service on the Suez Canal Defences:—

REMEMBRANCE.

I'm soldiering in Egypt, but I often think of home, and I think as well of "where I used to work"
(I ought to say "the place at which I used to *think* I worked") ere I got the job of watching Johnny Turk.
For I once had the delusion that I really earned my pay, and I wore a "Village Blacksmith" sort of air.
But I've recently discovered that my job was really "soft" and I wish with all my heart that I were "there."

I march across the desert underneath a broiling sun, with my rifle slung, and pack upon my back.
And the waves of sunlight on the sand are quivering, till the heat makes me think that very soon my throat will crack;
And I watch a string of camels pass with sympathetic gaze, as with awkward gait they "hoof it" o'er the sand.
And the great Truth dawns upon me as it never did before, that Old England is a happy, happy land.

All day I'm using pick and spade and filling bags with sand, while the bored N.C.O.'s are looking on.
But I'm thinking oft of "kilowatts" and "Units sent to Subs," and when evening comes and all parades are done
I lie and dream of Turbos and Reciprocating Sets and I walk along the Switchboard in my sleep;
Then "Reveille" breaks my slumbers, and I tumble out of bed; then I drink my cup of "Gunfire" tea and weep!

I used to think the Boilerhouse a sultry sort of place. (It will be a Winter Gardens after this)
And a good old steady downpour such as Manchester oft sees will be looked upon as real unalloyed bliss.
O, there'll be a good time "bardeen," and we'll all feel "quice keeter," when the order comes to "Imshi" o'er the foam.
When the boys are back in Blighty and they taste some "Blighty" beer, they'll be all "magnoon" with joy to be at home.

WILLIAM TRANTER.

"Bardeen." = Arabic. "Shortly."
"Quice Keeter." = Arabic. "Very good."
"Imshi" = Arabic. "Hook it!" "Get out!"
"Blighty" = England.
"Magnoon" = Arabic. "Mad."

Electrical Wages at Edinburgh.—A meeting of the members of the Edinburgh District of the Electrical Trades Union, on Friday night, discussed a number of important questions. With regard to the application for an increase of wages, the secretary reported that employers had granted them 1d. increase from June 16th to September 16th, when another 1d. would be granted, provided the general cost of living had not gone down in the interval. As regards holidays, the meeting agreed to recommend that, with the exception of those who had made arrangements for earlier holidays, the holidays be held between August 5th and 12th. It was pointed out that the employés who were at present engaged upon actual war work would have to postpone their holidays indefinitely, as recommended by Mr. Asquith.

Inquiries.—Makers of the "Star Electrophone," or other electrical instruments, for the use of partially-deaf persons, who are interested in purchasing these with standard Edison screw marked E.B.N.O. sockets, and suppliers of the same, are asked for.

Appointments Vacant.—Fitter (with the rank of chief assistant) for Diesel engines, for the Aylesbury U.D.C. electricity department (50s.); shift engineer, for Portsmouth Corporation tramways; man for X-ray work and male nursing, £2, for the Royal Berkshire Hospital; shift engineer, for High Wycombe. See *electrical* column, page 100, for details.

British Tumbler Switches in France.—A Paris correspondent, who has been disabled by German shrapnel and is now back in commercial life in Paris unable to return to the Front, asks us to put him in touch with a British firm making tumbler switches, desirous of having its interests represented in France.

A.S.E. Funds.—The *Times* states that the funds of the "Associated Society of Engineers" exceed £1,000,000.

Fatalities.—Considerable attention was paid at an inquest held at Coventry, on the 14th inst., to the question whether a live electric wire in connection with the overhead crane at a local factory was in any way responsible for a man's death.

Dr. Pickup stated that he had come to the conclusion that the man died from heart syncope, the cause of which he could not say. He might have slipped, or felt faint, or he might have touched the live wire, and got a little shock that caused him to fall.

The jury's verdict was that "Death was due to an accident through falling, causing syncope."

At an inquest held at Sheffield, on July 13th, it was stated that Ernest Bage, an electrician, while fixing some new electric wires on the roof at the works of Messrs. Wm. Cooke & Co., Ltd., missed his footing, fell to the ground, and was killed.

An inquest was held last Friday, at Lancaster, concerning the death of a woman named Clarkson (26), an electric crane driver employed at a local factory. When she was ascending a ladder to go on duty in her driving box, a travelling crane knocked her down. She fell about 15 ft., alighting on a girder, and sustained injuries which proved fatal.

Jacobus Rabie, for whom the course of true love appears not to have run too smoothly, declared to one of the daughters of a certain household in an outburst of jealousy that he would—climb an electric light standard. And he did so on the Main Reef Road between Germiston and Malvern. Scaling the pole, he gripped the live wire with both hands and gave a grim and fatal ending to a Rand Reef romance.

Thomas Crossley, an electrician, his son, and another were drowned last Saturday while fishing in Belfast Lough, during excitement occasioned by the capture of a big conger eel.

J. J. Halliwell (22), electric crane driver, was found dead on the floor of his cabin at the works of the British Westinghouse Co. on Saturday.

Instruction and Lecture Notes.—Physical Society of London.—At the meeting held on June 16th, a paper entitled "Experiments with Mercury Jet Interrupters," was read by Capt. C. E. S. Phillips. The paper described an experimental attempt to ascertain the form of the mercury column issuing from a hole in the side of a rotating drum, that was continuously supplied with mercury by centrifugal action. Incidentally a new form of interrupter was introduced, in which the interior was visible through a window in the lid. The usual copper segments were replaced by tantalum, which is not "wetted" by mercury, remains clean and bright indefinitely, and has a high melting point. Experiments with various forms of orifice were described, and it was pointed out that the issuing stream was only slightly affected by this means. An explanation was given of the fact that a vertical slit orifice would not produce a ribbon of mercury, and that no matter how much the diameter of the orifice was increased, beyond about 2 mm., the cross section of the mercury column remained unaltered.

Illuminating Engineering Society (U.S.A.).—The Society has decided to hold a series of lectures at the University of Pennsylvania, from September 21st to 28th inclusive, immediately following the annual Convention of the Society in that city. The lecture course will include the principles of illumination and various aspects of lighting practice, and will consist of about 20 lectures by men selected on account of their qualifications, to deal authoritatively with the several phases of the subject. Associated with the lectures will be an exhibition of the latest developments in illuminating appliances, together with novel applications of light.

The United British Industries' Association.—The *Morning Post* states that Mr. Dudley Docker presided at a luncheon given at the Grand Hotel, last week, to manufacturers who are interested in the movement for starting the United British Industries' Association. A Committee has been appointed representative of British manufacturers, and the British Engineers' Association and the British Manufacturers' Association of 1915 have become affiliated to the new organisation. We gather that considerably more than the required 100 firms, each putting down £1,000, have been enrolled. Our contemporary gives a list of the firms provisionally consenting to become members. They include the British Aluminium Co., Ltd., the British Electrical Federation, British Insulated and Helsby Cables, Ltd., the British Thomson-Houston Co., Ltd., the British Westinghouse Co., Ltd., Crompton & Co., Ltd., Dick, Kerr and Co., Ltd., General Electric Co., Ltd., Greenwood & Batley, Ltd., W. T. Henley's Telegraph Works Co., Ltd., India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., the Marconi companies, Mather & Platt, Ltd., Willans & Robinson, Ltd., and many more large engineering firms.

Steel Furnace on the Rand.—At the present time a large quantity of old steel shoes and dies is thrown to waste annually on the Witwatersrand, and, although under pre-war conditions it might not be profitable to attempt to remake the waste material into shoes and dies, in view of the present greatly-increased cost of these articles, and also the difficulty of obtaining deliveries, it has been decided to erect an electric furnace and accessory plant for the purpose. The construction of the furnace is now in hand as a department of the Witwatersrand Co-operative Smelting Works, Ltd., under the supervision of Prof. W. Buchanan, who was also the designer, and the scheme is likely to prove a useful adjunct to the mining industry.

Joint Action to Develop Electric Road Motors.—Considerable progress has been made during the past two years by the Electric Vehicle Committee of the Incorporated Municipal Electrical Association in the matter of organising facilities for road transport by means of electric battery vehicles. The constitution of the Committee is on a broad basis. It includes representatives of the parent Association, the Commercial Motor Users' Association, the Royal Automobile Club, the Society of Motor Manufacturers and Traders, the Provincial Electric Supply Companies, the Electrical Contractors' Association, the British Electrical and Allied Manufacturers' Association, the Incorporated Association of Electric Power Companies, the Institution of Municipal and County Engineers, and of the Tramways and Light Railways Association. The chairman of the Committee is Mr. R. H. Chattock, city electrical engineer of Birmingham. The hon. secretary is Mr. F. Ayton, chief engineer and manager of the Ipswich Corporation electric supply and tramway departments.

The electric vehicle has its own special field in goods delivery work in urban and suburban areas, and the excellent results that have, so far, resulted from its use by some of the largest and most up-to-date business firms, would seem to indicate quite a considerable field for its extended employment in the future, not only for the delivery of merchandise, but also for passenger carrying work in and about towns and cities. The economy in operating cost and the simplicity of the mechanism are, of course, the main features of this class of vehicle. While these advantages were manifest in the period before the war, the present scarcity of horses, the high price of fodder, and the rising cost of petrol, very greatly enhance the merit of economy possessed by "the electric."

Electrolytic Treatment of Ores in Australia.—At a meeting of shareholders of the Mount Lyell Mining and Railway Co., in Melbourne, it was stated by the chairman that the arrangements made with the Tasmanian Government for the supply of 50,000 H.P. from their hydro-electric scheme had added to the importance of the options held by the company over the Tasmanian Copper, Hercules, and Primrose mines. Electrolytic treatment of similar ores, he said, was carried on satisfactorily elsewhere on a large scale, and with a supply of hydro-electric power, the production of electrolytic splter on profitable lines from ores of the West Coast mines was now in sight. The board decided to give notice of its intention to exercise the options conditionally upon raising the necessary capital.

Removing Enamel from Wire.—A manufacturer of magnet wire states that many serious mistakes are made in measuring the diameter of enamelled wires. Many users scrape the enamel from the copper wire with emery cloth or sandpaper. In doing this it is almost impossible to keep from removing some of the copper. If only 0.0001 in. is removed, it will show on a micrometer caliper or wire gauge. Two ways to remove enamel from wire are suggested: One of these is to pass the wire over a hunsen gas flame several times until the enamel melts and drops off; the other is to dissolve it in amyl alcohol.—*Electrical World*.

Volunteer Notes.—1ST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place. Orders for August by Lieut.-Col. C. B. Clay, V.D., Commanding.

The Headquarters will be closed during August except on Tuesday evenings. The range will be open on Thursday evenings only.

Instruction Classes at Regency Street will be held as usual for Platoons Nos. 9 and 10.

The Camp at Otford will be available until August 31st. Members wishing to attend should enter their names at Headquarters.

Sunday Entrenching Parades. Parade in Uniform at Victoria Station (S.E. and C. Railway) Booking Office, 8.45 a.m.

MACLEOD YEARSLEY, Adjutant.

3RD BATT. (OLD BOYS') CENTRAL LONDON VOLUNTEER REGIMENT.—Battalion Orders by Capt. R. J. C. Eastwood (Commandant), Thursday, July 27th, 1916:—

Week-End Parades.—Saturday.—The Battalion will Parade at Wembley Park, at 3 p.m., for Drill under the Commandant.

Entrenching.—A party will parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 8.40 a.m., and proceed by train for entrenching duties. Those who cannot take the early train will parade at 1.20 p.m.

Sunday.—Parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 9.30 a.m.

Musketry.—Holland Cup Competition.—Saturday, 29th inst., 9.30 a.m. and 12.45 p.m., report at No. 8 Platform, Waterloo Station. Sunday, 30th inst., 9.45 a.m., at No. 8 Platform.

Recruits will Parade at Wembley Park on Saturday at 3 p.m., and Sunday at 11 a.m., for recruit drill.

C. T. COGGIN, Acting Adjutant, O.B.C.

Lady Electricians in Meter Departments.—Our contemporary, the *Electrical Times*, recently referred to the employment of girls for fully a year past by the St. Pancras Borough Council's electricity undertaking, for meter reading. This, however, is only part of the story, as only a few girls are engaged, for three weeks each quarter. Girls were put under training in the first instance on the work of meter maintenance in the workshops, and some are now being drafted to the standardising room.

The St. Pancras electricity department created quite a flutter among the meter manufacturers some years ago, when it imposed a further test on all meters (both overhauled and new) at $\frac{1}{2}$ th (25 per cent.) of full-load rating, and expected them to comply with the same conditions as were stipulated for $\frac{1}{2}$ th load by the British Engineering Standards specification. It would be interesting to know that this high standard of working has not been impaired by the training of the girls.

St. Pancras, by the way, has been systematically removing rotor meters from circuit for overhaul in the workshops every four years, as a result of which very few units have been allowed to pass through to customers unchanged; also, the serviceable life of the meters must be considerably lengthened, which fact should go a long way to appease the manufacturers of those particular meters who may deplore (in peace times—they are otherwise engaged at present) the lack of large orders from St. Pancras for new stock.

The electricity meter doubtless owes its present standard of efficiency, in no small degree, to the foresight of those supply engineers who, recognising the commercial value of efficient meters, have installed the necessary testing plant and imposed stringent conditions, in advance of other authorities.

We congratulate St. Pancras on this further display of initiative in starting the training of girls for meter work, and should like to hear of others who can be placed in the same category; although, like St. Pancras, they individually hide their light under the proverbial bushel, until it is disclosed by an inquisitive push from some quarter. It is a pity, however, that this should be the case, having in view the general interests of the profession.

Electrolytic Disinfecting Fluid.—During the year 1915, according to the report of Dr. F. W. Alexander, medical officer of Health to the borough of Stepney, 36,985 gallons of electrolytic disinfectant were manufactured, making 73,970 gallons as diluted for distribution. The cost was—for materials, £36; electrical energy, £50; total, £86. The plant has now been running ten years, and has manufactured 148,779 gallons of the fluid, at a cost for electricity of £450 and materials £381 (under 3d. per gallon).

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—Our Johannesburg correspondent writes:—"Prof. J. H. DOBSON, the general manager of the Johannesburg Municipal tramways and electricity department, has been appointed Officer Commanding the S.A. Pioneer Regiment, with the rank of Major. He and his men have been in training for some weeks at Potchefstroom prior to their departure for German East Africa. During Major Dobson's absence, the management is in the hands of Messrs. E. T. PRICE, the chief electrical engineering assistant; F. STOKES, the mechanical assistant; and G. B. MILFORD, the tramway manager.

On leaving to take over the management of the East Kent Tramway Co., Mr. T. G. CLABURN, manager of the Peterborough Tramway Co., has been presented by the employees with a rose bowl, &c. He is succeeded by Mr. P. R. BLAKE, of Deal.

The Aylesbury U.D.C. has increased the salary of Mr. A. H. FOWLES, assistant electrical engineer, to £131 10s. per annum. Mr. A. C. SUSSEX, electrician with Hill's Plymouth Co., Ltd., of Merthyr Tydfil, who is leaving to take up a position on the staff of Messrs. Guest, Keen & Nettlefold, at Bedding, has been presented by the electrical staff with a cabinet of table cutlery.

The Bath Corporation Electricity Committee has appointed Mr. R. F. SIDWELL, leading joiner, to succeed the late Mr. D. T. Miles as mains superintendent.

Captain GRAY, Accrington's borough electrical engineer, who joined the Howitzer Brigade at the outbreak of the war, was stationed at Woolwich for some time, but is now employed in a munition factory near Morecambe.

The St. Pancras Electricity Committee proposes to increase the wages of Mr. S. A. CRABSEY, shift engineer, from £2 12s. 6d. to £2 15s. per week, thus placing him on an equality with another shift engineer who carried out similar duties.

Mr. J. S. D. MOFFETT, general manager of the West Ham Corporation tramways, has been appointed general manager of the Belfast Corporation tramways, at £800 per annum.

The Metropolitan Munitions Committee has communicated to the Marylebone Electricity Committee its thanks for the services of Mr. A. H. SEABROOK, whose whole time is now devoted to the work of the Council. The Committee stated:—

"Mr. Seabrook's untiring efforts have been of the greatest assistance to the Board, and they desire to place on record their high appreciation of the courtesy of your Council for so willingly loaning his services, and of the whole-hearted manner in which Mr. Seabrook has devoted himself to this important national work."

General.—The Executive Committee of the City and Guilds of London Institute have appointed Mr. W. ECCLES, D.Sc., A.R.C.S., M.I.E.E., to the Professorship of Electrical Engineering and Applied Physics at the Institute's Technical College, Finsbury, rendered vacant by the death of Prof. Silvanus P. Thompson, F.R.S. Mr. Eccles is at present University Reader of Graphics at University College, and is the author of a work on *Wireless Telegraphy and Telephony*, and numerous papers and inventions on subjects connected with electrical engineering.

Mr. FRANCIS H. DAVIES, assistant engineer, Weston Electrical Instrument Co., has been gazetted Lieutenant in the Army Ordnance Department.

Mr. S. R. MULLARD, A.M.I.E.E., of the research laboratory, Edison & Swan United Electric Light Co., Ltd., Ponders End, has been granted a temporary commission as Lieutenant, R.N.V.R., attached to the R.N.A.S. Lieutenant Mullard has been actively employed in connection with research work on the Ediswan "Pointolite" (nitrogen) arc lamp. He is being retained by the Ediswan Co., and will thus keep in touch with his laboratory work.

We read in the *South African Mining Journal* that Mr. BERNARD PRICE has been elected President of the S.A. Institute of Engineers.

Roll of Honour.—The death in action, on July 1st, of Captain C. C. MAY, Manchester Regiment, is reported. He was the only son of Captain C. E. MAY, New Zealand Forces, and had been district manager for Associated Fire Alarms, Ltd., in the Manchester district since 1911. "Though mortally wounded," his Colonel writes, "he gallantly continued to give orders and encourage his men to the last. Had he lived I would have recommended him for the D.S.O." Born in Dunedin, N.Z., he obtained his commission in January, 1915, and was promoted captain a month later. Previously he had served six years with King Edward's Horse, and at the outbreak of war founded and commanded the Legion of Volunteers in Manchester. Captain May was well known in business circles in Manchester.

Lieutenant A. R. COURTENAY, of the General Electric Co., Ltd. (Publicity Department), has been invalided to St. Andrew's Hospital, Malta, from Salonika, but we are pleased to learn that his indisposition is not serious.

Private H. BURNISTON (26), who has been killed in action, was a draughtsman at the Leeds Corporation electricity works.

Private W. C. MCNEIL, who has been wounded, was in the employ of the Cramer Lamp & Engineering Co., Armley, Leeds, before enlisting.

Private P. PALEY, of the Yorkshire Regiment, who has been killed, was an electrician at Grimthorpe Colliery.

Private S. GREENWOOD, of the Yorkshire Light Infantry, who has been killed in action, was an electric wireman at Halifax before being called up as a Reservist.

Private C. W. BARKER, of the 8th Battalion Royal Fusiliers, and late of the electrical fittings department at the Ediswan Works, Ponders End, has been seriously wounded in France.

Private FRANK MCGEEHAN, of the 20th County of London Regiment, who was killed in action on July 15th, was, before the war, employed in the testing department at Hooper's Telegraph & India-Rubber Works, Ltd., Millwall Docks, London, E.

Corporal REGINALD BUCKLEY, of the Liverpool Regiment, aged 29, an employee at the electricity works, Waterloo, Liverpool, has been killed in action.

Private M. HAYDOCK (23), an employee of the British Westinghouse Co., Trafford Park, has died of wounds.

Private JAMES MILLS, who was formerly employed by the Manchester electricity department, at Clayton, has been killed.

Private JAMES WALKER, a worker at the Manchester electricity works, Ardwick, has been killed.

Private THOMAS L. WOOD, of the Liverpool "Pals," has died of wounds. He was 25 years of age, and formerly employed at the Formy electricity station.

Private J. E. EDWARDS, of the Manchester Regiment, aged 28, has died of wounds. He was employed at the Manchester Corporation electricity works before the war.

Sergeant JAMES WARD, of the Northamptonshire Regiment, who has been wounded, was formerly employed by Messrs. W. T. Glover & Co., Ltd., Trafford Park.

Bandsman SIDNEY MORRIS, of Harpurhey, Manchester, aged 18, who was on the clerical staff of the British Insulated and Helsby Cables, Ltd., Manchester, has been killed.

Private HARRY CROWTHER, aged 22, killed in action, was an employee of the British Westinghouse Co., Trafford Park.

Private JOHN ROYDMAN, of the Grenadier Guards, an employee of Messrs. Ferranti, Ltd., has been killed in action.

Private S. J. WALLEY, of the Welsh Regiment, killed in action when going to rescue a comrade, was formerly engaged in the electrical department of the Crews railway works.

Armourer-Staff-Sergeant W. F. RAWSON, Army Ordnance Corps, aged 29, for many years employed at the Stuart Street generating station, Manchester, has been killed through the accidental bursting of a gun which was being overhauled.

Private **HARRY HOLLINS**, of the Manchester "Pals," an employé of Messrs. **Bexendale & Co., Ltd.**, has been wounded. Private **ALBERT BROWN**, another employé of the same firm, has been killed in action; and Private **U. BOOTH**, a third employé, has been wounded.

Rifleman **W. WOOLHAM**, of the Rifle Brigade, now in a Manchester hospital, was formerly employed by the **St. Helens Cable & Rubber Co., Ltd.**

Private **W. H. BARLOW**, of the Norfolk Regiment, formerly a draughtsman at the electrical works of Messrs. **Laurence, Scott & Co., Norwich**, and previously with the **Lancashire Dynamo Co.**, has been killed in action.

Corporal **HARRY HOOSE**, of the Royal Welsh Fusiliers, aged 22, killed in action, was an employé of the **British Insulated and Helsby Cables, Ltd.**

Second-Lieutenant **CYRIL R. WARD**, of the Royal Engineers, killed in action, was educated at **Sandbach Grammar School** and at the **Manchester Municipal School of Technology**. He was engaged, prior to the war, with the **British Westinghouse Co., Trafford Park**.

Private **WALTER HEWES**, who was formerly employed at the electricity station, **Broadheath (Cheshire)**, has been wounded.

Second-Lieutenant **NORMAN HAWORTH**, of the **South Lancashire Regiment**, killed in action, aged 26, was formerly in the employ of Messrs. **Siemens Bros., Stafford**.

Second-Lieutenant **RALPH NESBIT LODGE**, of **Manchester**, a nephew of Sir **Oliver Lodge**, is reported missing. Before the war he was employed by the **General Electric Co., Ltd.**

Sergt. **H. B. CROSFIELD**, of the **Manchester Regiment**, an employé in the **Manchester electricity department**, who was mentioned in despatches by Sir **Ian Hamilton**, has been killed, aged 26.

Private **A. E. JOHNSON**, of the **Lancashire Fusiliers**, who was an electrician with Mr. **W. Brierley, of Bury (Lancs.)**, has fallen in action in France.

Private **L. F. WATKINSON**, who was, on his enlistment, in the office staff of the **Leicester Corporation electricity and tramway department**, has been wounded, and is in hospital at **Lichfield**.

Private **G. FAIRHURST**, of the **R.A.M.C.**, who was in the electrical department of the **Vulcan Foundry Co., Ltd., of Earlstown**, has died of dysentery at **Amara, Persian Gulf**.

Second-Lieutenant **STEPHEN F. WEEKS, B.Sc. (Lond.)**, of the **Royal Engineers**, killed in the advance in France, was a nephew of **Ald. G. Weeks, of Messrs. G. Weeks & Son, electrical engineers, of Bromley (Kent)**. He was 28 years of age, and came home from **Siam** to join the Forces.

Private **RICHARD HARDMAN**, of the **Royal Scots**, wounded at **La Boisselle**, was formerly engaged as an electrician with Messrs. **Smith, at Pendleton (Lancs.)**.

Private **H. W. RAWKINGS**, who was on the staff of the **Cain bridge electric light works** when he enlisted in the **Suffolk Regiment**, was wounded in France, and is in hospital at **Birmingham**.

Private **G. L. RICHARDSON**, of the **Oxford and Bucks Light Infantry**, who was, prior to the war, an employé of Messrs. **Hill, Upton & Co., electrical engineers, of Oxford**, has died in hospital.

Private **W. BAILEY**, of **Swinton**, an employé of the **Chloride Electrical Storage Co., Clifton Junction**, has died of wounds, aged 19.

Sapper **E. W. LUCAS**, at one time a partner in the firm of Messrs. **Walmesley & Lucas, electricians, Pendlebury**, has been killed in action, aged 23.

Private **H. NOBLE**, **Bermuda Rifle Volunteer Contingent**, attached **1st Lincolnshire Regiment**, who was with the **Halifax and Bermuda Cable Co.**, was killed in France on July 3rd.

Captain **H. K. TURNER**, aged 25, who, according to the *Times*, was killed in action on July 16th, was a director of Messrs. **E. R. & F. Turner, of Ipswich**.

The *Times* states that Second-Lieutenant **J. H. PARR-DUDLEY**, **Royal Fusiliers**, who was killed in action on July 1st, spent a year at the **Faraday House Electrical Engineering College**, where he took a silver medal; he received a commission in January, 1915.

Private **HAROLD GORDON TAYLOR**, **London Scottish**, late assistant draughtsman at **Fulham electricity works**, who was wounded in four places in the charge at **Gommecourt Wood**, on July 1st, is lying in the **London Hospital**, progressing favourably.

Obituary.—SIR WILLIAM RAMSAY.—By the death of Sir William Ramsay, on Sunday last, we have lost perhaps the most distinguished of our chemical physicists, and one who had, moreover, rendered unsurpassed services to the Allied cause by his strenuous advocacy of a closer blockade, and of reform in our educational methods. He was born in Glasgow in 1852, educated at the Universities of Glasgow, Heidelberg, and Tübingen, and, after serving on the staff of Anderson's College and the University in his native city, became Professor of Chemistry at and Principal of University College, Bristol. From 1887 to 1913 he occupied the Chair of Chemistry at University College, London, where most of his most striking discoveries were made. Jointly with Lord Rayleigh he discovered argon, a new constituent of the atmosphere, and later he isolated helium, neon, krypton, and xenon. In 1903, Sir William Ramsay proved that helium was a product of the disintegration of radium, and carried out further research into the transmutation of the elements. He received many honours in recognition of his scientific achievements,

including the Nobel prize in 1904, and was the author of important works on chemical subjects. His work in connection with radium and radio-activity, in which he collaborated with Prof. Soddy, was of the highest order. He was also interested in the conservation of our stores of coal, and proposed a scheme for the distillation of coal in its natural bed, the resulting gases being utilised on the surface for the generation of electrical energy. Sir William was a talented musician and an excellent linguist. He leaves a widow and two children.

MR. EDWARD ROCK.—Mr. E. Rock, electrical engineer, of Worthington, died on July 21st from injuries received whilst cycling on July 4th.

MR. H. F. C. EGERS. The *Commonwealth Engineer* reports the death, which occurred in May, of Mr. H. F. C. Eggers, A.M.I.E.E., from injuries received in a motor car accident. Mr. Eggers was a partner in the firm of Haes and Eggers, Ltd., Sydney. On the death of Mr. Haes in 1909, Mr. Eggers took over the management of the business, and continued it until his death. Born in New Zealand, he graduated in civil engineering at the **Dunedin University**.

At Barrow Education Committee last week, the Mayor of Barrow referred in terms of very high praise to the services rendered to the Barrow Technical Schools by Mr. E. THORNTON, electrician, whose tragic death recently occurred.

NEW COMPANIES REGISTERED.

Arthur Ellis & Co., Ltd. (144,348).—This company was registered on July 14th, with a capital of £2,000 in 41 shares (1,000 profit), to carry on the business of general mechanical, electrical, and engineering manufacturers of and dealers in motor and other vehicles, aeroplanes, airships, motor cycles, boats, and accessories of all kinds; makers of electric lamps and apparatus, garage keepers, carriers, coach builders, motor and tire manufacturers, electricians, &c. The preferred shares are to be fully paid up, and to entitle the holders to a dividend of 8 per cent. per annum, and to a further 40 per cent. of any surplus profits available for dividend after providing for 8 per cent. on the ordinary shares. The subscribers are: A. T. Ellis, Caxton House, Westminster, S.W., electrical and general engineer; J. ord, shares; W. L. Heald, Caxton House, Westminster, S.W., electrical and general engineer; 1 pref. share, Private company. The first directors (to number not less than two or more than five) are A. T. Ellis and W. L. Heald. Registered office: 201, Caxton House, Westminster.

Higgins & Griffiths, Ltd. (144,330).—This company was registered on July 12th, with a capital of £10,000 in 41 shares, to take over the business of electrical and general engineering carried on by A. Higgins and S. Griffiths at 21, Orchard Street, Portman Square, W., as Higgins and Griffiths. The subscribers (with one share each) are: A. Higgins, 21, Orchard Street, Portman Square, W., electrical engineer; S. Griffiths, 21, Orchard Street, Portman Square, W., electrical engineer. Private company. The number of directors is not to be less than two or more than three. The first are A. Higgins and S. Griffiths (both permanent, subject to holding 3,000 shares each). Remuneration as fixed by the company. Registered office: 21, Orchard Street, Portman Square, W.

British Italian Corporation, Ltd. (144,404).—Registered July 20th, by Herbert Smith, Goss, King & Gregory, 62, London Wall, E.C., Capital, £1,000,000 in 50,000 shares of £20 each. Objects: To carry on, subsidise, assist, participate in financial, commercial, industrial, manufacturing, electrical, railway, navigation, land development, mining, and other businesses, works, contracts, undertakings, and operations of all kinds in the British Empire, Italy, and elsewhere, to undertake any operations commonly carried out by public utility companies, contractors, capitalists or merchants, concessionaires, contractors for public and other works, capitalists or merchants, to establish and carry on the business of a bank of deposit, to act as agents for the collection, receipt, transmission, or payment of money, &c. The signatories (with one share each) are: C. Goss, 62, London Wall, E.C., solicitor; F. H. King, 62, London Wall, E.C., solicitor; J. Sims, 121, Albert Palace Mansions S.W., solicitor; W. A. Bewes, 2, Harcourt Buildings, Temple, E.C., barrister; S. A. Sharpe, 205, Friern Road, Dulwich, S.E., accountant; E. J. Burrows, 22, Ashchurch Road, Chingford, Essex, clerk; A. G. Mount, 22, Norfolk Road, Clapton, N.E., clerk. Minimum cash subscription, seven shillings. The first directors (to number not less than three or more than nine) are Arthur Hill, 106, Eaton Square, S.W., bank director; Robert H. Benson, 31, Bishopsgate, E.C., merchant banker; J. W. Beaumont Fease, 13, Stratton Street, W., bank director; Sir Hy. Babington Smith, K.C.B., 121, St. James' Court, S.W.; Joseph Burn, 142, Holborn Bars, E.C., actuary; Alberto Pirrelli, 144, Queen Victoria Street, E.C., company director; Ignatius G. Manzile, 22, Abchurch Lane, E.C., manager of Credito Italiano; Riccardo Bianchi, 23, Abchurch Lane, E.C., director of public companies. As long as the Credito Italiano holds at least £50,000 shares, it may nominate not more than one-third (or the number nearest to one-third) of the board. Remuneration in each year when the issued and paid-up capital is £1,000,000 or less, £300 each per annum, and £700 extra for the chairman. In each year when the issued and paid-up capital is £1,000,000, sums bearing the same proportion to the issued and paid-up capital as £300 and £700 respectively, bear to £1,000,000. The directors may borrow or raise money, for any or on time (exclusive of moneys received from depositors or outstanding on bills or letters of credit or other instruments in the ordinary course of banking business) shall not, without the sanction of a general meeting, exceed twice the nominal amount of the issued capital. No notice of situation of registered office has yet been filed.

Birmingham Electrical Accessories Manufacturing Co., Ltd. (144,396).—This company was registered on July 19th, with a capital of £1,000 in 21 shares, to carry on the business of manufacturers of and dealers in electrical fittings and accessories, electrical, gas, hot water, and mechanical engineers, &c. The subscribers (with one share each) are: E. A. Welch, 48, Francis Road, Stechford, manufacturers; C. E. Garratt, 22, Thynne Street, West Bromwich, manufacturer. Private company. The first directors (to number not less than two or more than five) are G. Garratt, C. E. Garratt, E. A. Welch, and Alice Welch. E. A. Welch and C. E. Garratt are permanent. Qualifies: 50 shares. Secretary: Amy M. Garratt. Registered office: Whitmore Street, Hockley, Birmingham.

British Electric Trading Co., Ltd. (9,641).—This company was registered in Edinburgh on July 17th, with a capital of £2,000 in 21 shares, to carry on the business of manufacturers of and dealers in all apparatus and articles connected with electricity. The subscribers (with one share each) are: W. J. Kerr, 26, Carlton Court, Glasgow, dyssalter; R. M. Dimp, 10, Inverness, Glasgow, secretary. Private company. The first directors (to number not less than three or more than seven) are not named. Qualification, £50 shares. Remuneration, £50 per annum. Solicitor: H. Hannah, Edinburgh.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Anchor Cable Co., Ltd. (69,073).—Capital, £250,000 in £10 shares. Return dated June 8th, 1916. 6,500 shares taken up; £61,000 paid; 6,100; £4,000 considered as paid on 400. Mortgages and charges: £50,000.

Anglo-American Telegraph Co., Ltd. (2,891c).—Capital, £7,000,000 in £413,300 ord., £3,293,350 pref., and £3,293,350 def. ord. stock. Return dated May 19th, 1916. All stock taken up; £600,000 paid; £46,400,000 considered as paid. Mortgages and charges: Nil.

Carville Site & Power Co., Ltd.—Issue on July 7th, 1916, of £10,000 deb., part of a series of which particulars have already been filed.

Lampough & Son, Ltd.—Mortgage dated June 23rd, 1916, created by the Receiver and Manager to secure not more than £2,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Messrs. Hoare, 37, Fleet Street, E.C.

Edison Accumulators, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated July 4th, 1916, to secure all monies due up to be lent by the company to London County & Westminster Bank, Ltd., 41, Lombard, L.C., not exceeding £15,000, in addition to a previous amount for not more than £5,000.

Brachy Falls & Metallurgical Syndicate, Ltd. (110,780).—Capital, £48,000 in £1 shares. Return dated December 30th, 1915 (filed June 20th, 1916). All shares taken up; 10s. 6d. per share called up; £25,200 paid. Mortgages and charges: Nil.

Anglo-Foreign Tramway Syndicate, Ltd. (112,859).—Capital, £10,000 in 9,500 pref. shares of £1 each, and 5,000 "A," 4,000 "B," and 1,000 ord. shares of 1s. each. Return dated December 31st, 1915 (filed May 25th, 1916). 4,200 pref., 370 "A," and 74 "B" shares taken up; £4,222 4s. paid. Mortgages and charges: Nil.

Geo. Bray & Co., Ltd. (76,185).—Capital, £160,000 in 80,000 pref. and 80,000 ord. shares of £1 each. Return dated June 6th, 1916. 55,000 pref. and 55,000 ord. shares taken up; £7 paid; £109,903 considered as paid. Mortgages and charges: £40,000.

Birkdale District Electric Supply Co., Ltd. (70,259).—Capital, £50,000 in £5 shares. Return dated May 10th, 1916. 9,200 shares taken up; £5 per share called up on 6,000, and £3 on 3,200; £39,600 paid. Mortgages and charges: £6,000 deb., issued as collateral security.

Brisbane Electric Tramways Investment Co., Ltd. (67,853).—Capital, £975,000 in 75,000 pref. and 120,000 ord. shares of £5 each. Return dated June 7th, 1916. All shares taken up; £5 per share called up on 30,624 ord.; £150,129 paid; £824,880 considered as paid on 75,000 pref. and 89,976 ord. Mortgages and charges: £450,000.

Harry W. Cox & Co., Ltd.—Particulars of £2,000 debentures, created June 28th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Flather & Co., Ltd.—A memorandum of satisfaction in full on June 29th, 1916, of second mortgage debenture, dated May 23rd, 1905, securing £400, has been notified.

Coatbridge & Airdrie Electric Supply Co., Ltd. (89,178).—Capital, £1,000 in £1 shares. Return dated March 30th, 1916. All shares taken up; £1,000 considered as paid. Mortgages and charges: £161,812 8s. 11d.

British Insulated & Helsby Cables, Ltd. (52,285).—Capital, £1,000,000 in 100,000 pref. and 100,000 ord. shares of £5 each. Return dated April 10th, 1916. All shares taken up; £5 per share called up on 74,470 pref. and 40,065 ord.; £573,675 paid; £427,325 considered as paid on 25,530 pref. and 59,935 ord. Mortgages and charges: £700,000.

CITY NOTES.

MR. C. F. TUFNELL presided at the annual meeting, held on Monday at Salisbury House, E.C. He said that the trading for the last twelve months had been profitable. The year had been one of difficulty in many directions—the constantly increasing cost of material, the delays in delivery, the trouble of getting goods shipped, and the loss of further members of the staff, were a few of the obstacles with which they had had to contend. They had, however, managed to do a larger turnover during the year, and the gross profit was increased from £57,900 to £63,100, and, after deducting the various charges set forth in the accounts, they had at their disposal, with the carry-forward, £37,950, against £28,649 twelve months ago. They proposed to put £6,500 to the general reserve fund, as last year, and they suggested a larger sum as a special depreciation fund. In order to enable them the better to handle the orders with which they had been entrusted by the Government for the prosecution of the war, they had been obliged to purchase additional machine tools, and to make certain extensions to their premises. Not only had they had to pay war prices for these extensions and this new plant, but some of the expenditure would not be remunerative when the special war work on which they were engaged came to an end. In the circumstances, the board were of opinion that it was necessary to make a liberal reserve against this expenditure, and they had also to face the fact that in these strenuous times the ordinary rate of depreciation which they wrote off each year might not be sufficient, in some cases, to cover wear and tear. They next proposed to write off £1,600—the balance of preliminary expenses—so that this item would disappear from the balance sheet. They recommended the payment of the full dividend of 7 per cent. on the preference shares, but they felt com-

pelled to again appeal to the patience of the ordinary shareholders. When addressing them last year, he referred to the need of husbanding their resources in these times of uncertainty and stress, and they had now to face war taxation on a scale which was altogether unforeseen twelve months ago. Although the carry-forward was increased from £7,691 to £10,479, this sum was subject to excess profit duty and assessment under the Ministry of Munitions Act, and this liability was in respect not only of the profits of the year under review, but applied to the previous year's profits also. They were quite unable to tell at the present moment what amount they would have to pay under these heads, but he might remind the shareholders that the basis of assessment for war taxes was the average profit of pre-war years, to which certain additions were made. They would remember that in the two or three years before the outbreak of war, in the old company's days, the business was not making profits, and, although the Acts allowed some relief in such cases, there was no doubt that if the reorganisation of the company had been carried out two or three years earlier they would have been entitled to retain more of their profits for the shareholders than they could hope for in the existing circumstances; but such was the fortune of war. The company's works were declared a controlled establishment in August of last year. During the year they had delivered a very large amount of war material, as well as equipment for Government and other munition works throughout the country, and the orders in hand for these various classes of work at the end of the year under review showed a considerable increase over the figure at which they stood twelve months previously. Having referred to the election of Mr. Britten, the manager at Chelmsford, to a seat on the board, the Chairman said that, as to the future, he was glad to say they had plenty of work in hand to keep them busy for many months to come, so they were not very much concerned for the current year as to their shops. What was to happen after the war was over was another matter. Some people anticipated considerable activity for a period, but they were taking steps to meet a possible set-back in the demand. He hoped the results of what they were doing would enable them to obtain business in other directions, as and when they required it, to compensate for any falling off in their ordinary trade, and this matter of the future was receiving their most careful attention. He would like once more to testify to the loyal manner in which they were being supported by the staff and others, from the managers downwards, and he would like to include their branch managers and representatives abroad. One and all were feeling the burden put upon them by the war and were striving their best in the interests of the shareholders.

Lieut.-COL. JOHN CLIBBORN seconded the motion.

MR. DE UPPEAUGH, referring to the £10,000 put aside for excess profits, said that, as an ordinary shareholder, he had not received any dividend for ten years, and now, when there was a chance of getting a return on his money, it seemed as if the Government had stepped in and taken it. He thought it was an understood thing that the Government was going to allow investors a certain return on their capital before they annexed the excess profits.

MR. HUSBAND said he thought the directors were to be congratulated upon the satisfactory way in which they had carried on the company during the past twelve months. It must have been a very anxious and troublous time, and that they had weathered the storm so well was distinctly a matter for satisfaction. He had intended to refer to the huge comparative reserves in the balance sheet, but after what the Chairman had said, he was satisfied that they were wanted for the purposes of the business. He was an old-fashioned financier, and he held that all reserves should be liquid, but he supposed that in the case of Crompton's that was a policy of perfection which it was not possible to adopt.

The CHAIRMAN, in reply, said that the matter of the excess profits tax was a very delicate one which they had better not discuss publicly. As to the large reserves, the special reserve of £10,000 was to cover the expenditure which they had incurred on plant and machinery which had been bought specially for Government work, and which would not be of any use after the war.

The report was adopted.

Edmundson's Electricity Corp., Ltd.

The annual meeting was held on Thursday last week, at Salisbury House, E.C. Mr. P. D. TUCKETT, who was in the chair, said that the set-back in the steady progress which the company had been making year by year prior to the war, which was shown in the accounts, was directly and entirely attributable to the abnormal conditions resulting from the war. Almost all the undertakings had been adversely affected, the aggregate profits showing a reduction of over £12,000. Their costs had been increasing, while the lighting revenue had been shrinking, owing solely to the increased cost both of materials and labour, aggravated in some cases by the reduced efficiency resulting from the reduced loads. Coal, oil, copper, and all other materials used in the business had greatly risen in price. The increased cost of coal (often of inferior quality) accounted for a difference of near £13,000. Then, again, the unprecedented demand for labour, and particularly for skilled labour, coupled with the high cost of living, had necessitated the payment of higher wages, or of war bonuses, which was

the same thing in another form. They had continued the payment of rent, and had the depredations of men on active service, and the fact that the year absorbing nearly £3,000. What was, however, in some respects the most serious feature of the situation, so far as the staff was concerned, lay in the fact that they had been deprived of the services of many of their most experienced and highly-trained men at a time when they could least afford to lose them and were least able to replace them. Altogether, 364 men had left them to serve in the Army or Navy, and of these ten had laid down their lives. In order to cover, to some extent, the heavy extra expense incurred, they last year raised their rates of charge, and in view of the still heavier expense with which they were now faced they had had no alternative but to again increase them, in some cases up to their authorised maximum, and, indeed, in two or three cases they had been obliged to ask the Board of Trade to sanction an increase beyond the maximum. How far this would compensate them for increasing costs it was impossible to forecast, but it would fall considerably short of what was required to compensate them also for the loss of lighting revenue. They were, however, doing all they could to develop the power and heating loads, the importance of which they had long recognised, and so far as their limited opportunities admitted, he thought they were meeting with a very fair measure of success in this direction, for last year their power and heating connections aggregated the equivalent of 124,000 lamps, whilst for the first five months of the current year they represented the equivalent of 56,000 lamps. The revenue derived from this additional load had tended to minimise the loss of lighting revenue, but the shrinkage in the latter was so marked, and was likely to be so increasingly felt during the current year with the influence of the Summer Time Act super-added to those which were previously operating, that he felt it was useless to cherish any illusions that the new load would make good the loss on the old. Proceeding to refer to the accounts, he said the net balance of the profit and loss account was £13,259, about £10,000 less than last year. They had been able to pay the final half-year's dividend on the cumulative preference shares and carry forward £4,625. The general financial position of the company remained satisfactory; its cash resources amounting to nearly £36,000, as against £34,000 last year, and little more than £14,000 two years ago. The reserve stood at £73,148, or over £17,000 in excess of the figure last year. In view of the probability of a further shrinkage of profit during the current year, he thought they would have to withhold the payment of an interim dividend on the preference shares next January. It was most disappointing that the war should for the time being have largely deprived them of the fruits of their past labours, for he thought there was little doubt that, but for the war, they would to-day be paying a substantial dividend on the non-cumulative preference shares. They were not, however, alone in their sufferings, for all electric supply undertakings were suffering, and were likely to suffer increasingly, as long as the war lasted where no special condition existed to compensate them for their increased costs and reduced lighting revenue. Their lamp connections, amounting to an equivalent of 150,284 lamps, had been well maintained, but of these only 17 per cent. represented lighting, as compared with 32 per cent. for the previous year, and this tendency was still more marked in the connections for the first five months of the current year, the proportion of lighting to power having fallen to 10 per cent. It had been a feature of the war period that their power connections had been stimulated by the exceptional demands for power created by the war, and he hoped they might continue to derive a large part of the benefit from those connections after the war, although it was difficult to say at present how far many of them were likely to be permanent. Thus, at one place they had a single factory taking 600 kw., equivalent to over 18,000 lamps, for shell making. Dealing with the results of the subsidiary companies, he said the Isle of Wight Co. afforded as good an illustration as any of the way in which they had been adversely affected by the war, since it was that company which was chiefly responsible for the reduction in the dividend and interest item in the profit and loss account. Prior to the war, the company was progressing as steadily and satisfactorily as they could desire, its profits having increased by over £3,000 during the four years from 1909 to 1913, whereas for 1914 they declined by £1,456, and during the past year by a further £2,453. The two principal items accounting for this last reduction were an increase of £721 in the price of coal and a reduction of £2,241 in the lighting revenue. Last year Ventnor's lighting revenue shrank by as much as 31 per cent., and Sandown's by not much less. They had had very similar experiences at Lynton, Ilfracombe, Ramsgate, and Cromer, all holiday resorts deserted by their visitors. At Lynton the lighting revenue dropped 15 per cent. last year, at Ilfracombe 16 per cent., at Ramsgate 23 per cent., and at Cromer 29 per cent., following a drop of 10 per cent. in the previous year. Melton Mowbray's hunting season and Newmarket's racing and training activities had, of course, suffered owing to the war, and in both cases this had affected their dividends, and had consequently reacted on them, whilst Bromley and Surbiton both suffered from the smaller consumption of their lighting consumers, Bromley's lighting revenue shrinking by £1,133, and Surbiton's by not much less. Finally, there was the Scarborough tramway undertaking, which, starting from a much less satisfactory point

of departure, had suffered more seriously than any of the other undertakings in so far as its profit of £238 for 1914 had been converted into an actual loss of £1,722 for 1915. The bombardment by the German cruisers, followed by Zeppelin raids, besides reducing the resident population, was estimated to have deprived the town of nearly 500,000 of its summer visitors, on whom, to a very large extent, the earnings of the tramway necessarily depended, with the result that the revenue actually shrank by 58 per cent. as compared with 1914, and by 66 per cent. as compared with 1913. The undertaking presented one of the most difficult problems with which they had to deal, since it was obvious that they could not afford to run it indefinitely at a loss. On the other hand, it earned an aggregate gross profit of over £1,900 in the three years prior to the war, it gave promise of decided improvement during the first half of 1914, and they could not but hope that it might again show improving results after the war. For the time being, they were operating it with every possible economy, but, do what they would, they could not expect to avoid a substantial loss as long as they were confronted with the present conditions. There remained two developments of a much more satisfactory character. The Lancashire Power Co. increased its profits last year from £30,471 to £32,843, whilst for the current year, in spite of increased coal prices, it promised to do very substantially better still. It had not yet reached the stage at which it could prudently divide its profits, but if it continued to make the progress it was doing, he saw no reason why it should not be in a position to do so within two or three years. Consequently, it was a source of considerable satisfaction to them to feel that they were fully justified in supporting and saving their investment when, in 1908, they decided to take upon themselves the responsibility of increasing it by a further £23,000. The other satisfactory development related to the Surbiton undertaking, which had now been taken over from the Council. They were interested jointly with Callender's Cable and Construction Co., and the arrangement came to be similar to that made in the case of Frome. They took over the undertaking subject to the payment of the balance of the interest and sinking fund on the capital provided by the Surbiton Council, which in any case they were under an obligation to discharge, but, whereas previously they had no interest in the reversion, they now had the entire interest therein, and this should ensure their eventually making good, and, indeed, far more than making good, the losses incurred in the earlier years. In conclusion, he said that, as they would have gathered from his remarks, they were by no means sanguine as to their ability to avoid some further shrinkage of profit with the capital expenditure reduced to the barest minimum, and with costs tending to rise and lighting revenue to decline still further. They were doing what they could to minimise the consequences of these conditions, but the conditions were such that they could not hope entirely to overcome them, and he was afraid they had got to recognise the fact and accept the sacrifice which the exigencies of the time might require them to make. Their present position and prospects were wholly due to war conditions, and should, therefore, rapidly improve as the country resumed its normal way of life after the war. In the meantime, it should prove reassuring to them to remember that the gross profits of the various undertakings increased by approximately £60,000 between 1908 and 1914, or at an average rate of nearly £9,000 per annum, whilst for this past year the subsidiary companies, in addition to providing for the depreciation of their free wiring and wiring stocks, had appropriated to reserve and carry-forward over £40,000 in excess of the amounts provided in 1908. It was this policy, which they had steadily pursued, of building up the resources of the subsidiary companies which would prove their salvation in this time of stress, and would, he hoped, enable them, a year or two hence, to proceed once more on that path of steady progress which for the time being had been so rudely interrupted. And, after all, however disappointing it might be, and however they might deplore it, this temporary loss of profit was a comparatively small matter when they considered the overwhelming issues at stake and the supreme sacrifices which were being made to remove once for all the intolerable menace which had been threatening Europe with increasing impotence for so many years.

Mr. A. A. CAMPBELL SWINTON seconded the motion, which was adopted without discussion.

French Lighting and Tramway Undertakings.

The accompanying tables show the financial results realised by a number of electric lighting and tramway companies in France during the past two years. In the case of the two supply companies for which no rate of dividend on the ordinary shares is mentioned for 1914, no information is available for the moment, and it must therefore not be assumed that a distribution did not take place for that year. The absence of any dividend declaration by certain other companies in both years is due chiefly to the allocation of net profits to contingency funds in consequence of the effects of the war. The list of tramways also comprises the Compagnie Générale des Omnibus, whose rate of distribution for 1914 is also lacking. The inclusion of this Paris company is explained by the fact that it owns an extensive mileage of trolley and conduit lines in Paris, whilst the company's motor omnibus services, although resumed to a slight extent in June of the present year, were entirely at a

standstill in 1915 owing to the requisition of the 'buses by the Army authorities. The tables are as follows:—

LIGHTING AND POWER COMPANIES.

	Dividend per cent.	
	on ord. shares.	
	1915.	1914.
Compagnie Parisienne de Distribution d'Electricité	4	4
Société d'Electricité de Paris	8	8
Parisienne Electrique	—	—
Compagnie Générale de Distribution d'Energie Electrique	—	—
Energie Electrique du Littoral Méditerranéen	4	3
Compagnie Centrale d'Energie Electrique	—	—
Energie Industrielle	—	—
Forces Motrices et Eclairage de Grenoble	—	—
Force Motrice de l'Arve	7	—
Compagnie Centrale d'Energie Electrique	—	—
Forces Motrices du Rhone	4.2	3.15
Havraise d'Energie Electrique	5.6	5.6
Hydro-Electrique de Fure et Morce	—	—
Société Biterroise de Force et Lumière	5	—
TRAMWAY UNDERTAKINGS.		
Compagnie Générale des Omnibus de Paris	5	—
Société Parisienne pour l'Industrie des Chemins de Fer et des Tramways Electriques	—	—
Compagnie des Tramways de l'Est Parisien	—	—
Compagnie Générale de Tramways	5	4
Tramways de la Rive Gauche	—	—
Tramways Algeriens	3.6	3.2

The directors report continued satisfactory progress. Revenue from sale of electricity increased, and notwithstanding the very high costs of coal and labour the net profits, after payment of bank and other interest, also increased. The net profits for the three half-yearly periods ended June 30th have been:—1916, £13,550; 1915, £9,873; 1914, £10,414. The dividend on the 6 per cent. cumulative preference shares for the half-year, absorbing £4,787, will be paid August 1st. In view of the financial conditions arising out of the war and the heavy commitments which the company has had to incur, due to the demands for munitions, the directors have deferred the consideration of a dividend on the ordinary shares until the end of the year. An important extension of the Thornhill power station is being made in consequence of the demands from the company for additional supply, and as a first instalment a 6,000-kw. turbo-alternator will shortly be erected.

County of Dorset
Electric
Power Co., Ltd.

The report for 1915 shows that the capital expended in the associated companies to date amounts to £34,451. The revenue receipts, exclusive of the Lyme Regis dividend, amount to £2,461, against £1,062 last year. The gross profit, including the dividend of the Lyme Regis Co., amounts to £1,271. Against this must be placed interest on temporary loans £846, leaving a profit on the year's operations of £425, against a deficit of £160 in 1914. The subsidiary companies (Lyme Regis, Blandford Forum & District, and Swanage Companies) have each shown satisfactory progress. The Lyme Regis Co., in spite of lighting restrictions, shows a substantial profit on the year's working, equivalent to a dividend of 8 per cent. The number of consumers on December 31st was 112 in Dorchester, 64 in Blandford, 133 in Lyme Regis, and 86 in Swanage. Progress during the year has been steady and satisfactory, especially considering the adverse conditions due to the war.

Standard Waygood Co., Ltd. (Australia).—The report of this company for the year ended March 31st, after writing off £9,286 for bad and doubtful debts and depreciation of securities, shows a loss of £1,165. With £17,802 brought forward there was an available balance of £16,638. An interim dividend of 1s. per share on the fully paid-up shares and 6d. per share on contributing shares absorbed £7,819, and the directors recommend a final dividend of like amount, making 10 per cent. for the year, leaving £1,000 to be carried forward as provision for income-taxes. The report states that a plant designed and used for the manufacture of electric searchlight carbons has been of service in developing an industry new to Australia, and useful to the defence forces. The cost and the loss on the manufacture of carbons has been entirely written off. Work in progress brought forward from the previous year was expected to show good profits, but increased cost of labour and material swallowed up these margins, and left losses, some very large. Orders are extremely scarce, and no interim dividend will be paid.—*Sydney Morning Herald.*

Mather & Platt, Ltd.—Interim dividend on the ordinary shares of 5 per cent., less income-tax, for the half-year to June 30th, being at the rate of 10 per cent. per annum.

Copper Prices.—F. Smith & Co. and James & Shakespear report, July 26th.—No changes in prices quoted last week.

Companies to be Struck Off the Register.—Unless cause to the contrary is shown within three months, the following companies will be struck off and dissolved:—

Anglo-German Wireless Syndicate,
Arkons Filter, Engineering & Water Softening Co.,
Bryan Locks-Sui Co.,
Blanchard Lamp Foreign Patents Co.,
Bridlington Electrical Engineering Co.,
Helis Cell & Accumulator Co.,
Improved Railway Signals,
International Filaments,
New Century Arc Light Co.,
Paris Accumulator Co.,
Power Transmission Syndicate,
Soudka Consumption (Copper-Cables Patents),
United Electric Light & Power Supply Co.,
Warner Engineering Co.

Tubes, Ltd.—A further interim dividend of 15 per cent., free of tax, making 20 per cent., free of tax, for the year ended April 30th last. It is intended to increase the capital of the company by a further 50,000 shares of £1 each.

Veritys, Ltd.—The separate meetings of the holders of the ordinary and management shares held, by order of the High Court, on July 25th, according to the *Financial Times*, considered a scheme of arrangement which provides that—

1. The 6,980 £10 ordinary shares shall be called preferred ordinary shares, and as from January 30th, 1916, have the right to a cumulative dividend of 7 per cent. and rank both as regard capital and dividend in priority to the management shares, but after the 5 per cent. and 6 per cent. cumulative preference shares, without further participation; and

2. The 200 £1 management shares shall be called deferred ordinary shares, and as from January 30th, 1916, and subject to the provision for a reserve fund and to the rights of the preferred ordinary shares, shall confer the right to the surplus profits which it may be determined to distribute.

Southern Brazil Electric Co., Ltd.—Mr. E. H. Tootal presided at the annual meeting, on 19th inst., and said that steady progress was being made with their different undertakings, and there was every reason to look for a satisfactory increase of revenue all round, but as the present stage was largely one of development and extension it would be some time before that increase could attain the full anticipated proportions. The Piracicaba tramways was opened for traffic, and it would soon show material development of passenger and goods traffic. Work was also progressing well with the electrification of the Campinas steam tramway, though unfavourable weather and the difficulty of obtaining material caused delay.

Wm. Beardmore & Co., Ltd.—After providing for depreciation, debenture interest, contingencies, excess profits, paying the preference dividend, and putting £50,000 to special preference dividend reserve, 6 per cent., free of tax, is to be paid on the ordinary shares, carrying forward £195,288.

Underground Electric Railways Co., of London.—Interest on the 6 per cent. first cumulative income debenture stock for the half-year ended June 30th at the rate of 6 per cent. per annum, less tax, and on the 6 per cent. income bonds of 1948 for the half-year ended June 30th at the rate of 6 per cent. per annum, free of British income-tax.

Central London Railway Co.—Interim dividends for the past half year on the undivided ordinary stock at the rate of 3½ per cent. per annum, and on the preferred ordinary stock at the rate of 4 per cent. per annum.

City & South London Railway Co.—Interim dividends for the past half-year on the whole of the outstanding 5 per cent. preference stocks 1891, 1896, 1901 and 1903 at the rate of 5 per cent. per annum, and on the ordinary stock at the rate of 1½ per cent. per annum.

Metropolitan District Railway Co.—Interim dividends for the past half-year on the 4 per cent. guaranteed stock at the rate of £4 per cent. per annum, on the first preference stock at the rate of £4 10s. per cent. per annum, and on the second preference stock at the rate of £3 per cent. per annum.

London Electric Railway Co.—Interim dividend for the past half-year on the 4 per cent. preference stock at the rate of £4 per cent. per annum, and on the ordinary shares at the rate of £1½ per cent. per annum.

W. & T. Avery, Ltd.—Dividend of 10 per cent., making 12½ per cent. for the year. Scarcity of clerical labour and other circumstances have delayed the preparation of the balance sheet and the holding of the annual meeting for the present.

Newcastle-upon-Tyne Electric Supply Co.—The "Financial Times" states that it has been decided to postpone the payment of the preference dividend until about the end of September.

Chatham & District Light Railways Co.—Interim dividend at the rate of 3 per cent., less tax, for the past half-year.

Bournemouth & Poole Electricity Supply Co., Ltd.—Interim dividend on the ordinary shares at the rate of 5 per cent. per annum, less tax, for the past half-year.

County of London Electric Supply Co., Ltd.—Interim dividend on the ordinary shares at the rate of 5 per cent. per annum, less tax, for the half-year ended June.

Credenda Conduits, Ltd.—After writing £2,000 off goodwill, and paying 5 per cent. per annum dividend, tax free, £955 is to be carried forward.

London Electric Supply Corporation, Ltd.—Interim dividend of 5 per cent. on the ordinary shares.

Kaministiquia Power Co.—Dividend at the rate of 7 per cent. per annum for the past quarter.

Lanarkshire Tramways Co., Ltd.—Interim dividend, 6½ per cent. per annum, less tax, for the past half-year.

Hong-Kong Tramway Co., Ltd.—Interim dividend, 7 per cent. per annum.

Metropolitan Electric Supply Co., Ltd.—Interim dividend on ordinary shares, 1s. per share for the past half-year.

City of Buenos Ayres Tramways Co. (1904), Ltd.—A dividend of 1s. 5d. per share at the rate of 5 per cent. per annum, less income tax, is announced for the past three months.

STOCKS AND SHARES.

TUESDAY EVENING.

Stock Exchange markets have recovered to a great extent from the depression into which they were plunged by the raising of the Bank Rate to 7 per cent. The tardy explanation of the way in which the country's daily expenditure of six million pounds on the war was arrived at helped to promote a better feeling, and it was considered a little unfortunate that explanation at greater length was not afforded by Mr. McKenna at the time that he made his statement.

Money continues to pile up from profits and savings, and has to be used in one direction or another. Treasury Bills and Exchequer Bonds are splendid investments; but capitalists do not care to put all their money into such securities, and the consequence is that the money is overflowing into other departments. The raising of the Bank Rate to 7 per cent. was feared at one time; but even if it were advanced to this level, the root factor would not be destroyed—that there is plenty of money seeking a more permanent investment than any short-term borrowings offer.

Home Railway stocks have recovered, after being dull and heavy. The factor outlined in the preceding paragraph becomes daily more obvious; and the first of the half-yearly dividends from the Home Railway companies are sufficiently good to stimulate buying of the stocks.

The Underground group entered the field early with its dividend declarations. It may be well to recall that the present occasion is the first that the profits are divided under the arrangements made by the recent shuffling of the cards in this group. The various companies pay their receipts into a single account or pool, from which it is shared out again in fixed proportions.

The City & South London Railway takes 6 per cent. from this pool, which is three times as much as its previous share; and no doubt this enables the company to pay a dividend at the rate of 1½ per cent. on its ordinary stock, against nothing at all since the first half of 1913, when the shareholders got ¼ per cent. The London Electric Railways takes 30 per cent. of the joint earnings, instead of 26 per cent. as previously, and the dividend on its ordinary shares goes up from 1 per cent. to 1½ per cent. No change was made in the proportions of the Central London or the District Companies, and the undivided ordinary stock of the former is to receive 3½ per cent., giving the preferred ordinary 4 per cent., while District pays 3 per cent. on its 5 per cent. second preference stock, the same as it did a year ago.

The London General Omnibus dividend is reduced to 5 per cent., free of tax, which is 1 per cent. less—due to the company's getting 32 per cent., instead of 40 per cent., of the fund already referred to. Obviously, the Tube companies have benefited at the expense of the London General Omnibus Co.

So far as prices are concerned, these dividend declarations have had little effect. The quotations are firmer, and Underground electric incomes have recovered most of their 34 points drop of last week. It is announced that the company will pay its coupon of 3 per cent., free of tax, on September 1st. Most of the Steam stocks are better, those in the Southern passenger group improving from a revival of the 35-year-old scheme for a Channel tunnel. The idea of such a tunnel is, of course, much older than this; but the company now in existence for the purpose of constructing a tube between this country and France came into being in 1881, under a title slightly different from the present one.

County of London ordinary and preference shares are both up ¼ on the declaration of an interim dividend at the rate of 5 per cent. on the former, this being the same as a year ago, and regarded, therefore, as distinctly satisfactory. City Lights and Charing Cross preference hold their previous improvements. A rise of 1/16 in London Electrics has taken the price to 15/16. No further changes have occurred in the list. There is still, however, a quiet demand for shares, and very little supply to meet it. Electric Constructions are better at 16s. 6d. British Westinghouse preference maintain their substantial improvement, and during the past few days have been up to 52s. 6d., which price tempted a few sellers, with the result that, on balance, there is no quotable change in the shares at 51s. 6d.

The Telegraph market has halted in its upward march, and the high prices have brought a little stock to market. The only change in quotations, however, is a fall of ¼ in Globe Telegraph & Trust preference. The rest of the list exhibits sufficient strength for the market to absorb with ease the shares that are offered. United River Plate Telephones reacted to 6½, but Chili Telephones remain good at 7.

Marconis took a turn for the better; the price touched 3½ bid, but eased off a trifle to 3 7/32. The subsidiaries, however, have improved, Americans hardening to 18s. and Canadians to 11s., while there has been a little business this week in Spanish and Generals on the basis of 10s. 6d. The Government is bidding 99½ for New York Telephone bonds or 103½ for the dollar bonds. Of the cable companies' shares, British Insulated at 11½ continue to advance, and are ¼ up on the week. Cromptons keep about 10s., the meeting held early this week having no effect upon the price.

Brazil Tractions are ex 1 per cent. dividend, equal to 2 per cent. net, so that at 62 ex dividend the price is actually ¼ higher. Anglo-Argentine second preference eased off to 3½. The British Columbia Electric group is firmer, the preferred and the deferred stocks both hardening. Mexico Tramways 5 per cent. first mortgage bonds are 1 lower at 41, although the news from Mexico seems to wear a somewhat brighter complexion.

The rubber market is quiet and disposed to droop, in consequence of the fall to 2s. 2d. per lb. in the price of the raw material. From this there was a small recovery, but the dwindling in rubber has checked the volume of buying. Armament shares are better, and there is a brisk demand for nearly all the companies connected with the iron, coal and steel industries. Copper shares remain heavy, for want of a recovery in the price of the metal itself.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.					
	Dividend		Price	Rise or fall this week.	Yield p.c.
	1914.	1915.	July 26, 1916.		
Brompton Ordinary	10	10	62	—	47 18 9
Charing Cross Ordinary	6	6	88	—	6 18 0
do. do. do. 4½ Pref.	4½	4½	88	—	8 8 7
Chelsea	6	4	8	—	6 18 4
City of London	8	8	122 8	—	6 8 0
do. do. 6 per cent. Pref.	6	6	104	—	6 14 8
County of London	7	7	103	+ ½	6 10 0
do. do. 6 per cent. Pref.	6	6	104	+ ½	6 14 8
Kensington Ordinary	9	7	68	—	6 16 7
London Electric	4	8	1 3	+ ½	6 17 2
do. do. 6 per cent. Pref.	6	6	4½	—	6 13 4
Metropolitan	34	3	28	—	6 6 4
do. do. 4½ per cent. Pref.	4½	4½	8	—	8 10 0
St. James' and Pall Mall	10	8	6	—	6 13 4
South London	5	6	26	—	8 13 10
South Metropolitan Pref.	7	7	62	—	8 4 6
Westminster Ordinary	9	7	68	—	6 14 8
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	10 3	—	6 16
do. do. Def.	30	33 6	23	—	7 10 9
Chile Telephone	8	8	7	—	6 14 5
Cuba Sub. Ord.	6	6	1 3	—	* 6 18 4
Eastern Extension	7	8	112 3	—	* 6 7 8
Eastern Tel. Ord.	7	8	149 3	—	* 6 7 8
Globe Tel. and T. Ord.	6	7	123 3	—	* 6 8 8
do. do. Pref.	6	6	105 3	—	6 10 4
Great Northern Tel.	22	22	48	—	6 18 0
Indo-European	13	13	49	—	6 12 8
Marconi	10	19	3 5	+ ½	3 2 0
New York Tel. 4½	4½	4½	93 3	—	4 10 3
Oriental Telephone Ord.	10	10	2	—	3 0 0
United R. Plate Tel.	8	8	62	—	* 13 6
West India and Pan.	1	—	1 1	—	—
Western Telegraph	7	8	15 3	—	* 6 6 8
HOME RAILS.					
Central London, Ord. Assented	4	4	74	+ 1	5 8 1
Metropolitan	12	1	264	+ 1	3 15 6
do. do. District	Nil	Nil	194	+ 1	Nil
Underground Electric Ordinary	Nil	Nil	2	+ ½	Nil
do. do. "A"	Nil	Nil	8 6	+ 8d.	Nil
do. do. Income	6	6	91	+ 3	* 6 11 10
FOREIGN TRAMS, & CO.					
Adelaide Sup. 6 per cent. Pref.	6	6	5	—	6 0 0
Anglo-Arg. Trams, First Pref.	6½	6½	84	—	7 2 0
do. do. 2nd Pref.	6½	6½	86	—	8 16 0
do. do. 5 Deb.	6	6	77½	—	6 9 0
Brazil Tractions	4	4	62 3	+ 2	6 9 0
Bombay Electric Pref.	6	6	109	—	6 14 8
British Columbia Elec. Rly. Pref.	5	5	60 3	—	6 6 8
do. do. Preferred	Nil	4½	41½	+ 1½	Nil
do. do. Deferred	Nil	40	40	+ 1	Nil
do. do. Deb.	4½	4½	65	—	6 10 9
Mexico Trams 5 per cent. Bonds	Nil	Nil	41	Nil	—
do. do. 6 per cent. Bonds	Nil	Nil	34	—	Nil
Mexican Light Common	Nil	Nil	20	—	Nil
do. do. Pref.	Nil	Nil	88	—	Nil
do. do. 1st Bonds	Nil	Nil	42	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	13	—	6 0 0
British Aluminium Ord.	6	7	28½	—	6 7 8
British Insulated Ord.	15	17½	112	+ 1	7 9 0
British Westinghouse Pref.	7½	7½	51 6	—	6 16 8
Callenders	15	20	124	—	8 0 0
do. do. 5 Pref.	5	5	44	—	6 11 1
Casner-Kellner	20	—	82	—	6 6 8
Edison & Swan, £3 paid	Nil	—	9 6	—	Nil
do. do. fully paid	Nil	—	12	—	Nil
do. do. 5 per cent. Deb.	6	6	57	—	8 16 8
Electric Construction	6	7½	16 6	+ 8d.	9 1 10
Gen. Elec. Pref.	6	6	10	—	8 0 0
Henry	20	26	154	—	8 1 9
do. 4½ Pref.	4½	4½	4	—	6 12 6
India-Rubber	10	10	122	—	* 8 8 4
Telegraph Con.	20	20	89 3	—	* 6 4 0

* Dividends paid free of income-tax.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JUNE, 1916

THE June returns of electrical business show considerably increased values, both in the export and import sections, as compared with the previous month, which was itself considerably above the average as regards business.

Thus the exports for June reached a total value of £603,510, as compared with £499,384 in May and £353,266 in April. This excellent showing is largely accounted for by submarine cable exports to Canada (£96,000) and Brazil (£17,500), although machinery, cable, and lamp exports, amongst others, reached higher values than in May, while telephonic and battery exports fell off in value.

The imports for the month were valued at £316,697, as compared

with £302,583 in May: a considerable decrease occurred in telegraphic and telephonic imports, but in other directions increased values obtained.

The re-exports at £22,604 showed a slight increase on the previous month's total.

Canada takes precedence as our best customer during the month, but business was good in many directions, including India and the various Colonies, while nearer to home France, Russia, and Norway were excellent customers.

As regards the importers into this country, the United States did a considerably increased business, while from Holland we purchased some £26,000 worth of lamps.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consuming imports.	Electrical goods and appliances.	Wires and cables, including insulated cables.	Electric lighting apparatus.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric motors and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus.	Telegraphic cable and apparatus.	Total.
Russia, Sweden, Norway and Denmark ...	1,855	12,709	347	3,052	5,129	1,195	17,253	751	309	221	641	8,242	51,704
German West Africa ...	...	...	...	...	...	...	...	...	59	...	...	...	59
Netherlands, Java and Dutch Indies ...	2,171	22,030	1,052	37	...	15	1,891	488	157	8	1,789	2,055	31,693
Belgian Congo ...	17	...	36	...	...	...	...	...	...	...	51	...	104
France ...	2,905	1,317	505	27	62	53	24,708	11,130	1,228	146	3,256	9,557	57,888
Portugal ...	135	834	...	8	...	236	545	705	...	...	1,033	880	4,376
Spain, Canary Isles and Spanish N. Africa ...	472	98	17	277	...	5,354	9,015	102	920	35	13	328	16,784
Switzerland, Italy and Austria-Hungary ...	223	112	121	...	...	538	565	235	...	261	297	93	2,445
Channel Isles, Gibraltar, Malta and Cyprus ...	174	299	15	104	...	34	...	...	44	...	28	224	922
U.S.A., Philippines and Cuba ...	3,901	...	249	63	...	34	219	135	159	...	196	815	5,763
Canada and Newfoundland ...	366	29	16	183	...	485	5,187	...	398	10	...	102,621	109,195
British West Indies and British Guiana ...	41	...	16	49	...	...	118	...	...	...	95	185	537
Mexico and Central America ...	54	1,263	...	18	...	...	411	...	...	...	...	...	1,749
Peru and Uruguay ...	10	...	...	50	...	845	42	239	163	...	8	73	1,481
Chile ...	175	259	186	292	...	70	873	...	174	50	62	171	2,612
Brazil ...	161	560	17	178	...	252	1,092	3	1,690	48	...	17,559	21,590
Argentina ...	2,176	8,303	1,172	1,149	310	1,975	12,737	1,025	1,372	13	982	4,659	35,905
Colombia, Venezuela, Ecuador and Bolivia ...	71	737	...	...	...	...	20	...	101	77	75	...	1,081
Egypt, Tunis and Morocco ...	335	883	138	483	...	127	786	11	16	16	506	7,608	10,912
British West Africa ...	131	165	17	15	...	...	1,163	4	15	...	27	137	1,674
Rhodesia, O.R.C. and Transvaal ...	1,131	1,898	172	566	...	902	1,721	578	48	69	6	15	7,076
Cap of Good Hope ...	1,044	5,907	397	1,071	...	307	1,023	44	539	...	...	...	10,352
Natal ...	314	9,175	218	169	...	713	1,969	...	331	8	11	289	13,197
Zanzibar, Brit. E. Africa, Mauritius & Aden ...	39	111	30	84	...	...	100	...	...	16	...	...	380
Azores, Madeira and Portuguese Africa ...	...	49	...	75	...	60	...	...	...	...	...	73	257
French African Colonies and Madagascar ...	...	...	...	24	...	...	316	...	...	...	...	...	340
Persia ...	25	817	...	...	...	...	131	83	100	...	1	58	1,972
China and Siam ...	630	5,189	710	685	...	1,018	7,208	1,422	296	20	347	577	18,100
Japan and Korea ...	28	113	...	...	...	28	252	31	1,617	...	...	150	2,249
India ...	4,181	36,522	3,479	3,471	...	2,898	17,954	1,472	3,734	126	1,247	463	75,487
Ceylon ...	97	124	208	187	...	19	518	82	...	14	2	353	1,622
Straits Settlements, Fed. Malay States and Sarawak ...	568	5,756	98	298	...	1,022	1,897	29	212	167	650	1,326	12,314
Hong Kong ...	76	1,610	113	174	...	1,783	48	...	13	20	34	557	4,488
West Australia ...	117	1,939	126	179	...	360	842	344	361	8	...	115	7,276
South Australia ...	...	2,702	46	214	...	46	539	...	25	47	...	115	3,754
Victoria ...	899	16,973	936	1,637	23	1,994	10,664	...	411	...	747	67	33,451
New South Wales ...	728	16,666	195	1,635	...	890	4,055	624	1,046	292	3,139	934	30,135
Queensland ...	148	241	104	...	...	10	85	135	3,892	...	27	348	5,259
Tasmania ...	29	46	...	43	...	...	188	...	141	...	...	...	447
New Zealand and Fiji Islands ...	1,471	4,058	92	1,570	...	327	4,632	42	758	4	2,611	75	16,772
Total, £	26,901	162,464	12,108	18,067	5,554	22,990	130,800	23,828	20,439	1,679	18,132	160,547	603,510

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	290	...	...	...	1,073	...	4,742	1,053	793	75	2,789	10,725
Germany ...	...	...	...	...	...	...	...	...	...	...	...	27,933
Holland ...	...	1,127	161	18,534	7,776	...	322	13	...	...	...	13,551
France ...	262	...	100	100	406	907	1,374	...	8,014	2,114	274	3,972
Switzerland ...	1,045	22	328	225	...	1,517	155	...	...	680	...	7,659
Italy ...	140	6,719	...	...	...	...	800	...	...	...	...	417
United States ...	13,008	7,133	4,740	5,819	6,481	932	24,568	125,874	3,718	5,854	46,815	245,622
Total, £	14,655	15,681	5,329	24,678	15,736	3,356	31,961	126,940	12,525	8,723	49,878	309,462

Additional imports.—Spain, batteries, £2,500, carbons, £332; Japan, goods, £118, fittings, £1,436, glow lamps, £593, arc lamps, £351, batteries, £8; Canada, goods, £958, arc lamps, £157, machinery, £780, electrically-driven machinery, £2.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above—	1,547	3,765	...	1,530	...	372	4,860	...	930	969	8,431	22,604
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TOTAL EXPORTS: £603,510

TOTAL RE-EXPORTS: £22,604

TOTAL IMPORTS: £316,697

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

EXTENSIONS AT THE SIMMER PAN STATION OF THE VICTORIA FALLS AND TRANSVAAL POWER CO.

By R. TURNBULL MAWDESLEY.

THE writer is enabled, through the courtesy of Mr. Bernard Price, the chief engineer of the Victoria Falls and Transvaal Power Co., to give a brief description of the extensions to that company's generating plant, which extensions have been rendered necessary by the rapidly increasing demand for power on the Rand.

It will be remembered that an exhaustive description of the Victoria Falls and Transvaal Power Co.'s system has already appeared in these columns,* and these notes are confined principally to extensions at the Simmer Pan station, though, as will be noted, other extensions have taken place at Brakpan and at Rosherville.

The generating plant at Simmer Pan comprised six 4,000-K.V.A. turbo-alternators, and fig. 3 shows one of two additional turbines in course of erection. Both of these, together with the new boiler plant, were put in operation early last year. Each of these generators is of 11,000 kw. (15,700 K.V.A.) capacity, the alternators being of the totally-enclosed type.

There are three single-phase transformers operating in conjunction with each of the above alternators (one in each phase), and stepping up from 5,000 volts to

contained in circular cases, with the H.T. leads entering the top. The existing boiler-house at Simmer Pan was enlarged, and eight Babcock & Wilcox standard and marine type boilers, with chain-grate stokers of their latest design, were added. Each of these boilers is of 33,000—38,000 lb. per hour rated capacity, with internal superheaters.

Fig. 1 shows a comprehensive view of the Simmer Pan station, with boiler-house extension. The lake in the foreground is, it is understood, used only for circulating water, and not for boiler feed.

Regarding extensions at the company's other stations, it may be mentioned that last summer the work of installing at the Brakpan station two further three-phase turbo-alternators, each of 12,000 kw. capacity, and 10 boilers similar to those already put into commission at

Simmer Pan, was completed, and the plant was brought into use.

At Rosherville eight boilers of 33,000 lb. capacity were installed, and three further turbo air compressors, each of about 10,000 H.P. capacity.

Fig. 2 shows an existing 10,000-kw. turbo-alternator, with part of the station control-board at Rosherville power station.

Under normal conditions, the four stations (*i.e.*, Vereeniging, Brakpan, Simmer Pan and Rosherville) are operated in parallel, and the average load during the heaviest hour of an average day now reaches 100,000 kw. This should not be confounded with the peak loads, which may be considerably higher.



FIG. 1. SIMMER PAN POWER STATION, SHOWING BOILER HOUSE EXTENSIONS.

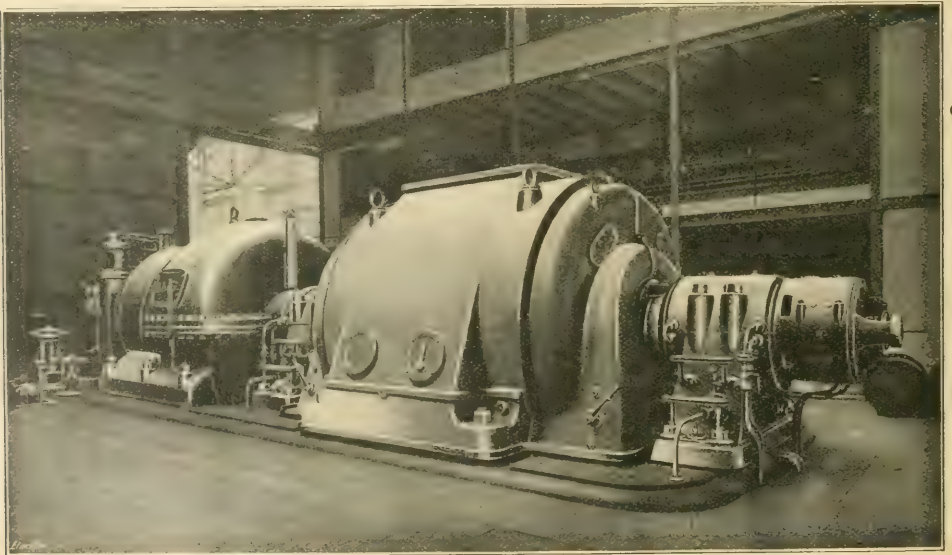


FIG. 2. 10,000-KW. TURBO-ALTERNATOR, ROSHERVILLE POWER STATION.

either 42,000 or 10,500 volts. These transformers were made by the American General Electric Co. in Schenectady, and are of the oil-insulated water-cooled type,

The total generating capacity of the four power stations is now more than 137,000 kw. The present business (inclusive of the supply of compressed air) closely approaches 600,000,000 units sold per annum, and the extensions of plant will enable this figure to be considerably increased in the near future.

* A paper read by the company's managing director, Mr. A. E. Hadley: *ELEC. REV.*, March 28th, 1913.

THE UTILISATION OF WASTE HEAT FOR AGRICULTURE.

The following letter appeared in *Nature* last week:—

In the cheap generation of electricity the great problem must be how to secure and utilise by-products. With steam-driven stations the chief by-product is an abundant supply of hot water from the condensers, which in this country is looked upon as a nuisance to be got rid of as easily as possible. Would it not be possible to make use of this low-grade heat for agricultural purposes, so supplementing our all too scanty summers?

Power-houses burning 1,000 tons of coal and upwards per week are quite common, and something like half of the heat generated by the coal is absorbed by the condensing water. It might be possible to heat fields by running the warm water through ditches, or perhaps better results would be obtained

carried out on a considerable scale, might replace cooling towers, the piping being arranged so as to return the cooled water to the power station, and obviously, if the go and return conduits were laid side by side, a few feet apart, the heating of the soil on the whole would be fairly uniform. By suitable grading, the flow could be made gravitational, and very little pumping should be necessary. The maximum supply of heat would be available in the winter, when most needed, and the minimum in the summer.

Assuming that a large area of level land is thus piped, then, except near the boundaries of the area, the heat can escape in the vertical direction only. The earth being a poor conductor of heat, in the course of time the downward flow of heat would be limited by the establishment of a steady temperature gradient, for the determination of which data are

available. The remainder of the heat would pass through the surface of the soil by radiation and by convection currents of air, also by evaporation of moisture; we know of no data as to the rate of loss of heat from the surface of soil covered or partly covered with vegetation, but some rough idea can perhaps be formed as to its order of magnitude. The loss of heat per sq. ft. per hour per deg. F. difference of temperature between the air on one side and that on the other of a 24-in. brick wall is 0.2 B.T.H.U. If we

suppose the pipes to be laid about 2 ft. deep, and the nature of the soil, its emissivity, &c., to be comparable with that of brick, we may employ this value for k in the equation:—

$$H = kA\theta / l,$$

where H = heat lost in B.T.H.U.,

A = area of surface in sq. ft.,

l = time in hours,

θ = temperature difference between the soil at a depth of 2 ft. and the air.

Taking A = 1 acre = 43,560 sq. ft.

l = 24 hours,

θ = 20° F.,

then H = 4,180,000 B.T.H.U. per acre per day required to keep the soil 20 deg. F. above the temperature of the air.

Assuming, after Mr. Turnbull, that half the heat originally in the coal is transmitted to the circulating water, or, say, 7,000 B.T.H.U. per lb. of coal fed to the boilers, the above quantity of heat would be available for every 600 lb. of coal consumed (neglecting for the moment the downward flow of heat).

In the case suggested by Mr. Turnbull, the consumption averages 1,000 tons a week = 320,000 lb. of coal a day, which divided by 600 gives 533 acres as the area that could be thus warmed.

According to Kennelly's results, quoted by Messrs. Melsom and Booth in the *I.E.E. Journal*, the conductivity of ordinary moist sandy soil may be put at about 0.29; taking a depth of only 10 ft., and a temperature difference of 10 deg., the loss of

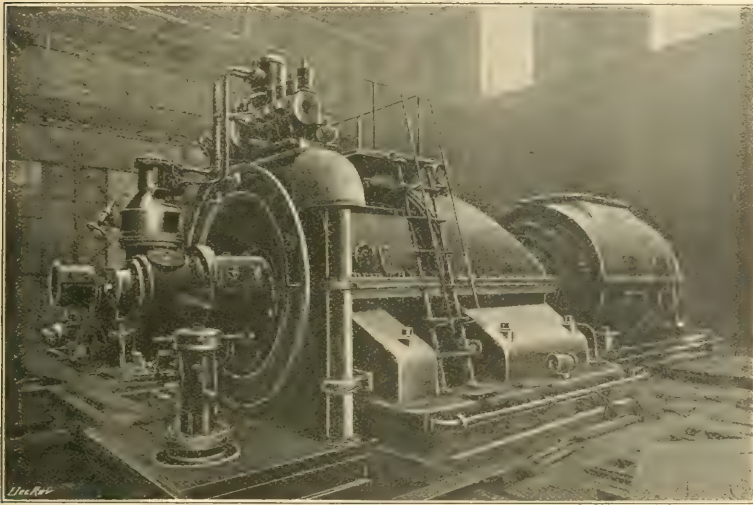


FIG. 3. 15,000-K.V.A. TURBO-ALTERNATOR DURING ERECTION, SIMMER PAN POWER STATION (S. P. 1908).

by running it through pipes buried in the ground. By this means large areas of land might be stimulated to produce much greater crops than have hitherto been found possible. It may be urged that the majority of existing power-houses are not in agricultural districts, so that the proposed experiment is not possible except in a few cases. To this one may reply that, in the near future, many large stations will be put down to supply current in bulk to vast areas. With the high voltage used for them the location of the power-house becomes a matter of wide choice, and it would be possible to put them in agricultural districts if this should prove financially worth while. The views of readers of *Nature* on this point would be of interest.

G. TURNBULL.

Electricity Works, Tynemouth, June 29th.

Like many other ideas, Mr. Turnbull's suggestion can only be tested by trying it on a practical scale. It seems not improbable that something might be made of it, and the experiment could easily be carried out on a plot of ground at no great cost, a control plot being, of course, provided for comparison. Our personal knowledge of agriculture being a negligible quantity, we cannot make any estimate as to the rise in temperature that would be required to produce tangible results, but from the engineering point of view, certain considerations appear to be fairly obvious.

In order to apply the heat to the soil to the best advantage, buried pipes should be employed in preference to open ditches, to prevent the loss of heat by evaporation and convection currents in the air over open water, which would be excessive. Ordinary drain pipes would serve, as the pressure would be trifling, and leakage at the joints might be not only harmless, but even beneficial. The system, if

heat by downward flow, when a steady state is reached, is $.29 \times 24 = 7$ B.T.H.U. per sq. ft. per day, or about 300,000 per acre, say, one-eighth of the total heat available. But if a sufficiently large surface were dealt with, so that the lines of heat flow were normal to the surface for a great depth, this loss would eventually become negligible, except near the boundaries of the area. How little it is may be deduced from the practice of making hot-beds with stable manure, a comparatively small quantity of which produces a remarkable effect for a long period. We may therefore take it that the great bulk of the heat will flow upwards.

The question arises whether it is sufficient to keep the soil warm; possibly it is still more important to warm the air over the soil, in which case a covering to retain the warmed air is essential. Already it is the practice for market gardeners to erect glass houses of enormous extent, the glass acting as a trap to retain heat, and clearly it would be to their advantage to do this over an area where bottom heat was available; this would entail no expense to the power suppliers, who, of course, would charge a rent to farmers or gardeners for the use of their waste heat. The alternative of using open ditches, in view of the great quantity of heat available, might serve to keep the air warm without a cover.

The cost of the piping would be set off against that of cooling towers, and the rent would go to cover any deficiency, any surplus being applied to increase the profits of the undertaking. With regard to the advantage of heating the ground in this way, we may cite the actual practice in Yorkshire of conducting the hot gases from furnaces through pipes buried in the ground for the purpose of forcing rhubarb. Large areas are cultivated on this system, although the coal has to be consumed especially for the purpose; and if the system pays under these conditions, surely it will pay still better where the heat is a waste product, which can be put to no other use owing to its low temperature. In all probability it would be possible to raise two crops, of suitable kinds, per annum with artificial heating.

If we could add to such an installation artificial fertilisers obtained from the by-products of combustion of the coal, it will be seen that we should have an exceedingly efficient all-round combination! The electrical engineer of the future might thus become, in addition to his present functions, a chemist and agriculturist, a prospect which some, no doubt, would consider appalling.

No doubt many objections can be raised to the scheme. The cost, even using cheap drain pipes, might prove to be inordinately great; the water might be insufficiently cooled, and so on. Our rough calculations are admittedly based upon very questionable assumptions, and may be very wide of the mark. However, our object in making these speculations is not to make predictions or to put forward accurate calculations, but to attract to this interesting subject the attention that, we believe, it merits, and to induce others, better qualified than ourselves, to investigate the matter. *In these days, we cannot afford to despise any possible source of economy.*

THE DIESEL ENGINE USERS' ASSOCIATION.

TAR OILS AS FUEL FOR DIESEL ENGINES.

At the July meeting of the Association the use of tar oils as fuel in Diesel engines was further discussed.

Mr. NAPIER PRENTICE (Felixstowe) gave his experience in regard to the use of tar oil, which he had obtained from a local distiller. He had found difficulty in obtaining quotations and in getting the work in hand of altering a Diesel

engine so as to adapt it specially for the use of tar oil in the manner which had been successfully employed on the Continent, and he therefore decided to try the effect of using tar oil in one engine without any alteration. At about half-load he found this was not successful, as misfiring and a smoky exhaust occurred. He was advised to work with a sharp edge on the flame plate, and with this alteration and a slightly different quality of tar oil he obtained satisfactory results so long as the engine was not run below about three-quarters full load. The blast pressure at all running loads was maintained at five atmospheres below the normal pressure used when running with petroleum fuel oil, and the cooling water outlet was restricted so as to maintain a temperature of 125 deg. F., as against 110 deg. F. which had been maintained when using the other class of fuel oil.

Mr. F. BANKS WARNER gave some information as to the general position in regard to the question of obtaining suitable supplies of tar oils, including delivery on site. At the present time, the high railway rates for this class of business were a serious handicap to its development in certain parts of the country where local supplies were not available.

LIFE OF DIESEL ENGINE CRANKSHAFTS.

Mr. P. H. SMITH read a paper on "Crankshaft Breakages in Diesel Engines," of which an abstract follows:—

All shaft failures that I have investigated owe their origin to lack of alignment of the main bearings. This is usually the result of unequal rates of wear of the several bearings supporting the shaft, though in some cases it can be traced to negligence during erection, or, in older engines, to defective foundations. So far as this paper is concerned, I am limiting my remarks to the case of bearings wearing away unequally on 4-cycle vertical engines.

The type of engine least liable to shaft-fracture is the 3-cylinder, and the worst is the 4-cylinder normally, though the 2-cylinder runs it a close second if fitted with a very heavy flywheel.

Almost without exception Diesel shafts have failed through the webs, the crack starting at the centre and working out-

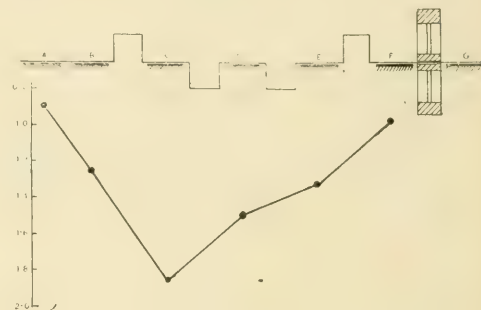


FIG. 1.—WEAR OF CRANKSHAFT BEARINGS.

wards; the time elapsing between the first appearance of the fracture and its complete failure generally extends over many weeks.

As regards location of fracture, either web may fail in the single-cylinder units. In 2-cylinder engines, web 4 fails most frequently (the webs being numbered consecutively, commencing from the end further from the flywheel). In 3-cylinder units the fracture occurs either in web 1 or 6, and in 1 as often as 6. Sometimes both fail simultaneously. I have no knowledge of any other webs failing in a 3-cylinder unit. In 4-cylinder units it is, I think, an almost invariable rule that web 4 fractures.

I have pleasure in placing before you data carefully compiled and extending over four years of continual observation on two engines of the 4-cylinder type.

The plant was installed about nine years ago, and comprised two Continental engines of four cylinders each, the cranks being arranged as shown in fig. 1, viz., up, down, down, up, as contrasted with the usual arrangement in this country, up, down, up, down.

The cylinder dimensions were 415 \times 600 mm., and the engines ran at 170 R.P.M., developing 330 B.H.P. each.

The flywheels weigh about eight tons each, and a bearing is interposed between the flywheel and a direct-current generator. Expressed in relation to the cylinder bore (D), the main dimensions of the shaft are:—Diameter of journals and crank pins, $0.53D$; thickness of crank webs, $0.265D$; length of pin, $0.83D$; length of main bearing, $1.1D$. The shaft is, therefore, on the weak side.

One engine broke its shaft about four years after its installation and the other after about five years. In both cases web 4 failed. These shafts were replaced by others obtained in England. The tensile strength of that now in No. 2 is about 32 tons, while in No. 1 it is 40 tons per sq. in.

The bearings were measured every year, and thus the actual wear has been regularly recorded for three and a half years in the one case and for four years in the other.

The curve, taken from No. 1 engine, explains why the 4-cylinder engine with this arrangement of cranks, fractures through the webs of the second cylinder. This curve is characteristic of 4-crank engines.

The engine was stripped right down; the bearings were found to have the metal loose and cracked, and the spare set was substituted. The shaft was bedded in the usual way up to a certain point, but, to complete the work, bearing c was left a shade high and bearing a was left a shade low. Finally the top caps were filed down, so that the journal ran in the bearing with running clearance only. Thus the perfect alignment of the shaft was assured, and before re-assembling the engine, we micrometered the thickness of metal on each bearing interposed between the shaft and bedplate. This has been recorded, and now from year to year we can re-measure this thickness, and so obtain the relative rates of wear in each bearing. That which is worn most will constitute the datum, and the data will show exactly how much must be scraped off the "high" bearings in order to re-introduce conditions of minimum stress on the shafts.

This system of assuring perfect alignment of the shaft will appeal especially to those engineers who have no reserve plant, and who have to get repairs done during the week-end.

As regards the subsequent adjustment of running clearance of main bearings, it is not usually feasible to measure this with feelers; where possible, I prefer to feel the lift in each bearing, and let the cap closer and closer until the bearing either heats (in which case scrape out the cap) or until the lift just disappears.

The original Diesel shafts were made in 32-ton steel to the following proportion:—

Diameter of pins and journals, 0.51 to 0.525 D.

Length of main bearings, 1.1 to 1.2 D.

Length of big-end pin, 0.51 to 0.525 D.

Thickness of web, 0.25 to 0.27 D.

The shaft I would propose, if my firm's system of re-alignment is adopted and your hearty co-operation is assured, is the following:—

Tensile strength, not less than 34 tons.

Ductility, not less than 25 per cent. in 2 in.

Diameter of pins and journals, 0.525 to 0.54 D.

Length of main bearings, 0.75 to 0.8 D.

Length of big-end pin, 0.525 to 0.54 D.

Thickness of webs not less than 0.32 D. but centre to centre of cylinder made minimum possible, and any excess over the proposed length of pin and journal to be put into the webs.

Fillet to be not less than one-tenth the diameter of the shaft.

This shaft is comparatively light, but it possesses the following advantages:—

1. The fuel consumption of the engine is reduced.

2. Initial cost and cost of upkeep is reduced.

3. The bearings will run cooler, other things excepting pressure per sq. in. being equal, for it is high peripheral speed rather than high pressure which causes bearings to heat.

4. Lubrication costs will be reduced.

However, the success or failure of such a shaft depends upon proper attention being given to its adjustment from time to time; if this is not given, it is merely a question of time before even the heaviest shaft will fail.

The Association will resume its meetings next October. Information concerning the Association can be obtained from the Hon. Secretary, Mr. Percy Still, 19, Cadogan Gardens, London, S.W.

TRADE STATISTICS OF INDIA.

THE following figures of the imports of electrical and similar goods into British India in the year ended March 31st, 1915, are taken from the recently-issued official trade statistics; details for the year ended March 31st, 1914, are added for purposes of comparison, and notes of any increases or decreases are given:—

	1913-14.	1914-15.	Inc. or dec.
	£	£	£
<i>Brass, wrought.—</i>			
From Great Britain ...	49,000	31,000	18,000
.. Germany ...	18,000	2,000	16,000
.. Italy ...	11,000	4,000	7,000
.. Other countries ...	31,000	30,000*	1,000
Total ...	109,000	67,000	42,000
	* Sweden £8,000.		

Copper and copper ware.—

From Great Britain ...	1,354,000	950,000	404,000
.. Germany ...	865,000	487,000	378,000
.. Belgium ...	61,000	12,000	49,000
.. France ...	170,000	126,000	44,000
.. Austria ...	3,000	2,000	1,000
.. Japan ...	274,000	254,000	20,000
.. Other countries ...	17,000	56,000	39,000
Total ...	2,745,000	1,887,000	858,000

	1913-14.	1914-15.	Inc. or dec.
	£	£	£
<i>Iron wire.—</i>			
From Great Britain ...	74,000	82,000	8,000
.. Germany ...	35,000	19,000	16,000
.. Belgium ...	15,000	7,000	8,000
.. Other countries ...	33,000	31,000	2,000
Total ...	160,000	139,000	21,000

Prime movers, other than locomotives.—

From Great Britain ...	512,000	428,000	84,000
.. Germany ...	28,000	1,000	27,000
.. United States ...	7,000	10,000	3,000
.. Other countries ...	8,000	8,000	—
Total ...	555,000	447,000	108,000

Electrical generators.—

From Great Britain ...	20,000	14,000	6,000
.. Other countries ...	1,000	1,000*	—
Total ...	21,000	15,000	6,000

* Belgium £1,000.

Electrical motors.—

From Great Britain ...	83,000	74,000	9,000
.. Germany ...	5,000	1,000	4,000
.. United States ...	3,000	1,000	2,000
.. Other countries ...	2,000	3,000*	1,000
Total ...	93,000	79,000	14,000

* Italy £2,000.

Other electrical machinery.—

From Great Britain ...	195,000	243,000	48,000
.. Germany ...	30,000	6,000	24,000
.. Italy ...	2,000	4,000	2,000
.. United States ...	2,000	6,000	4,000
.. Other countries ...	3,000	1,000	2,000
Total ...	232,000	260,000	28,000

Mining machinery.—

From Great Britain ...	64,000	49,000	15,000
.. Germany ...	2,000	—	2,000
.. United States ...	28,000	48,000	20,000
.. Other countries ...	2,000	1,000	1,000
Total ...	96,000	98,000	2,000

Machinery, other (except textile, agricultural, and printing).*

From Great Britain ...	753,000	563,000	190,000
.. Germany ...	61,000	22,000	42,000
.. Belgium ...	2,000	—	2,000
.. United States ...	35,000	34,000	1,000
.. Other countries ...	33,000	17,000	16,000
Total ...	887,000	636,000	251,000

* The details for the two years are not strictly comparable, those for 1913-14 including some items which were not included in 1914-15.

Electric fans.—

From Great Britain ...	32,000	28,000	4,000
.. Italy ...	16,000	10,000	6,000
.. United States ...	23,000	13,000	10,000
.. Germany ...	1,000	2,000	2,000
.. Other countries ...	7,000	2,000	5,000
Total ...	82,000	55,000	27,000

Electric lamps and parts.—

From Great Britain ...	42,000	24,000	18,000
.. Germany ...	9,000	3,000	6,000
.. Austria ...	6,000	2,000	4,000
.. Japan ...	1,000	—	1,000
.. United States ...	1,000	—	1,000
.. Other countries ...	2,000	2,000	—
Total ...	61,000	31,000	30,000

Electric wires and cables.—

From Great Britain ...	144,000	149,000	5,000
.. Germany ...	5,000	2,000	3,000
.. Belgium ...	3,000	—	3,000
.. Other countries ...	6,000	2,000	4,000
Total ...	158,000	153,000	5,000

Other electrical instruments, apparatus, &c. (except telegraph and telephone materials).—

From Great Britain ...	327,000	290,000	37,000
.. Germany ...	24,000	7,000	17,000
.. Belgium ...	2,000	—	2,000
.. Austria ...	2,000	1,000	1,000
.. United States ...	52,000	19,000	33,000
.. Other countries ...	8,000	6,000	2,000
Total ...	415,000	323,000	92,000

	1914-15 £	1914-15 £	Incr. or dec. £
From Great Britain	82,000	63,000	- 19,000
Germany	5,000	2,000	- 3,000
United States	2,000	1,000	- 1,000
Other countries	3,000	3,000	-
Total	92,000	69,000	- 23,000
From Great Britain	7,000	18,000	+ 11,000
Germany	2,000	17,000	+ 5,000
United States	1,000	1,000	-
Other countries	2,000	1,000	- 1,000
Total	23,000	17,000	- 6,000

In addition to the foregoing the following were imported as Government stores:—

Instruments, apparatus, &c. (except musical).—			
From Great Britain	137,000	181,000	+ 44,000
Germany	1,000	1,000	-
United States	1,000	2,000	+ 1,000
Other countries	1,000	1,000	-
Total	137,000	183,000	+ 46,000

Machinery.—			
From Great Britain	201,000	212,000	+ 11,000
Germany	1,000	1,000	-
United States	1,000	1,000	-
Other countries	1,000	1,000	-
Total	204,000	213,000	+ 9,000

Iron and steel.—			
From Great Britain	12,000	10,000	- 2,000

Telegraph construction materials.—			
From Great Britain	97,000	102,000	+ 5,000

Copper and copperware.—			
From Great Britain	102,000	113,000	+ 11,000
Other countries	68,000	78,000	+ 10,000
Total	170,000	191,000	+ 21,000

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Published expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 9,696. "Incandescent electric lamps." F. HARRISON & J. J. RUSSELL. July 10th.
- 9,697. "Shades of screens for electric lamps." W. FAWLEY. July 10th.
- 9,702. "Electric controllers." C. P. ELISON & E. G. PAYNE. July 10th.
- 9,738. "Machines for making electric cable." AC. MACINTOSH CABLE CO. AND P. W. SANKEY. July 11th.
- 9,742. "Portable electric lamps." F. WESTWOOD. July 11th.
- 9,745. "Electric couplings." ALMANNA SVENSKA ELEKTRISKA AKTIEBOLAGET. July 11th. (Sweden, July 21st, 1915.)
- 9,749. "Spoke plugs." G. BAYSDORFER & O. BAYSDORFER. July 11th.
- 9,750. "Electric signalling or telegraphing systems." T. McLEOD. July 11th.
- 9,753. "Transmitting gear of ships' telegraphic &c. apparatus." G. W. HASTINGS, H. M. R. MAUDER, and A. ROBINSON & Co. July 11th.
- 9,760. "Towing ropes, wires or cables." CALLENDER'S CABLE & CONSTRUCTION CO. July 11th.
- 9,762. "Selenium cell." M. MARTINEZ & P. SALENTE. July 11th.
- 9,763. "Device for electric or magnetic registration of images." M. MARTINEZ & P. SALENTE. July 11th.
- 9,764. "Radio." M. MARTINEZ & P. SALENTE. July 11th.
- 9,766. "Regulators for polyphase transmission systems." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). July 11th.
- 9,774. "Means for winding and unwinding coils of wire." F. J. BROOKHUIS (A. W. Risher). July 11th.
- 9,776. "Automatic method of electrical heating." A. M. JANE. July 11th.
- 9,790. "Arc light stand." W. G. MOORE. July 12th.
- 9,804. "Electric lamp." H. S. GULSTON. July 12th.
- 9,812. "Regulators for polyphase transmission systems." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). July 12th.
- 9,819. "Flanging glass tubes for electric lamps." J. A. ALLISON & MOREL AND WHITMAN. July 12th.
- 9,825. "Electric couplings for electric cables." D. F. BATTERY CO. & B. M. DRAKE. July 12th.
- 9,835. "Incandescent electric lamps." BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO. July 12th. (U.S.A., July 12th, 1915.)
- 9,833. "Electric oscillating or wireless systems and apparatus." INDO-EUROPEAN TELEGRAPH CO. & H. R. RIVERS-MOORE, AND A. H. MORSE. July 12th.
- 9,848. "Electrolytic process for manufacture of flexible wire and strip." S. O. COWPER-COLES. July 13th.
- 9,850. "Electric time switches." A. M. COATES. July 13th.
- 9,860. "Method of electric bell alarm." J. FLEMING & W. W. KIRK. July 13th.
- 9,865. "Field telephones." I. P. LANGTON. July 13th.
- 9,866. "Electrical operating or controlling apparatus." T. McLEOD. July 13th.

- 9,884. "Electric switches." H. GOLDSMITH. July 13th.
- 9,909. "Electrical terminal of connection." A. G. PRINCE. July 14th.
- 9,921. "Telecommunication telephone systems." J. W. DUNGEY. July 14th.
- 9,926. "Incandescent lamps." M. STEINMAN & E. PLANCH. July 14th.
- 9,927. "Powering asynchronous potential waves." BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO. July 14th. (U.S.A., July 14th, 1915.)
- 9,937. "Dissipating energy of the unipolar type." M. BIESELER. July 14th. (Germany, July 10th, 1914.)
- 9,943. "Process of electric transmission systems." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). July 14th.
- 9,942. "Electrical resistance apparatus." P. H. DAVIS. July 14th.
- 9,949. "Electric telegraphs." J. W. RAY. July 15th.

PUBLISHED SPECIFICATIONS.

1915.

- 9,979. "PROTECTED OR ARMOUR-CLAD ELECTRIC SWITCHES." H. BEER & W. J. THOMSON. May 2nd.
- 9,982. "ELECTRIC SYSTEMS AND APPARATUS FOR THE PROTECTION OF ELECTRICAL CABLES, LINES, & H. H. HARRISON. July 12th.
- 9,982. "MAGNETIC CORES OF INDUCTIVE MOTORS." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). June 30th.
- 9,984. "GALVANIC BATTERY CELL OF THE MERCURIC OXIDE TYPE." J. N. BRONSTEAD & HILLESSEN ENKE & V. LUDVIGSEN (firm of). July 2nd.
- 9,986. "ELECTRIC MOTOR CONTROL SYSTEMS." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). July 6th.
- 10,330. "PROTECTIVE REACTANCE COILS." G. HARLOW. July 15th.
- 12,516. "SWITCHES FOR RESISTANCES." L. KAMM. August 31st.
- 12,994. "ELECTRIC ARC LAMPS." G. M. J. MACKAY. September 10th. (September 12th, 1914.)
- 13,088. "SPARKING PLUGS AND THEIR MANUFACTURE." K. E. L. GUINNESS. September 13th.
- 13,733. "SPARKING PLUGS." V. J. J. September 27th.
- 15,460. "ELECTRIC ADAPTORS. General Accessories (L. Rosenthal & C. Seymour, Transvaal). November 2nd.
- 15,539. "ALARM FUSES FOR TELEPHONE, TELEGRAPH AND THE LIKE SYSTEMS. Automatic Telephone Manufacturing Co., J. Savin & S. R. Smith. November 4th.
- 15,681. "OPERATING ROTARY CONVERTERS AND OTHER ALTERNATING-CURRENT MACHINERY." A. H. RAILING & C. C. GARRARD. November 6th.
- 15,863. "ELECTRIC POCKET LAMPS." Dr.-Ing. SCHNEIDER & Co. Elektrizitäts Ges. November 10th. (December 3rd, 1914.)
- 15,922. "COMBINATION ELECTRIC TURN SWITCH AND WALL PLUG." C. E. BEGG. November 11th.
- 16,349. "ELECTRIC INCANDESCENT LAMP HOLDERS." C. G. M. BENNETT. November 13th.
- 16,827. "TRAYS OR RECEPTACLES FOR HOLDING ARTICLES. Automatic Telephone Manufacturing Co. & W. Rogers. November 30th.

1916.

- 1,248. "MEANS FOR CONTROLLING ELECTRIC MOTOR CIRCUITS." Igran Electric Co. (Carter-Hammett Manufacturing Co., U.S.A.). January 26th, 1916. Patent No. 100,703.
- 1,300. "APPARATUS FOR THE OBSERVATION OF AZIMUTH ANGLES AND THE SIMULTANEOUS ELECTRICAL TRANSMISSION OF THE VALUE OF SUCH ANGLES TO REMOTE OPERATORS." E. A. GRAHAM & W. J. RICKETS. January 28th, 1916. Patent No. 100,704.
- 4,688. "ELECTRICAL SYSTEMS FOR ENGINES." C. F. KETTERING & W. A. CHRYST. July 16th, 1914. (Added application on 7,759/15.) Patent No. 100,228.
- 5,685. "MAGNETO-ELECTRIC MACHINES." J. W. MILLER & M. COLLARD. April 6th, 1916. Patent No. 100,713.
- 6,042. "DRY BATTERY." F. P. BAUMANN. February 4th, 1916. (Addition to 100,086.) Patent No. 100,714.
- Nitrogen Fixation.**—In *Nature*, of July 15th, there was reported the formation of a Swedish company to manufacture artificial fertilisers, such as ammonium nitrate, and other nitrogenous compounds, by chemical processes from easily accessible raw materials, without the aid of electricity. It is stated that the company is preparing to turn out large quantities of its products, and is increasing its capital from 3.7 to 8 million kronor. Apparently the new system will prove a serious rival to the electrical fixation of nitrogen.

Niagara Falls to be Flood-Lighted.—The City Council of Niagara Falls, N.Y., has authorised an expenditure of \$10,000 for the illumination of Niagara Falls. The money is to be devoted to carry out the flood-lighting scheme submitted by the American Lighting Co., Chicago. For some weeks Will J. Davis, president of the company and inventor of the flood-lighting system of the American Lighting Co., has been making arrangements to illuminate the Falls, and for several nights previous to the action of the City Council a battery of 25 flood-lights was turned on the American Falls and the rapids of the Niagara River. The effect created was so far beyond the expectations of the promoters of the project, that the expenditure was enthusiastically approved, and it is now planned to double the number of lamps in service, and from time to time to add to the battery as new lighting effects are desired.—*Electrical Review and Western Electrician*.

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ELECTRICAL REVIEW.

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ELSEWHERE in this issue, by the courtesy of the Council of the Institution of Electrical Engineers, we are enabled not only to announce the *personnel* of the two committees appointed respectively by the Institution on the one hand, and by the Incorporated Municipal Electrical Association jointly with the Incorporated Association of Electric Power Companies on the other, to deal with the subject of the future of electricity supply in this country, but also to give some idea of the plan which they propose to adopt in order to prevent overlapping and to ensure effective co-operation. As we surmised when commenting on this subject some weeks ago, the Committees intend to divide the field of operations between them, and whilst keeping in close touch with one another, they will act on more or less independent lines. The Institution Committee will deal with the subject from the national point of view, while the joint Committee will concern itself with questions in their local aspect. Apparently the duties of the former will be to consider principles and methods, to confer with the Board of Trade on questions of policy, and to solve engineering problems, while the latter will be a committee of ways and means, and will investigate local conditions in the various areas concerned, with a view to expediting the accomplishment of the work of linking-up.

As an alternative the two bodies might have decided to hold joint sittings and combine their activities, but in all probability it would have been found necessary to appoint sub-committees with terms of reference very similar to those outlined above, so that in effect the same organisation would have been arrived at; and in case of need it will always be possible to hold joint sittings. It is interesting to note that out of the seven members of the I.E.E. Committee, no fewer than five belong also to the Joint Committee of twelve. In both committees the representatives of municipal and private enterprise are practically balanced; Mr. Chattock is the Chairman of the I.E.E. Committee, and Mr. Chamen, who combines municipal with company experience, presides over the Joint Committee. The selection of the membership in both cases leaves little room for criticism, and we have every reason to hope that their deliberations will be fruitful.

The attitude of the Board of Trade towards the primary object of the movement was further defined by Mr. Harcourt in reply to a question in the House of Commons, when he stated that the Board had not contemplated comprehensive schemes of interconnection involving heavy expenditure, but rather the linking-up of adjoining undertakings, where the difficulties to be overcome would be of minor importance. He indicated that, while special legislation for the purpose did not appear to be required, he was prepared to consider the question if necessary. This statement agrees with the impression we gained from the circular issued by the Board to all British supply undertakings. The difficulty which seems most likely to arise is in connection with the obtaining of wayleaves, an ever-present bone of contention in this country, which certainly demands consideration. If it were possible to secure compulsory wayleaves for public supply mains, whether overhead or underground, across private or public

property, on reasonable terms and at small cost, the situation would be transformed, and many useful schemes which have been hung up on this account would at once become practicable. Such legislation is urgently required, not only for the present purpose, but also for the due development of many undertakings quite apart from the new proposals.

The further proceedings of the Committees will be awaited with interest, and we trust that they will not fail to follow the excellent example already set by the Council of the Institution, and take the public into their confidence, as far as possible. When nothing is known of what is being done, the general impression is that nothing is being done, a view which in the light of past events is not without a measure of justification. But the door is closed upon the past; the Council of the Institution has adopted a new and active policy, and, we hope, a new era has dawned for the electrical industry in this country.

Private Supply of Electricity.

THOSE who essay to supply electricity to their neighbours otherwise than in accordance with the terms of a Provisional Order may have met with a series of difficulties. A cor-

respondent has recently drawn our attention to his own case. Having established a small system of supply in his immediate neighbourhood, he has endeavoured to extend it to a town close by. He is opposed by a local gas company, who endeavour to prevent his carrying cables over their shareholders' property, and by the District Council, which refuses to allow the cable to be carried over highways under its control. We fear that there is nothing in any of the electric lighting Acts which will enable him to extend his system in these circumstances. It is quite true that wires may be laid over private property by agreement, and that, subject to the consent of the Board of Trade given pursuant to Sec. 4 of the Electric Lighting Act, 1888, they may, in certain cases, be laid over any street, but otherwise statutory powers must be sought. The Board of Trade have no power to sanction any invasion of private rights, whatever the motive of those who refuse to assent to the development of a scheme of supply.

Copper.

DEVELOPMENTS in copper have been decidedly more interesting lately, although the progress of actual business has been very slow. The chief feature has been the spectacular rise in the price of standard copper, which now stands near £111 a ton, which compares with £84, the lowest point recorded in the course of the past month. The recovery which has thus taken place has certainly been quite out of proportion to the amount of business transacted. Dealings, in fact, might be described as utterly insignificant, though this is not really surprising, owing to the prohibition of speculative trading. It seems absurd that such fantastic movements, running into as much as £25 a ton, should be possible in the space of a few weeks with but few transactions passing; but the fact remains that there are only a few sellers, and the limited supply of warrants is lodged in strong hands. It is rather difficult to explain the change of sentiment which has become manifest. Of course, so far as warrant copper is concerned the fall was much overdone, and a natural reaction was bound to ensue, and the latter having synchronised with inquiries by parties who were short against outstanding contracts, and some demand from sulphate makers for rough copper, the upward movement was the more pronounced in face of the unwilling attitude of sellers. There is some reason for believing, however, that American manipulation has been at work in one direction and

another, as may be surmised from the rather sudden disappearance of cheap American offers of refined copper which has thus resulted in the current quotations being brought to within measurable distance of the terms maintained steadfastly by the chief producing groups. Alongside of the swift rise in warrant metal there has, however, not been much change in the state of the market for fine copper, beyond the fact that second-hand metal is less plentiful on this side, and more firmly held in anticipation of some revival in the demand from consumers. Developments are thus being awaited with no little curiosity, especially in view of the highly inflated level of values ruling. American authorities in any case seem more hopeful that the strong control exercised by the copper magnates must eventually influence consumers and stimulate new buying, but this remains to be seen, although it is argued that producers have already placed the great bulk of their output over the current half-year, and that, therefore, they have no big lines of metal to sell for several months to come. Admittedly there are possibilities in the way of a revival of buying by consumers who neglected somewhat to cover themselves ahead, but it is rather doubtful whether the orders to emanate from these quarters will be of sufficient importance to enable first hands to secure anything like a big business until fresh requirements for munitions are being released, a prospect which it is as yet rather premature to discuss, since it is understood that needs in that respect were already covered far ahead or right up to the end of this year. American consumption is undoubtedly heavy, manufacturers being reported to be well supplied with orders to keep them going for another five months or so. On the other hand, American production is excessive, a fact to be remembered, although it is to be inferred that American interests can now afford to accumulate supplies and are well able to persist in their arbitrary control.

The Metric System.

JUDGING from recent items of news, the demand for the adoption of the metric system and decimal coinage is gaining strength, though the Government maintains an attitude of uninterested aloofness from the subject. Asked by Mr. M. Barlow, in the House of Commons, whether, in view of the advantage to the internal and external trade of the country, he would consider the appointment of a committee to inquire into the matter, Mr. Harcourt said that the compulsory use of metric weights and measures was not contemplated by the Board of Trade, and he doubted the desirability of appointing a committee. The adoption of decimal coinage was a matter for the Treasury. However, the indifference of the Government is a small matter; everyone knows that it never moves unless it is pushed hard enough, and it is the nation's business to exert the necessary pressure. The London and Provincial Chambers of Commerce, the London Corporation, the Institution of Electrical Engineers, the National Federation of Building Trades Employers, and other important bodies have joined in the movement, and editorials in the daily Press have supported it. We welcome a leading article in our contemporary the *Builder*, which vigorously advocates the cause of reform. In the United States the scientific departments of the Government have taken the lead, but it is interesting to note that the National Wholesale Grocers' Association is also working hard for the metric system, thus showing that practical commercial men over there, whose business transactions would be intimately affected by the change, and who, if anyone, might be expected to raise difficulties, are convinced that the advantages of the metric system far outweigh the drawbacks attending its compulsory adoption.

THE ELECTRICAL EQUIPMENT OF A MODERN FOREIGN SUBMARINE BOAT.

By NORMAN H. WOOD.

WHEN running on the surface this vessel has a displacement of about 180 tons, and is propelled by a 6-cylinder double-acting reversible Diesel oil-engine of 350 H.P. and 450 R.P.M. The maximum surface speed is about 12.5 knots, and the cruising speed 10 knots, with a radius of action of 950 miles. In the submerged condition the submarine is driven by means of a storage battery in connection with an electric motor of 330 H.P. at 115 volts and 460 R.P.M. which imparts an under-water speed of about 9 knots for $1\frac{1}{2}$ hours or 8 knots for 3 hours. Diving and emerging are effected by filling or emptying the ballast tanks, distributed fore and aft and at the sides of the battery tank. Two tanks for trimming are fitted, connected with each other and the sea; an auxiliary buoyancy tank is also provided to compensate for alterations in weight during the voyage. A complete pumping equipment comprising two main bilge pumps of 26 H.P. each and one auxiliary bilge pump of 8 H.P., together with one hand pump, is fitted, all of which will work at a depth of 60 metres.

The storage battery, situated amidships in a special steel tank, consists of 60 cells connected in series and arranged in four longitudinal rows of 15 cells each, as with this arrangement the magnetic effect on the projector compass is practically nil. The plates of the individual cells are of lead, but as they are called upon to withstand repeated heavy discharges, the positives are of the large-surface type, whilst the negatives are pasted. Grooved wood separators are inserted between the plates, and a space of 60 mm. is allowed between the lower edges of the plates and the container bottoms to collect any mud that may accumulate. The containers are of special vulcanite composition, with watertight covers, on each of which is mounted a large inspection plug carrying a small non-return

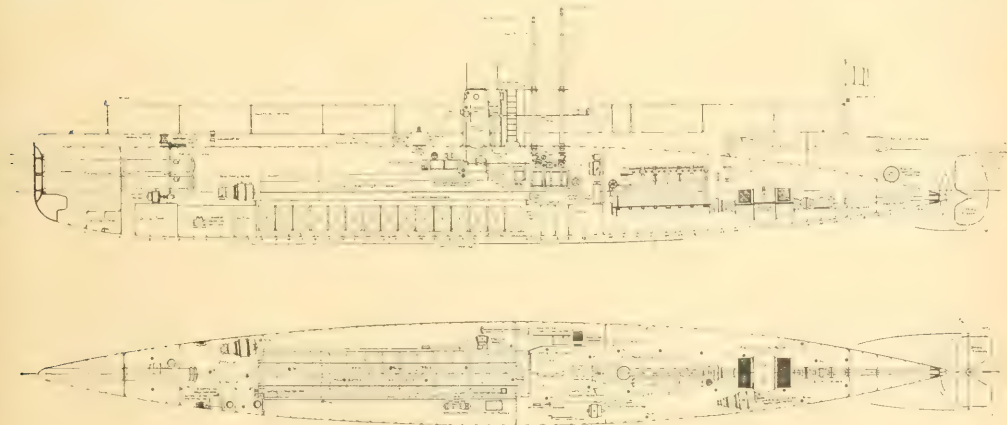
air from the tank is admitted into the cell through the small inlet valve. Each individual cell, as well as the battery tank itself, is thereby perfectly ventilated, and the possibility of an internal explosion is entirely removed. The officers' quarters lavatory is connected to the forward end of the battery tank through a special lead-coated vent pipe with screw-down flap cover, which is opened when the fans are running. The floor and sides of the tank up to a height of 110 mm. are covered with 2-mm. sheet lead, soldered at the corners to form an acid-tight tray, and over this and completely up the sides is placed a covering of 2-mm. 20-megohm rubber sheeting vulcanised directly on to the metal. The rubber covering is applied to all other fixed metal parts in the tank, and those parts which, owing to battery repairs, removals, &c., cannot be permanently fixed, are treated with three coats of antisliphuric enamel. The battery tank cover is of 5-ply wood impregnated with acid-proof enamel, and over the whole is stretched a 3-mm. thick seamless rubber sheet, secured to the upper sides of the tank, with small teak channels and screw-down clips, whereby the whole tank is rendered gas and watertight. The capacity of the battery is as follows:—

3,160 ampere-hours or 350.76 kw.-hours at the 1 hour discharge rate.

4,610 ampere-hours or 525.54 kw.-hours at the 3-hour discharge rate.

5,980 ampere-hours or 699.66 kw.-hours at the 10 hour discharge rate.

The battery can be discharged at the 1-hour rate without excessive heating taking place; further, the vessel can assume an angle of 25 deg. in any direction without the acid running out of the cells. The total weight of battery and connections is 37,000 kg. The battery ventilating valve placed between the fan trunk and the tank top is of the automatic non-return-flap type with a small cock and run-off pipe to drain away any liquid that may accumulate there. The connections between the individual cells are of h.c. copper electrically coated with lead, the same type being used for the conductors between the battery and main motor fuses. The latter leads are



SECTIONAL ELEVATION AND PLAN OF SUBMARINE BOAT.

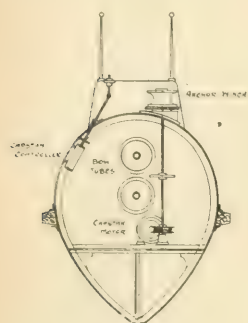
valve and flexible rubber connection. Running just above each longitudinal row of cells is a vulcanite pipe, the forward end of which is closed, whilst the after end joins up to a common pipe connected, through a non-return battery valve, to two electrically-driven exhaust fans. The flexible tube fitted to the cover of each cell joins up to the overhead pipe, so that if either fan is running the explosive gases are sucked away from each individual cell and thrown overboard, whilst

covered with 2-mm. para rubber vulcanised directly on the metal, and protected with a sheathing of 1-mm. sheet bronze soldered at the seams. Where these leads pass through the 7 in. channel at the after end of the tank, gunmetal glands with rubber packing are fitted to prevent ingress of sea water. The cells are arranged in two groups of 30 in series, with the middle wire permanently connected at their junction point, and earthed through an ammeter in conjunction with a small overload cutout. To check

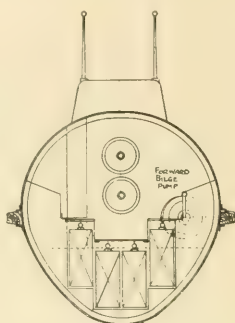
the efficiency of the battery, two ammeters reading to 3,000 and two ampere-hour-meters registering to 9,999 are placed in circuit with the main leads, the latter meters being of the double-dial type fitted with ratchet and pawl gear, which automatically enables them to register charge and discharge currents. Each of them is also fitted with a small winding gear to enable the dials to be quickly reset to zero if desired. The ammeters are of the long-scale illuminated-dial type, and have each a double-pole change-over switch, operated by hand, to enable them to register charge and discharge currents. An illuminated-dial voltmeter and switch are also provided. The main propelling motor is of the 8-pole shunt-wound type, with one armature but two

weight of the armature in the event of the boat assuming a list to fore or aft.

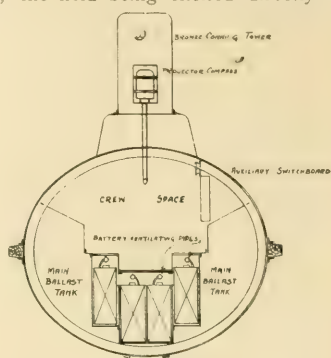
The motor is connected to the engine and tail shafting through claw-couplings, either of which can be thrown in or out quickly. When running on the surface, both couplings are connected up and the motor, driven as a dynamo, is used to charge the battery, but when diving or running submerged the engine is uncoupled, and the submarine is propelled by the motor. There are, however, isolated instances when it is desirable to charge the battery when the boat is at anchor or in dock, in which case the motor is coupled to the engine but uncoupled from the tail shaft, and driven as a dynamo in the usual way, the field being excited directly



At Frame No. 14.



At Frame No. 16.

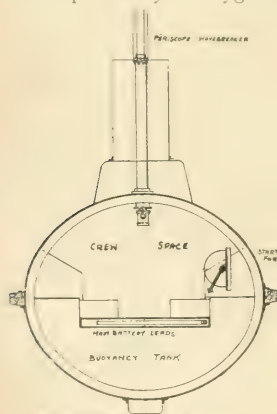


At Frame No. 32.

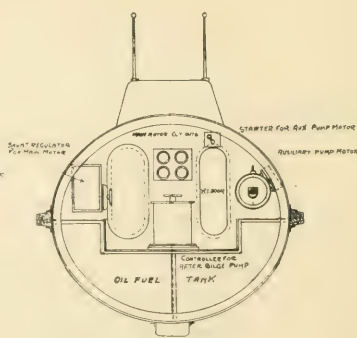
TRANSVERSE SECTIONS OF SUBMARINE, LOOKING FORWARD.

separate windings and two brush-rocker sets placed one at each side of the common field, with interpole and compensating windings fitted to prevent sparking and surging when starting up. The full output capacity is 330 B.H.P. at 460 R.P.M., at 115 volts, for $1\frac{1}{2}$ hours, with a temperature rise of 50 deg. C. allowed. Cooling is effected by natural draught, and as seamless mica only is used for armature insulation, the whole is rendered practically non-hygroscopic and capable of

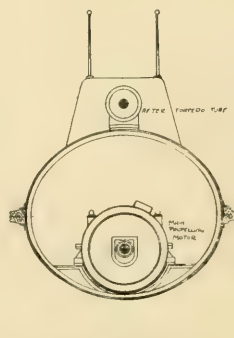
from the battery. When driven thus, the machine is capable of giving 750 amps. at 165 volts, or 1,500 amps. at 140 volts continuously, which ensures the battery being fully charged in about four to five hours. This motor can be run in either direction, or driven as a dynamo without any brush regulation; further, sparking is not set up at any load, even with a variation in pressure from 160 to 105 volts due to the battery voltage sinking on discharge. The complete weight of the motor in running order



At Frame 45—Looking forward.



At Bulkhead 39—Looking aft.



At Frame 49—Looking aft.

TRANSVERSE SECTIONS AFT.

withstanding any temperature up to 90 deg. C. The cast steel yoke has its bearings secured to the lower half with light steel sheets screwed on to the bearing arms, to prevent splash water from the bilges reaching the commutators. The solid shaft is ground up from 3 per cent. nickel steel, with a minimum diameter of 120 mm. in the bearings, as it is required to transmit the full power of the oil engine when the boat is running on the surface. A thrust collar is fitted in each bearing to take up the

is 6,880 kg. The machine is started, stopped, and regulated by the manipulation of four quick-break change-over knife switches and a shunt regulator; no starting rheostat is installed (see article on "German Submarine Motors," ELEC. REV., May 28th, 1915).

To start, the shore charging switch is first of all placed in the "down" position, and current is at once sent through the shunt windings; it is thus quite impossible to start the motor upon an open

field. The armature windings are now placed in series across the half battery pressure, and an instantaneous current of about 3,000 amps. passing through them causes the armature to revolve and reach a final speed of 85 R.P.M. By means of the shunt regulator the speed is increased to the utmost, the shunt resistance is quickly cut out and, at the same time, the armature windings are placed in series across the full battery pressure, with a speed of 165 R.P.M. Again the shunt resistance is all switched in slowly, then cut out, and the armature windings are placed in parallel across the full battery with a resultant speed of 330 R.P.M. The speed can now be adjusted at will up to 460 R.P.M. With this arrangement a continuous regulation from 85 to 460 R.P.M. is possible without interfering in any way with the lighting and auxiliary circuits, a most important point. To protect the motor against wrong switching whilst starting up, constant overloads, &c., double-pole fuses and automatic overload releases fitted with overload and time-limit relays are provided. The 3,000-amp. fuses are of pure silver wire enclosed in a very light watertight steel case carrying on the underside two small bronze safety valves, controlled by springs, &c., to release any gas pressure that may be set up in the event of the fuses blowing.

(To be continued.)

LABOUR AND INDUSTRY.

(Concluded from page 80.)

We have already quoted the views of the Lord Mayor of Birmingham respecting the need for higher efficiency on the part of the worker in exchange for the higher standard of wages of the future, and we may now refer to the opinions very frankly expressed by Sir Richard Cooper, M.P., at a meeting of Trade Union delegates at Walsall, held last month under the auspices of the local Trades and Labour Council. Sir Richard was of opinion that past misunderstandings between Capital and Labour should be removed, that there should be a closer relationship between the two parties, and that a new system should be introduced which would be mutually advantageous to employers and workpeople. In view of a Birmingham conference which was to be held, he asked organised Labour to consider whether, if they found a certain number of employers were willing to give them much of what they had been fighting for—recognition and a better wage system—they were prepared to respond by bringing any class of labour which was at present inefficient up to higher standard. It had to be clearly recognised that if a much higher rate of wages was to be paid, labour must be brought up to a corresponding degree of efficiency. Sir Richard, who was addressing his constituents, expressed himself as being tired of politics and convinced that nothing could be done at Westminster; he added that he had taken up this Labour problem because of his anxiety that progress should be made. Many will join with him in hoping that we shall not "go on tinkering with it for an indefinite period." It was stated that women who had gone into munition factories absolutely unskilled could in a few weeks turn out double the finished product of some skilled trade unionists; but while it was not suggested that that applied to trade unionists as a whole, it was a fact that a large proportion of Labour in this country was not as efficient as it might be. Sir Richard said that he had works in America—where, he admitted, there was more speeding-up of labour, but where for the same hours of work double the rate of wages was paid—from which skilled engineers could turn out machines and land them in this country as cheaply as a Birmingham or Sheffield manufacturer could make them. This fact, he thought, showed that with a proper system of organisation in this country, wages could be doubled.

According to the local reports of the Walsall meeting, there was a rejoinder by the secretary of the Trades Council,

which, as printed, is both a confession of, and a justification for, inefficiency. It was said that the reason why no trade unionist would work to his fullest capacity was that he knew that if he did so, his employer would at once cut down the rates of pay.

But this was no answer to Sir Richard, who presumably considered such a grievance as being open to remedy as part of any new bargain. How far we can expect Labour to adhere lastingly to any new agreement respecting increasing the workers' efficiency in exchange for new standards of payment, is one of the very important parts of the whole controversy. By no means has all the slacking that has occurred been due to inadequate wages; there has been some of it in war-time directly owing to wages being much higher than the normal. Fatigue through over-strain, excessive overtime, perhaps the need of a holiday (the old saw is perfectly true that "all work and no play makes Jack a dull boy"), and undesirable surroundings in the factory, may account for much, and call for serious and sympathetic consideration, but while reasonable thought should be given to such points, particularly in war-time, we must not imagine that industrial life and occupation after the war can be transformed into an enchanting holiday. Betterment of conditions is at best a slow process and recognising that we have got to *work* for our living as well as play, we shall do well to get pleasure out of it by putting our best into it, remembering that a measure of hardship makes better characters of us all. Life may be more strenuous after the war than it was before, but if it can be conducted with greater harmony it will be more bearable, perhaps bringing to the worker a greater spirit of content. If the worker increases his output, and thus increases the efficiency of production, the employer should be able to pay higher wages. It will be agreed that the labourer is worthy of his hire, and the good worker should not be penalised for performing good work, either by his employer or by his fellow-workers. In the past we believe that the enterprising worker has been penalised by Union men if he has set a pace that they have not desired to maintain. There have been officials who have taken away legitimate inducements to speeding-up in the way complained of, but inasmuch as both sides have erred, this is just one of those points for consideration at such a conference as Sir Richard mentioned. Reliable assurances of higher efficiency should render grievances of the kind bad policy for the foreman and for his employer. Harmonious co-operation is, perhaps, an ideal, but that is what we must aim at if we are going to get the best out of both Capital and Labour. *Incomplete* organisation of either Capital or Labour will leave the way open for difficulties. Complete organisation may make a basis for general agreement for the whole of our industries reasonably probable.

If we are to judge from the speech delivered by Mr. Harry Gosling before the National Transport Workers' Federation, the huge profits that have been made by ship-owners have whetted the appetite for higher wages to be paid for earning those profits, but from the shipowners' side we find the Government "Excess Profits" measures attacked because of their economic unsoundness. The shipowners want to put the money to building new ships—incidentally swelling their capital account—which will be so badly needed at the end of the war. Shipbuilding operations are proceeding in neutral countries at high speed and on an enormous scale. This "production" will be needed to make up for the great war losses of the past two years, but British shipowners are not blind to the possibility of a certain injury being done to their supremacy by this neutral activity. However, on the point of those "Excess Profits," the Government must have all the money it can get to finance the war; the Navy is protecting our shipping; and the shipping is feeding us all. But it must be remembered that after the war the bigger the shipping facilities there are at disposal for imports and exports, the more speedily will industry be able to return to its normal activity. The transport workers ought to be enabled to see that. We note from Mr. Gosling's speech that his Federation intends, as far as lies in its power, to see that any changes in our fiscal system shall be *prevented* by an adequate established minimum wage, a limitation in the hours of labour, State provision of work for the unemployed,

and an assured standard of life for one and all? That this ambitious and idealistic programme was received with "cheers" goes without saying—such things generally are applauded by audiences of a certain kind under excitement; but the "cheers" are doomed to die away into silence when, calmly and dispassionately, Labour and Capital sit round a table and try to find how, with the menace of foreign competition still existing, or even without it, for the matter of that, such things are to be brought into being in the days that, we trust, are not at hand. The Federation passed a resolution affirming that Trade Unions should so adjust working hours as to secure employment for demobilised men after the war and make a surplusage of labour impossible. Yet the door is to be left open for German manufactures to be dumped here, reducing the available work, until everybody has an adequate minimum wage; and though a surplusage of labour is to be made impossible, the State is to provide work for the unemployed! There is just a little contradiction somewhere in these programmes, all of which, and much else besides, shows that Labour orators and organisations—well, want more Board! One important Labour organisation recognises that the worker cannot secure his ends unless the State safeguards the interests of his employer. Mr. Gosling's Federation reverses the order, and says give us better wages, &c., and we will give State protection to industry. The cart before the horse, assuredly!

We referred a week or two ago to the fact that, in spite of all that has been done in the interests of Labour in Australia, no era of Industrial Peace has yet dawned there. This opinion receives full confirmation in a speech delivered by Mr. Herbert Brookes to the Victorian Chamber of Manufacturers, reported in the *Australian Statesman and Mining Standard* for May 18th. The speaker deplored the marked increase of "industrial strife fermented by self-seeking agitators" and supported by the militant section of Trade Unionism. The Chamber re-affirmed its determination to thwart, by means of continuous organisation and co-operation, the efforts of those who were working to the destruction of all domestic peace and progress. Members of the Chamber were prepared to make sacrifices in the interests of Industrial Peace, and Australia ought to emulate the example of France, where, though it was the home of Syndicalism, the Unions welcomed the introduction of women into their factories and skilled workers willingly undertook their training. The courage of the French people, Mr. Brookes described as a splendid rebuke to all shirkers, and he said that one could not be other than humiliated by the position in Australia, where, "even in this supreme hour of trial," domestic strife was predominant. The speaker went on to show that it was only by increasing production that wages could be kept high. If the present spirit of strife was to be continued when we were at peace again, how could we hope to compete with other nations? If the seriousness of the Australian position is in proportion to the strength of Mr. Brookes's strictures, the services of Mr. W. M. Hughes, the Prime Minister, will be sorely needed now he has reached Home from Home again, if he is going to secure the co-operation of his own people in the work of Imperial consolidation and progressive development which has been the theme of his speeches here. But these are largely domestic questions for Australia; we are lost in admiration at the magnificent service that the Commonwealth has rendered to the cause of the Allies in Gallipoli and elsewhere; what we are being frequently reminded of by such speeches as Mr. Brookes's is that Australia has not yet found a solution for the problems of Labour. Mr. Brookes advocates the presentation of a united front by the employers in order to "crush this militant official Union caste." We quote his following words:—

It was a profound cause of shame that, while the Empire was locked in a deadly struggle, official Industrial Unionism should be seizing every opportunity, like the Sinn Feiners, to take advantage of others' necessity and press for aggrandisement, which was not justified in the circumstances. In the opinion of many members of the Chamber, professional Unionism was becoming a caste, which was quite as offensive as the military caste in Germany, which had led to the present war. If he were asked calmly which of the two castes he would prefer to live under, his answer would be that he would infinitely prefer the military tyranny of Germany to the tyranny of Industrial Unionism. The one led to competency and

efficiency, and the other to incompetency and inefficiency, as well as to individual and national decay. He trusted the Empire would see the death of both when peace was established.

From the utterances of Alderman Chamberlain, Sir R. Cooper, M.P., and others, we find a more conciliatory spirit present at home in viewing the developing situation, and while hard things are undoubtedly amply justified by numerous occurrences, they will not make easy the pathway to Peace. Yet the truth must be told, and there will have to be plain-speaking and hard-hitting if Labour is to understand the errors of its ways and to be brought to act up to its responsibilities, so that after-the-war industry may be made attractive to all parties concerned in it.

During the past week several important events have occurred in connection with the subject of Labour after the war. One of these has been the publication of the summary of memorandum by the Demobilisation Committee of the Social Welfare Association of London, in which it is declared that reinstatement to be successful "must be carried out by Capital and Labour, acting in partnership under the authority of the Government." The Committee also sets out a scheme for a Central Committee, with local Committees, to carry out the work. The other event was the receiving of the deputation of the Industrial Triple Alliance by Mr. Asquith yesterday. In this connection, Mr. W. A. Appleton, Secretary of the General Federation of Trade Unions, is credited with having urged Trade Unions and employers to set aside all petty jealousies and to co-operate in an effort to find a solution for dealing with the reinstatement problem. He holds that a joint conference would be of inestimable value, and goes so far as to recommend Lord Derby as one who would readily facilitate the task. We have no doubt that Lord Derby, having, under great difficulties, done such magnificent work for the nation in securing recruits for the Voluntary Forces, will feel that no task would be more worthy of his good offices than that of facilitating the return of those men to industrial activity when their fighting work is done. Whether he will feel that the time is suitable for him to so concentrate his attention is open to question, in view of his speech of a few days ago, in which he saw no signs of a speedy termination of the war. That there will have to be joint effort, conference, co-operation and co-ordination of all forces concerned, in settling the vast problem along harmonious lines, is perfectly obvious. What is so essential is that each side should be able to sympathetically appreciate the point of view of the other, and that there should be a willingness to give as well as take. Only thus can we steer safely amid innumerable rocks, pass safely over turbulent waters, and avoid serious friction in negotiating a situation of unexampled difficulty, fraught with consequences quite without parallel for either good or ill.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Mexican Eagle Bitumen.

We have received a sample of the bitumen produced by the Mexican Eagle Oil Co. at their refineries at Minatitlan, Tampico, &c., under the most modern conditions and by the latest refining plant; we understand that the bitumen is always of the same high quality, and it is guaranteed 99.5 per cent. pure, which is as high a degree of purity as it is possible to obtain in a material of this sort. This bitumen is used extensively by cable manufacturers for all electrical purposes, including pothead insulators for cable ends, and for filling joint-boxes and ordinary cable troughing. It has been tested for dielectric strength; breakdown was found to take place at over 40,000 volts, with spheres of 2.2 cm. diameter, separated by 1 mm., fully immersed in the bitumen and allowed to cool for 24 hours after fusion. Particulars may be obtained from the ANGLO-MEXICAN PETROLEUM PRODUCTS CO., LTD. (Bitumen Department), Finsbury Court, London, E.C.

The Bowden-Thompson System of Protection for Electric Cables.

The former practice of relying solely on overload devices is not now considered sufficient protection for cables, and it is essential to adopt some means for automatically disconnecting a faulty length of cable from the rest of the system before the fault has seriously developed. Moreover, the disconnecting should be performed as rapidly as possible, in order to minimise the damage to

the cable and avoid any possibility of injuring the plant and switchgear, or disturbing synchronous machinery.

The faulty cable should be isolated before the main conductors have short-circuited or broken down to earth, and, in order to achieve this, it has been necessary to design a special form of cable, as shown in fig. 1, with metallic shields interposed between the cores, and also between the cores and the lead sheathing, in order to intercept any leakage currents.

The principle on which the system works is shown by the diagram of connections (fig. 2), which shows a protected cable switched from one end only.

A is the metallic shield between the cores, B the shield between the cores and the lead sheathing, C the main conductors. If any leakage occurs from any of the main cores to shield A or B, it is directed through relay D to earth, and the relay operates the main switch by trip coil E. If the cable is externally damaged, shield B is earthed before the main cores are reached, and as this shield is maintained above earth potential by battery F, current will flow through the relay and open the main switch. If preferred, a small transformer may be used instead of the battery.

The following diagrams show the system as applied to cables switched at both ends, ring mains, &c.

Amongst the chief advantages claimed for the system are the following:—It isolates the faulty cable before the main conductors

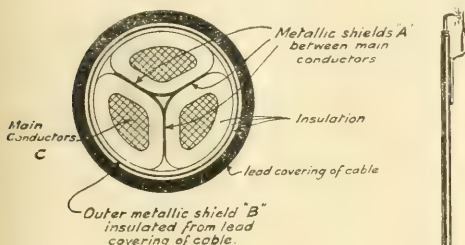


FIG. 1.—SECTION OF CABLE PROTECTED ON THE BOWDEN-THOMPSON PATENT SYSTEM.

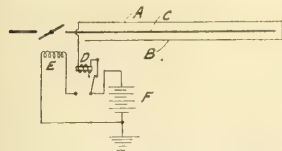


FIG. 2.—CABLE SWITCHED FROM ONE END ONLY.

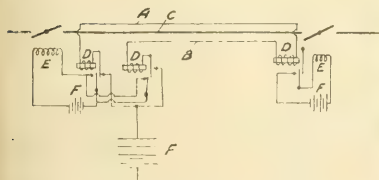


FIG. 3.—CABLE SWITCHED AT BOTH ENDS.

FIG. 5.—ELECTRIC GAS LIGHTER.

short-circuit or break down to earth, thus preventing damage to cable, plant and switchgear.

It provides protection between phases as well as against earths.

Its operation is not dependent on any supposition as to the path

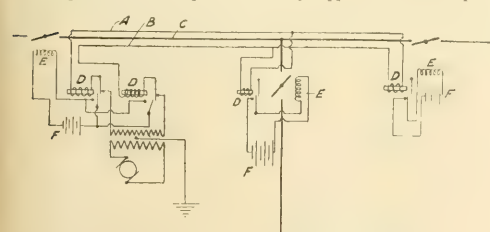


FIG. 4.—BRANCH FEEDER FROM RING MAIN.

of the heaviest current in case of a fault, nor does it assume that parallel feeders of the same cross-section share the load equally.

It is independent of any fluctuations in supply pressure or load.

As faulty sections are simultaneously isolated at both ends, the system is suitable for protecting parallel feeders, branch feeders, ring mains, or any combination of feeders.

If the cable is externally damaged when the supply is off, the relays will operate and prevent the cable being made alive until the fault has been cleared.

It will not operate on sound cable when being switched in, if the switch contacts are not all closed at the same instant. This is experienced with some balanced systems, which either have to be cut out when switching is being done, or a time limit is inserted.

There is no tendency to switch out sound feeders in parallel with a faulty one.

Special switchgear is not required, and the switchgear will not have to deal with excessive overloads when faults occur.

The system is being introduced by the MACINTOSH CABLE CO., LTD., of 176, Rice Lane, Walton, Liverpool.

Electric Gas Lighter.

MESSES. WARD & GOLDSTONE, of Sampson Works, Salford, are introducing the "Gnita" electric gas lighter and hand lamp as a novelty for the forthcoming season.

We illustrate this device in fig. 5; it consists of a Volex dry battery and ignition coil arranged so as to give a series of sparks at the end of the lighter. A small electric lamp is also provided, which can be switched on when entering a dark room, and thus help to avoid breakages of gas mantles.

We may add that the standard lighter is 20 in. long overall.

An Electric Bullet Probe.

The determination of the exact position of a foreign body, such as a bullet or piece of shell in a wound, has always been a matter of considerable difficulty. Even an X-ray photograph is frequently vague, and sometimes actually misleading, and therefore any instrument which will indicate more definitely the position of these bodies, and so supplement the information given by the X-rays, cannot fail to be exceedingly valuable.

An electric bullet probe, designed for this purpose, has recently been introduced by the CAMBRIDGE SCIENTIFIC INSTRUMENT CO., LTD., of Cambridge, England. The complete instrument consists of a fine metal probe and a contact wire of the same metal, both of which are connected by flexible leads to a galvanometer. The contact wire is placed in the edge of the wound in good contact with the tissues, and the probe is employed in the usual way. Since the probe and contact are both of the same metal, there is no difference of potential between them when they are inserted in the wound, and consequently, no deflection of the galvanometer. As soon, however, as the probe touches some other piece of metal in the wound a voltaic cell is formed, of which the metal constitutes one pole and the contact in the edge of the wound the other, the

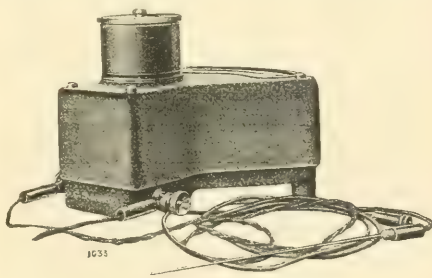


FIG. 6.—ELECTRIC BULLET PROBE.

blood being the electrolyte. Consequently, a current flows through the galvanometer and deflects the pointer. The instrument is, therefore, simple and self-contained, no battery or other accessories being required.

The galvanometer used is of the type shown in fig. 6. It is a moving-coil instrument fitted with a pointer, which swings across a scale, thus enabling the deflections to be observed directly.

Although very sensitive, this galvanometer is of robust construction. It is portable, and when in use can stand on the table conveniently near the patient. The extent of the galvanometer deflections depends on the size and nature of the metallic body touched by the probe. The great sensitiveness of the instrument is shown by the fact that the presence of a small piece of metal measuring only a millimetre or so in any direction causes a deflection of 10° or 20° (about 3 cm. on the galvanometer scale), while for larger pieces, the size of a bullet, the pointer is thrown completely off the scale. As long as the probe is not in contact with any metallic body, the pointer remains steady. It is evident that by means of this instrument the presence of even a small piece of metal is distinctly indicated by a comparatively large deflection of the pointer, while the absence of any deflection is a clear proof that no metal has been touched by the probe.

The probes are made in various thicknesses for different uses, and can be very fine when necessary. The probe and contacts and the portions of the leads which may come near the patient can readily be sterilised.

"Kwik" Electric Conduit Fittings.

The accompanying illustrations show a new and quick (or "Kwik") type of fitting for electric conduit applicable to plain coupling or to use in other forms. The special feature of the device is the means provided for opening the socket to receive the pipe. The pipe is inserted with a collar and is slipped into position through the open slot in the lug L, the latter being slightly sprung open to receive it when assembling the fitting. Once in place the screw cannot be let out and be lost, a few turns back-screw with the screwdriver force open the grip by means of the screw, enabling the pipe P to be readily slipped into the socket A.

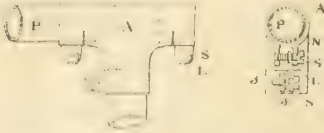


FIG. 7. THREE WAY KWIK SOCKET.



FIG. 8. END OF SOCKET OPENED TO RECEIVE PIPE.

after which the screw is turned forward to grip the conduit in the usual way. The effect of this arrangement is to save time in erection, a matter of present and increasing importance; the inventor and patentee, Mr. H. F. JOEL, of 72, Finsbury Pavement, E.C., claims that experience shows that the economy of time in fitting the pipes together is 50 per cent., and the cost of labour in wiring is reduced by about one-third. The invention has also been adapted to the opening and closing of the covers of switch and street surface inspection boxes, valve covers, &c.

A Combination Soldering Bit.

A soldering bit which has many advantages over the ordinary type of soldering iron is shown in the accompanying illustrations. The bit is made of pure copper of octagonal shape, $\frac{1}{4}$ in. in length and 1 in. in width. The copper bit is mounted in a handle about

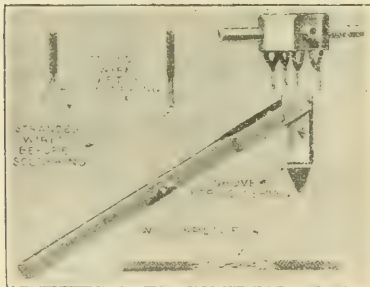


FIG. 9. COMBINATION SOLDERING IRON IN ORDINARY ADJUSTMENT HEATING ON BLOW TORCH AND IN USE AS SOLDERING POT.

12 in. in length, and by means of a wing nut and bolt can be adjusted to any desired angle or kept in a rigid position like the common soldering iron. The bit may be folded or reversed in the handle, thus shortening the overall length and preventing the point from damaging the tool bag in which it may be carried.

The construction of the handle is such as to enable it to be placed upon the burner of a blow torch and heated, thus avoiding the use of a blow torch direct on the wire. This method is shown in one of the illustrations. There is a groove on the nose of the copper bit for facilitating the soldering of wire.

In cases where a soldering pot is not available or its use is not advisable this combination tool may be used. The base of the copper body is drilled out to a depth of 2 in. and an approximate

diameter of $\frac{1}{4}$ in. A miniature soldering pot is thus formed in the copper body, in which solder may be readily melted.

This combination soldering tool is made by the CHAMBERS, BERING, QUINLAN Co., Decatur, Ill. *Telephony.*

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Performance of Steam Turbine Sets.

Referring to the record performance of the Glasgow turbine, published in your issue of July 14th, I shall be glad if you can also insert the enclosed results, obtained from a Fraser & Chalmers set installed here in 1911.

I think too much prominence cannot be given to records of this kind obtained from all British-built machinery, particularly in view of the disastrous breakdowns of German-built plant reported from Shanghai and elsewhere.

This particular plant was installed here in June, 1911, and is of the well-known Fraser & Chalmers-Rateau multi-cellular type, coupled to a Siemens alternator with a direct-coupled exciter.

The set was designed for 1,000 kW. capacity, running at 3,600 r.p.m. The alternator generates three-phase alternating current at 50 periods, at a pressure of 3,000 volts, and the set has an overload capacity of 25 per cent. for two hours, and 50 per cent. for half-an-hour.

During the year ending March, 1916, this set generated 6,084,000 units at about 80 per cent. power factor, which equals 94.6 per cent. of the total output. The machine has done a considerable amount of overload up to peaks of 1,550 kW.

The daily load factor has reached 104 per cent.

The machine has been overloaded for 13½ hours out of the 24, and has had to take the peak load with 24 in. and 25 in. of vacuum, due to shortage of condensing water.

It is two years since the turbo was opened out, and with the exception of slight adjustments to the governor, no repairs of any kind have been required.

Such results may not establish a record, but I think, coupled with the performance of the Glasgow plant, they argue well for the British manufacturer.

J. C. Williams,

Engineer and Manager.

Erith Electricity Supply and Tramways Dept.,

July 25th, 1916.

This is certainly an admirable record of good service. We shall be glad to receive particulars of similar performances. *EDS. ELCC. REV.]*

Mechanical Aids for Wounded Men.

May I ask you, through the medium of your valuable journal, to appeal to all electrical manufacturers and contractors who have any form of workshop, whether large or small, to help me in the following excellent cause?

A very large number of metal leg and arm rests are required for those of our wounded heroes returned from the front with fractured limbs. I have taken it upon myself, on behalf of a branch of the Red Cross Society, to offer to supply a certain number of the necessary parts required in making up the above frames. This form of apparatus relieves the wounded of much suffering, and helps to hasten the mending of the fractures.

Anybody with an ordinary lathe can bend and drill certain simple parts of the apparatus, made up of ordinary pieces of flat iron strip and galvanised rod, and if contractors would kindly help to supply even a small number of these parts per week, I should then be in a position to keep this branch of the Red Cross equipped with sufficient material to enable the amateur workers who put the frames together to complete a considerable number per week.

At the present time thousands of these frames are required, and as the putting together is all done voluntarily, every small help is of valuable assistance. Therefore, again I appeal to all manufacturers and contractors to give me their support in this matter.

The raw material will be supplied by me, and patterns of the parts required can either be seen in my office, or would be sent on application.

Thanking you for granting me the space for this letter.

H. F. Simon,

Managing Director, Electrical Installations, Ltd.

27, Martin's Lane, E.C., July 29th, 1916.

Carbon Electrode Manufacturing in Sweden.—The carbon electrode manufacturing business of the Aktiebolag Brenas Bruk is being taken over by a new company in course of formation with a capital of £83,000.

HYDRO-ELECTRIC POWER PROPOSALS IN MYSORE.*

THE total capacity of the generating station at Sivasamudram Mysore, will be, after the installation is completed, 22,650 H.P., and after deducting 1,650 H.P. to be held in reserve to guarantee the continuity of supply, there will be available at the bus-bars 21,000 H.P. net for supply to the transmission lines. During about nine months of the year, there is sufficient water in the Cauvery river to generate at Sivasamudram 30,000 H.P. at no very great additional expense. The capacity of the generating station will be made up of 11 units of 1,150 H.P. each; 3 units of 2,000 H.P. each; and 1 unit of 4,000 H.P.

It is therefore possible to obtain 9,350 additional H.P. by changing the eleven 1,150 H.P. units to units similar to those of the third and fourth installations. The station would then consist of 14 2,000-H.P. units and one 4,000-H.P. unit, or a total of 32,000 H.P. at the buses, leaving available for the distribution lines 30,000 H.P. net. This substitution could be made remarkably easily; each of the three large penstocks of the first installation would be used for a 2,000-H.P. unit, and only eight new penstocks of 2,000 H.P. capacity bought. This increase of capacity could be obtained without any building modifications, and the forebay alone would have to be modified for three additional penstock intakes. With these small improvements, an additional 9,000 net H.P. may be obtained at a cost of approximately Rs. 15 lakhs.

Under the present allotment of water to be stored at Kannambadi Reservoir, during at least three months of the year the river supply is less than that required for 21,000 H.P., so this scheme will have to be abandoned. The number of consumers, both large and small, within reach of the power lines, is rapidly growing, and as the maximum supply of 21,000 H.P. from Sivasamudram is likely to be exceeded in the next few years, it becomes necessary to have recourse to a completely new installation elsewhere, to be operated in parallel with, or to entirely replace, Sivasamudram. For this the Cauvery river is ideal, as the Cauvery reservoir guarantees a certain definite discharge at any point below the dam.

Below Sivasamudram two projects offer themselves: (1) Shimsha and (2) Mekadatu. The power-station site of the former project is located on the Shimsha river just below the Shimsha falls, at its junction with the Hullabellia river, about 74 miles from the Cauvery. The Mekadatu project is situated immediately on the Cauvery itself, about 25 miles along the river below Sivasamudram, and just within the Mysore State. The power-station site is within a few yards of the boundary line where the river enters Madras territory.

The first proposal embodies taking the water from the Sivasamudram head-gates through an open channel for approximately 34 miles to a forebay or intake, and thence in steel pipes 14 miles to a penstock header. This header would be under approximately zero pressure, with a stand-pipe or surge tank open above the high-water level at the intake, of sufficient capacity to discharge all the water in case of a sudden shut-down.

To provide a crossing at Handia Nulla, it is proposed to dam this nullah, thereby forming a very large reservoir for equalising the flow, and, most important of all, to provide a settling basin for removing silt and floating submerged vegetation.

From the penstock header, four penstocks will be taken to the generating station. It is proposed to install in this station four units of 10,000 B.H.P., net output with a provision for a future fifth unit, one unit being in reserve as spare. Each of these units will be direct-coupled to Francis turbines, and provided with its own exciter mounted on an extended shaft. Each exciter will be of sufficient capacity to provide excitation for two units. The penstocks will be provided with automatic closing devices at the penstock header and also electrically-operated from the turbine room. The turbine governors will be of the oil-pressure type with auxiliary oil systems and arranged for adjustments of load without shutting down the units. The switchgear and control apparatus will be of the remote-controlled automatic type, and the voltage regulators arranged to compensate for line losses.

The transformers will be of the oil-insulated, water-cooled type, as recently installed at Sivasamudram and Kolar Gold Fields, stepping the generator voltage up to 70,000—78,000 volts.

The power will be transmitted over new lines about 4 miles and fed into the present system.

The second project is to utilise the rapids at Mekadatu 25 miles below Sivasamudram and 3 miles below its junction with the Arkavati. At the head of these rapids, the Cauvery canyon broadens out to such an extent that it is possible to construct channels for conducting the waters of the Cauvery from the head to the foot of the rapids.

A dam is proposed to be constructed across the river and the water diverted into a suitable channel which terminates in a forebay just above the power station site at the foot of the rapids.

The dam is proposed to be of coarse rubble masonry approximately 1,500 ft. long and 12 ft. high.

The channel will be approximately 20,000 ft. long with a bed width of 22½ ft. and a depth of water of 10 ft., and will terminate in a forebay with four penstock intakes for four main units. No exciter penstocks are provided, as the exciters will be driven direct from the main units.

Three horizontal type generating units are proposed each of 4,000 B.H.P. output, direct connected to suitable turbines. The generators will deliver three-phase, 25-cycle power at 2,200 volts and 80 per cent. power factor. The shaft will be extended for an exciter of sufficient capacity to supply excitation to two main units. Provision will be made for a future extension of a fourth unit.

The turbines will be of the Francis type, of 5,600-H.P. capacity, equipped with oil-pressure governors and pressure-limiting devices similar to those lately installed at Sivasamudram. The governors will be equipped with motors for load adjustment from the switch-board.

There will be four transformers (one spare) of the water-cooled and oil-insulated type, 1,750 kW. capacity, at 80 per cent. power factor, for stepping up the voltage from 2,200 to 70,000—78,000. There will be no separate transformer station, as at Sivasamudram. But all station apparatus will be located in one building, resulting in a considerable saving in capital cost, and obviating the necessity of a double operating staff.

The power will be transmitted over duplicate lines, 24 miles long, to Kankanahalli section house, and there fed into the present system. Both these lines will be on the same towers, spaced approximately 500 ft. apart. Suspension insulators will be used, and the lines protected from atmospheric disturbances by overhead grounded ground wires, and for the protection of stations aluminium cell lightning arresters will be provided at both ends.

LEGAL.

BROMPTON AND KENSINGTON ELECTRICITY SUPPLY CO. LTD. QUINQUENNIAL ASSESSMENT.

AT the County of London Quarter Sessions, held at Clerkenwell, Mr. A. J. Lawrie (the Deputy-Chairman) was engaged for nearly three days in hearing an appeal by the Brompton and Kensington Electric Supply Co. against an assessment of their works and cables of £22,800 gross and £12,000 rateable by the Royal Borough of Kensington.

Mr. Alexander Macmorran, K.C., and Mr. E. M. Konstam were counsel for the appellants, while Mr. Walter Ryde, K.C., and Mr. Cecil Whiteley appeared for the respondents.

On behalf of the appellants, evidence was given by Mr. Carpenter, of Messrs. Humphreys, Davies & Co., valuers; Mr. Spencer Hawes, of Messrs. May & Hawes; Mr. Ruthven Murray, Mr. R. S. Downe, general manager of the company, and Mr. J. T. Owens, the secretary.

On behalf of the Borough of Kensington, Mr. W. HAROLD EVE, rating surveyor, of Messrs. William Eve & Sons, Union Court, Old Broad Street, E.C., submitted a valuation on which he found a rateable value of £16,330.

SIR JOHN SNELL also gave evidence in support of the assessment, and, in the course of cross-examination by Mr. Macmorran, contended that he had done the right thing in basing his tables for renewals on a figure of £68,000, although the prime cost was £103,000. The witness also expressed the opinion that there would be a considerable drop in prices after the war.

MR. MACMORRAN: I suggest not for two or three years.

SIR JOHN SNELL: I happen to be connected with a large number of important contracts, and I have it from most eminent manufacturers in this country that there will be a very considerable drop, especially in metals.

MR. MACMORRAN: Do you anticipate much of a drop in wages?

SIR JOHN SNELL: I anticipate a drop. The war bonus will have gone.

In further cross-examination, SIR JOHN admitted that in a certain calculation in which he had taken the 3½ per cent. table, it was customary until a few years ago to take the 2½ or 3 per cent. The price of money had increased in the meantime, and it was now customary to take 3½ per cent.

MR. RYDE: But on this particular point, the difference between the 3 and 3½ per cent. table would be very small, wouldn't it?

SIR JOHN SNELL: Yes, about £80, certainly under £100.

MR. RYDE: If you were dealing with something to-day, what would be your figure?

SIR JOHN SNELL: To-day I should take it certainly at 4½ per cent.

MR. RYDE, K.C., addressed the Court on behalf of the Borough of Kensington, and submitted that the assessment was amply justified. As regarded Sir John Snell's tables for renewals, Counsel argued that the position depended not on prime cost, but the cost of producing an efficient substitute.

MR. MACMORRAN, K.C., for the electricity company, said that whereas the gross receipts of the company were substantially the same, the expenditure had increased, and this made a difference of £3,876 in 1915. That loss accrued to the company despite that increased charges were operating for nine months of the year. He submitted that the assessment, which it was sought to impose on the appellants was excessive, and not in accordance with the true principles of assessment. He urged that it should be remembered that in the case of electricity companies there were serious possibilities of litigation from time to time. Mr. Eve's gross value worked out at £22,995, which was £195 more than the Assessment Committee's valuation. As regarded Sir John Snell's figure of £68,000 instead of the prime cost, counsel contended that they could not ignore conditions as they existed to-day.

* Abstract of paper read before the Mysore Engineers Conference, and reprinted in the *Indian Textile Journal*.

The DEPUTY CHAIRMAN, in announcing his decision, said he had some interest in the figures connected with the case with considerable care, but he did not think any useful purpose would be served by his now going into them in detail. The decision he had come to was that the gross value should be reduced to £19,778, and the rateable to £11,378, and as that was a substantial reduction—a very considerable reduction—and as the appellants could not get it reduced without coming there, the respondents should pay half the appellants' costs.

CHRISTIE F. NOBLES' DRUG STORES, LTD.

In the Lord Mayor's Court, last week, before the Recorder (Sir Forrest Fulton, K.C.) and a jury, Mr. J. C. Christie, electrical engineer and contractor, of Mansell Street, Aldgate, E., sued Nobles' Drug Stores, Ltd., of Well Street, Cable Street, E., and Whitecross Street, E.C., for £20 ls. 8d., work done and material supplied in May and June, 1915.

The plaintiff's case was that in May of last year an order was received from the defendants for a Blanchard incandescent lamp, and at the same time a discussion took place concerning an electric light installation to be fitted at defendants' Whitecross Street establishment. The plaintiff did the work, and sent in his bill of charges. At first he was promised payment, but afterwards defendants suggested that there were overcharges in the bill. Plaintiff replied that owing to the increase in the price of labour and material, he could not see his way to reducing the account more than 5 per cent. The money had not been paid. Evidence was given by the plaintiff's traveller (Mr. HART), who spoke to taking the orders. He said it was not true, as now suggested, that he was shown an estimate given by the Electrical Installations, Ltd., and had agreed to do the electrical work at the price contained in the estimate.

For the defence, Mr. WILLIAM NOBLE, secretary and managing director of the defendant company, was called, and he said the plaintiff's traveller had agreed to supply a Blanchard incandescent lamp for £3 2s. 3d., and to do certain electrical work at the price of £8 15s., the amount of an estimate he had received. He had always been ready and willing to pay those sums amounting to £11 17s. 3d., but he had been charged £20 ls. 8d. When he pointed the matter out to the plaintiff's traveller, he said there had been a mistake, and he (defendant) had been charged for a time job instead of a contract job. The traveller had promised to arrange matters.

The jury, after hearing further evidence, found for the plaintiff for £15 15s. 1d.

COMMERCIAL CABLE CO. v. THE GOVERNMENT OF NEWFOUNDLAND.

THIS matter, which was before the Judicial Committee (Lord Chancellor, Viscount Haldane, and Lord Atkinson) on Monday, was an appeal from a judgment of the Supreme Court of Newfoundland, which, by a majority, dismissed a claim by the appellants against the Government of Newfoundland for payment of two sums of \$12,000 and \$10,916.13. The claim was based upon the provisions of an agreement under the Great Seal of Newfoundland, dated February 18th, 1909, between the appellants, an American company, and the Governor of Newfoundland in Council. By the agreement the company agreed to establish a cable station at St. John's, Newfoundland, for the transmission of cablegrams to and from Great Britain and Ireland, the Government undertaking to pay them \$4,000 annually for the advantages and facilities secured to it by the cable. Subsequently there was a change of Ministry in Newfoundland, and the new Administration declined to recognise the validity of the agreement on the ground that it had not been submitted to the Legislature of the Colony for its approval. The Chief Justice of Newfoundland dissented from the judgment of the two other judges of the Supreme Court, who dismissed the appellants' claim.

According to the report in the *Daily Telegraph*, appellants contended that the agreement was valid and binding upon the Newfoundland Government, and did not require the sanction and approval of the Legislature. On the part of the respondents, however, it was argued that the power of the Governor in Council to make contracts was limited by the rules of the House of Assembly made pursuant to the Representative Act, 1892, but the appellants contested that view, and contended that no rules established by the House of Assembly could have that effect.

Lord Haldane now delivered the judgment of the Judicial Committee, in which their Lordships intimated that they would humbly advise his Majesty that the appeal failed, and should be dismissed with costs.

WAR ITEMS.

Controlled Works.—The number of establishments now controlled by the Ministry of Munitions is 4,052; 124 have been added since the last announcement was made.

To be wound up.—The Board of Trade has ordered the following to be wound up under the Trading with the Enemy Amendment Act:—

Glastos, Ltd., 4, Charles Street, Hatton Garden, E.C., glassware merchants. Controller: H. Hartley, 70a, Basinghall Street, E.C.

Charles A. Muller, 10, Arcade, Westgate, Bradford, electrical accessories merchant. Controller: Walter Durrance, 12, Duke Street, Darley Street, Bradford.

Books for Prisoners of War.—The recent revelations respecting the condition and needs—physical and mental—of some of the British prisoners of war interned abroad, coupled with the recently imposed restrictions on the transmission, by private individuals, of any printed matter to enemy or neutral countries, make it more important than ever that friends and correspondents of our interned men, when writing to them, should acquaint them with the existence of an Educational Book Scheme under which they can get their wants supplied. Under this scheme any such prisoner can obtain, free of charge and carriage paid, good books of an educational character (not fiction or light literature) on almost any subject for reading or private study during his internment by communicating (either directly or through a correspondent) with Mr. A. T. Davies, of the Board of Education, Whitehall, London, S.W. Prisoners are invited to state as precisely as possible on a form (which can be had gratis on application) what kind of books they desire. The evidence that has already reached this country shows that it is necessary to provide not merely physical, but also mental, sustenance for British prisoners during their confinement—and this the above Educational Book Scheme aims at doing. Offers of suitable books for the latter will be gladly received by Mr. Davies, but they should be accompanied by a submission of the list of books proposed to be contributed.

Exemption Applications.—At the City of London Tribunal, on Friday, Mr. F. Shaw, who stated that he was in the employ of the British Thomson-Houston Co., Ltd., electrical engineers and manufacturers, made an appeal for exemption on business grounds. The applicant said he was appealing personally, as his employers would not make any appeals on patriotic grounds. The Clerk: "It is impossible for an applicant to say that he is indispensable if his employers do not appeal." The Chairman said there was no case made out, as the applicant claimed on business grounds, and his employers would not appeal. The claim would be disallowed. A claim on domestic grounds was made by Mr. H. C. Rodgers, also in the employ of the British Thomson-Houston Co., and the matter was referred to the applicant's local Tribunal.

At Rochdale, temporary exemption for one month was granted to Joseph Holroyd (33), armature winder and general electrical worker for the Sutcliffe Electric Company, with a view to enabling him to get work which would justify the authorities in giving him a badge.

At the City of London Tribunal, last week, an appeal for exemption was made on behalf of D. R. F. Dobson (35), an electrical fitter, and married, by Messrs. Walter Mossop and Co., electrical contractors. A partner of the firm said that they were supplying electrical fittings to firms occupied with war work. Dobson was specially experienced in the arrangement and control of dynamos, and was at present, and would be for the next three months, employed at a factory which was making munitions for the French Government. The firm did not know how they would be able to replace him. He was the only man of military age. The Chairman said that the man was included in the list of certified occupations as it now stood and came under the heading of "Electricians and electrical fitters," but, of course, the firm ran the risk of losing him if the list was altered.

At the Middlesbrough Tribunal, the electrician of the Grand Opera House was granted exemption on condition that he undertook work of national importance.

On the appeal of the Town Clerk, Mr. W. H. Wakefield (38), chief clerk at the Bexhill-on-Sea Electricity Works, has been conditionally exempted for three months.

Before the Axbridge Rural Tribunal, Mr. J. Winter Bobbett, Chairman of the Winscombe Electricity and Power Co., Ltd., applied for exemption for an engine-driver at the supply station named Hill, who is 41 in September. He stated that their customers numbered 130, and Hill had sole charge of the engine. Conditional exemption was given.

At the Keighley Tribunal, the Corporation claimed that a railless-car repairer was indispensable, and the question was adjourned for further consideration.

At the Southwark Tribunal, Hotton and Hodgson, electrical and lighting engineers, applied for the exemption of Mr. Fred Hotton, son of one of the principals, described as an engineer, and for an electrical fitter and engineer. Mr. Hotton, senr., stated that the firm had undertaken a contract from the War Office on the distinct understanding that they would get badges for their men, but they had not yet received them. Conditional exemption was granted in both cases on joining the Volunteer Training Corps.

Before the East Kent Appeal Court, ten employees were appealed for by the Chatham Light Railways Co. A month ago the cases were adjourned for a conference with the military; 26 cases were settled by arrangement, and the military did not oppose conditional exemption for the ten men before the Tribunal. The Chairman said that the men would be exempted until October 31st only, and leave to go before the Central Tribunal was asked for, on the ground that the arrangement entered into should be confirmed. Leave to appeal was refused.

At Grantham, application was made by the Electric Co. for the exemption of the sole manager, Mr. John E.

Edmundson (37), who also manages the works at Stamford and is visiting engineer at Cromer. Conditional exemption was granted.

Carlisle Tribunal, on the application of the military representative, has sanctioned the calling-up of Thos. Young, electrician at the works of Messrs. Carr, who said that they were increasing their electrical installation, and needed the man's services.

At Hitchin, application was made for exemption for Mr. J. Oppermann (40), manager of the Alexandra Electrical Engineering Co., Ltd., of Letchworth, who stated that all the employes had gone, and that he was carrying on the business with the aid of his two eldest daughters. Conditional exemption was granted.

Before the East Kent Appeal Court, on July 26th, the military representative appealed against the decision of the Whitstable Tribunal allowing conditional exemption to Mr. Arthur Stewart (32), engineer to the Whitstable Electrical Co., Ltd. After hearing the facts the appeal was dismissed, and the exemption confirmed.

At Lewisham, S.E., on July 21st, Mr. Hanson, electrician, appealed, and stated that he was willing to enter the Army for his profession, or in the Air Service, so that his wife could have larger means. He had, however, failed to get into the Royal Naval Air Service. No exemption was given.

Before the Redruth Rural Tribunal, on July 22nd, exemption was claimed for the cost clerk and the cashier of the Cornwall Electric Supply Co. The former has been with the company for five years and the latter, who is also in charge of the tramcar depot, for 13 years. Mr. Smith stated that they had lost a lot of their technical staff, and had to keep the concern going. As the company's employes had been previously dealt with, the military representative objected to the applications, the men not having been included in the previous list. Mr. Peter: "You can't pick up a cost clerk in ten minutes." The Tribunal allowed the cost clerk six months, but refused the other application.

The East Sussex Appeal Court has refused exemption to the electrician of the Eastbourne Pier Co., aged 30, stated to be the only capable man employed.

Maidenhead Tribunal, on July 25th, gave Mr. Arundell, electrical engineer, leave to renew an appeal for Walter Sibley, the only man applied for, and who is engaged on power work and on occasional Government contracts.

At East Grinstead, an electrical fitter in business at Forest Row, who has work at four military hospitals, was given one month's exemption without leave to apply again.

Extended exemption has been refused at Brighton to an electrician with a local firm, who pleaded that they had had to refuse work owing to their depleted staff. The man has already had three months' exemption.

At Folkestone, Mr. E. Morgan, electrician, appealed, and it transpired that he had offered his premises to the Minister of Munitions, who, however, could offer him no work. Conditional exemption was allowed, with the stipulation that appellant joins the Volunteer Training Corps.

At Buxton, on July 27th, a firm of electrical engineers appealed for their foreman fitter, who assists at the electricity works. Exemption was allowed until January 28th.

BUSINESS NOTES.

Empire Contracts: An Australian Criticism.—In a recent editorial, entitled "How Not to Treat British Tenderers," the *Australian Statesman and Mining Standard* writes as follows:—

"That something should be done to prevent large orders going out of the Empire, when they can perfectly well be executed within the Empire, has long been obvious. We are not going to say that an order must be placed within the Empire under any circumstances that may arise, but where work can be fulfilled by an Empire firm at no greater cost than by an alien firm, the Empire firm should certainly have the preference. That is not the feeling, apparently, of the City Electric Light Co., Ltd., Brisbane. This company issued specifications, which closed in September of last year, for rotary converters, transformers, &c. The value of the business in round figures was something between £12,000 and £15,000. Several British manufacturers tendered, and so did the Australian General Electric Co., which put forward apparatus manufactured by its principal, the General Electric Co., of New York. The British tenders were unsatisfactory in only one respect: though the manufacturers thought they would be able to carry out the work in a reasonable time, they were not willing, in view of the war conditions prevailing, to accept penalties for late delivery. This question of delivery was used as the main excuse for placing the order with the Australian General Electric Co. for the American apparatus, with the result that, at a time when money is of enormous importance to the Empire, a sum of something like £15,000 goes outside it when it might reasonably be spent within it. More recently the same company called tenders for further apparatus, consisting of a large turbo-alternator unit, the tenders being returnable March 1st. Although the conditions were just what they were before, the British firms were again invited to tender, and did so, and representatives of some of these companies

were later invited to meet the manager of the company to discuss their tenders. When these interviews took place, the demand for guaranteed delivery under penalty was made once again, with the result that an order for a plant worth something like £30,000 has been placed with the Australian General Electric Co., to be passed on to the British Thomson-Houston Co., the turbine to be provided by the British Thomson-Houston Co., the alternator to be built by the General Electric Co., of America, and the condensing plant to be made by W.H. Allen, Sons & Co., Ltd. The Australian General Electric Co. appears to have accepted the penalty for delivery, so that the plant may be operating under steam, in Brisbane, on May 1st, 1917, though it is obvious that the British Thomson-Houston Co. is in precisely the same position as all other British manufacturing companies in the matter of delivery."

Our contemporary goes on to suggest that, inasmuch as the Brisbane Electric Light Co. will probably have to issue new shares in order to pay for this plant, the Treasury should refuse leave to call up the money, if it should appear that the money is to be spent in America. "The flow of money to America for munitions is sufficiently large at the present moment to make exchange a difficult enough matter, without having orders placed in the United States for apparatus which can, and ought to, be bought within the Empire. The prices offered by the English makers are understood to be at least as good as the American prices, and the failure to accept the penalty for failure to deliver by a specified time should not, in present circumstances, be regarded as sufficient excuse for spending this money outside the Empire."

U.S. Electrical Exports.—The American *Electrical Review* and *Western Electrician* states that the U.S. electrical exports for the month of April, 1916, were valued at about 28 per cent. more than in the corresponding month of 1915, although somewhat less than the high values of last February and March. The volume or quantity of the export trade has probably not materially increased over last year, the increase in total value being due almost entirely to the high prevailing prices. Quantities are given in the official reports for only four classes of electrical shipments, which in April compared as follows:—

Articles.	Numbers exported in	
	April, 1916.	April, 1915.
Electric fans	3,419	4,523
Arc lamps	22	35
Carbon-filament lamps	45,818	248,338
Metal-filament lamps	740,657	196,725

The values are as under:—

Articles.	April, 1916.	April, 1915.
Batteries	\$168,142	\$88,372
Dynamos or generators	151,727	127,071
Fans	45,528	61,926
Insulated wire and cable	386,239	354,341
Interior wiring supplies, &c. (including fixtures)	44,805	67,605
Lamps—		
Arc	639	554
Carbon-filament	5,410	27,665
Metal-filament	128,734	36,936
Meters and other measuring instruments	52,255	69,835
Motors	272,261	193,802
Telegraph instruments (including wireless apparatus)	7,965	14,377
Telephones	52,064	59,730
Transformers	68,889	47,763
All others	1,245,511	875,395

Total \$2,630,169 \$2,055,375

For the first 10 months of the last three fiscal years, ended on April 30th in each case, the electrical export totals were as follows:—

Ten months of fiscal year.	Electrical Exports.
1913-14	\$21,569,687
1914-15	15,922,467
1915-16	28,666,267

These totals do not include electric locomotives, which for these three 10-month periods totalled as follows:—1913-14, \$272,387; 1914-15, \$249,096; 1915-16, \$122,340. During last April five such locomotives, valued at \$26,964, were exported.

Prohibited Swedish Exports.—The Swedish Government has prohibited the exportation from the country during the war of "mountings for incandescent lamps, with or without switches, with coverings or inner parts of other metal than iron."

Japanese Government Subsidy for Electrical Exports.—From a statement quoted in the *Hochi*, it seems that the Japanese Government is going to subsidise the export of electrical apparatus. The Tokyo paper, which is regarded as the organ of the Government, credits an authority in the Department of Agriculture and Commerce with the following statement:—"Japan's electrical industry has recently undergone a marked development. Efforts should be made to further national interests by promoting the export of the various products of the industry. The Government is therefore considering means to encourage the export of electrical apparatus to China, India, and other accessible places. A new item of expenditure is to be provided in the next Budget for the purpose of subsidising the export. The scheme, however, has not yet been considered by the Cabinet in detail.—*Eastern Engineering*."

Catalogues and Lists.—**IGRANIC ELECTRIC CO., LTD.**, 117, Oldham Avenue, Salford, Lancs. E.C.—Illustrated booklet No. 1621, containing full descriptive particulars and tabulated ratings of Igranic cables, conductors and busbars.

MR. GEORGE ELLISON, Victoria Works, Warstone Lane, Birmingham, N.W. No. 327, 34 pages, dealing with totally enclosed brake solenoids. Most exhaustive information—descriptive, tabular, and diagrammatic—is given regarding this type of gear, the contents being the result of many months' careful calculation and research. Some typical specifications are given, which have been found absolutely necessary owing to the fact that more than 50 per cent. of the inquiries received do not give sufficient particulars.

THE MACINTOSH CABLE CO. LTD., 176, Rice Lane, Walton, Liverpool.—Pamphlet describing the Bowden-Thompson patent system for the protection of electric cables.

THE METALLIC SEAMLESS TUBE CO. LTD., Wiggin Street, Birmingham.—64-page catalogue, giving illustrations, particulars, and clearly-arranged prices of "Metallic" steel conduits and fittings, enamelled and galvanised respectively. Copies may be had by the trade on application.

THE ELECTRIC SUCTION CLEANER CO., 56, Victoria Street, London, S.W.—A 12-page pocket pamphlet, entitled "The New Maid," tells a story—and a very attractive one, too—of war-time domestic difficulties, and how electricity solved them by the aid of a "Clarissa" electric housemaid, otherwise a "Premier" suction cleaner.

Board of Trade Inquiries.—The B. of T. Commercial Intelligence Branch has received applications from Home firms for the names of manufacturers and producers of electrolytic plant for the manufacture of caustic soda, also for machines for cutting and pressing peat for fuel.

Electric Light Switching.—As the result of a recent supplementary competition and examination on this subject, held by Messrs. A. P. Lundberg & Sons, 9, Advanced, 30, Intermediate, and 36 Preliminary Certificates have been awarded, the foremost place being gained by Mr. H. F. Ware, of Macclesfield. Though the number of competitors is small compared with those in the recent record examination, it is really good, considering the present circumstances.

For Sale.—The Postmaster-General is offering for sale certain plant and machinery at the Post Office Parcels Depot, Dublin.

The Receiver for the debenture-holders of the London Electron Works Co., Ltd., is inviting offers for the sale by tender of the land, factory, plant, &c., at Regent's Dock, E.

Messrs. Wheatley Kirk, Price & Co. will offer for sale by auction, on August 22nd, the plant of the Holloway Electric Supply Co., Ltd. Particulars appear in our advertisement pages to-day.

Book Notices.—The Swedish Chamber of Commerce for the United Kingdom (5, Lloyd's Avenue, London, E.C.) has issued a *Year Book* of the Chamber for 1915. It contains a copy of the annual report, and articles on Swedish shipping during the war, Swedish overseas steamship lines (with map), the Swedish route to Russia (with map and plan), statistics of trade between the United Kingdom and Sweden during 1914, &c. There are a number of trade reports treating with the principal markets for Swedish staple articles in the United Kingdom from an individual point of view. Innumerable charts are given, many of them showing the imports and exports of the United Kingdom for different classes of electrical manufactures during five or six years prior to the outbreak of war.

"Lektrik Schénas de Lumière," is the title of a French translation of their "Lektrik Lighting Connections," which Messrs. A. P. Lundberg & Sons, with characteristic enterprise, have just issued (price 1 fr.). The contents, which have been adapted by Mr. R. Drillon, one of the firm's advanced-grade certificate-holders, are in substance identical with those of the English edition; the total number printed, including the French edition, is now no less than 37,000 copies, a fact which speaks for itself.

The July issue of the *Journal of the Tramways and Light Railways Association* contains a full report of the proceedings at the recent annual congress of the Association.

Post Office Electrical Engineers' *Journal*, Vol. IX, Part II, July, 1916. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

"Programme for the Session 1916-17" of the City and Guilds of London Institute, Department of Technology. London: John Murray. Price 6d. net.

"The Trade Rule." By C. N. Pickworth. Manchester: Emmott & Co. Price 2s. net.

The British-Italian Corporation.—In the House of Commons on Monday, according to the *Financial Times*, Sir Archibald Williamson asked the Chancellor of the Exchequer if he was in a position to give any information with regard to the formation of a company to promote the joint economic interests of this country and Italy, and if he could state what financial assistance, if any, was being provided by the British Government.

Mr. McKenna, in reply, gave particulars of the British-Italian Corporation, Ltd., concerning which we gave details in our last issue. He added that the British Government agreed to contribute to the company, by way of subsidy, during each of the first 10 years after its incorporation, an annual sum of £50,000, or the equivalent of 5 per cent. upon its paid-up capital if less than £1,000,000. In consideration of the subsidy, the company agreed to pay to the Government amounts equal to any dividend above a cumulative dividend of 5 per cent. per annum which the directors

might distribute to the shareholders in any year after making such provision as the directors might think desirable for bad and doubtful debts and the establishment of a reserve fund, until by such means the Government had been repaid (without interest) the amount so received by the company by way of subsidy. He proposed to ask Parliament to give covering authority for the subsidy in the next Government War Obligations Bill. A company under the style of the Compagnia Italo-Britannica would forthwith be formed under Italian law, with a capital of 10,000,000 lire (£1,000,000), one-half of which is to be taken by the British Italian Corporation and the other half by the Credito Italiano and its friends. Out of the nine directors of the Italian company three would be British. The two companies would work together in close collaboration, and arrangements had been made by which their interests would be as far as possible identified, except that the subsidy of the British Government would naturally remain for the benefit of the British company exclusively. The primary object of the two companies is the development of economic relations between the British Empire and Italy and the promotion of undertakings in the commercial and industrial fields in Italy. They would carry out banking and financial operations which did not necessarily fall within the strict definition of banking as understood in this country.

The questioner also asked Mr. McKenna whether he was prepared to consider similar arrangements with respect to Russia, and, according to the *Morning Post*, he was understood to assent.

New Building and Engineering Work.—In connection with the new Order in Council restricting building and engineering work above a certain value, without licence from the Ministry of Munitions, it is explained that work which was in progress before July 20th need not be stopped pending the granting of a licence. Any building commenced before that date should be continued until such time as a licence should be definitely refused. There is no desire to restrict building unless a national purpose can thereby be served. The principal purpose of the Ministry is to limit the use of structural steel. A further purpose is to assist the Ministry of Munitions in obtaining such building labour as is urgently required upon munition factories.

Trade Announcement.—MESSRS. WARD & GOLDSTONE desire to remind the trade that their London address is Albion House, 59-61, New Oxford Street, W.C.; Telephone No.: "Museum 2988."

Dissolutions and Liquidations.—**ADNIL ELECTRIC CO., LTD.**—August 16th is the last day for creditors to prove their debts or claims. Mr. J. H. Stephens, 6, Clements Lane, E.C., liquidator.

T. W. THOMPSON & CO., electrical engineers, Endyne Works, Blissett Street, Greenwich.—Messrs. T. W. De Lasaux and E. J. V. Pucknell have dissolved partnership. Mr. De Lasaux, 39, London Street, Greenwich, will attend to debts, &c.

LIGHTING AND POWER NOTES.

Australia.—A scheme for the electric lighting of Murwillumbah (N.S.W.) has been approved by the Municipal Council. Application will be made to the Government for permission to borrow £7,480 for carrying out the scheme if the consent of the ratepayers is obtained.

Two of the six 15-ton high-speed electric cranes to be installed on the new wharf at Newcastle (N.S.W.) have been tested in position. These are for coal shipping purposes, and the tests showed a hoisting speed of 98 ft. per min., a slewing speed at 55 ft. radius of 433 ft. per min., and a travelling speed of 134 ft. per min. The cranes were manufactured by Messrs. Cowans, Sheldon & Co., Carlisle, to the designs of Mr. Percy Allan, Assistant Director-General of Public Works.

A fire occurred recently at the Adelaide (S. Aust.) Corporation electricity works at Jamestown; the power house was completely destroyed, also much of the plant.

In connection with the installation of an electrical pumping plant at Bendigo (Victoria), for the drainage of certain portions of the goldfields, arrangements have been made with the Electric Supply Co. of Victoria, for the supply of the necessary power.

Tenders.

With a view to testing the value of mountain streams for generating electric power, the N.S.W. Government has in hand a small scheme at Jenolan Caves. The work has been proceeding for some time, and is now almost completed. The scheme is to provide lighting for the Caves House, the caves and the various buildings; and to provide power for heating and other purposes.

Aldershot.—**YEAR'S WORKING.**—There was a deficit of £204 on the working of the electricity undertaking for the year ended March 31st last, partly attributed to heavy law costs, which had been met out of revenue. The total revenue for the twelve months amounted to £8,128, as against an expenditure of £8,153, leaving a gross balance of £1,975. The units generated totalled 676,220, an increase of 58,384.

Argentina.—The "Inspeccion General de Rentas" has been authorised to make arrangements with the Luz y Fuerza and Anglo-Argentina Companies for the supply of electric light at the port and dependencies of Paraná and Concepcion del Uruguay respectively.—*Review of the River Plate.*

Barrow.—**PROPOSED LOANS.**—The T.C. is to apply for sanction to borrow £10,300 for electrical extensions in Walney Island. tenders are to be obtained for an electric lorry.

Bridlington.—**YEAR'S WORKING.**—The annual report of Mr. F. Ffrench, the deputy electrical engineer, for 1915-16 shows a gross revenue of £5,766, as against £7,606; gross expenditure amounting to £2,980, compared with £3,841; and a gross profit of £2,776, as against £3,764. Interest and repayment charges amounted to £4,077, leaving a deficit of £1,321, which will be taken from reserve. During the year, the works have generated 260,000 units less than in 1913, and 150,000 less than in the previous year; the plant was closed down 15 times owing to war conditions.

Brighton.—**YEAR'S WORKING.**—The detailed figures of the Corporation electricity undertaking for 1915-16 show that a deficit of £3,990 resulted on the year, as against a deficit of £1,354 in 1914-15. The total revenue amounted to £93,397, which was in excess of the previous two years' revenues, and obtained on 9,336,639 units sold, as against 10,214,136 units sold in 1914-15. A considerable increase occurred in expenditure, and the gross profit of £40,345 represented a drop of over £2,000 on the year. Interest amounted to £17,760 and sinking fund to £24,908, leaving the balance as shown. The coal bill increased by £9,000 to a total of £25,760 (average cost now 32s. per ton), despite decreased output and increased efficiency (3·83 lb. per unit sold as against 3·97 lb. in 1914-15). The deficiency is charged to the reserve fund. Owing to the extinction of the public lamps, the ratepayers saved some £7,000 during the year on that account, although the undertaking had to meet capital charges on plant as usual.

Bury St. Edmunds.—**YEAR'S WORKING.**—Mr. S. E. Day, the borough electrical engineer, in his report for the past year, states that there has been a decrease in the units sold of 27 per cent., and that the demand for electricity for power purposes exceeded that for lighting, being an increase of 17 per cent. over 1914-15. The cost of production was £3,089, and the income £4,696, leaving a gross profit of £1,608. Mr. Day points out the necessity for replacing either, or both, of the 60 kw. generating sets by a larger and more efficient unit. The new storage battery has been working satisfactorily, and the reduction during the past year of 406 tons of coal consumed is almost entirely due to its use. The "free wiring scheme" inaugurated two years ago has been the means of introducing electric light into premises which otherwise would not have been secured, owing to the installation difficulty.

Chelmsford.—**STREET LIGHTING.**—On condition that the Electric Supply Co. withdraws opposition to the Council's application to extend for a year the option to purchase the undertaking, the T.C. has decided to enter into a new four years' contract for public lighting from April 1st, 1916. For such time as the lamps are not used there is to be a yearly payment of £150, and there are to be 14 500-watt "half-watt" lamps, instead of arc lamps, at £20 per annum each, 44 double lamps for street corners, and 190 single lamps, at £3 15s. each. From June 1st, 1915, to March 31st, 1916, when no lamps were used, a payment of £275 is to be made. The contract price for that period was £1,375.

Continental.—**SPAIN.**—Evidence of the progress in the production and consumption of electricity in Spain is furnished by the report of the Sociedad Hidroeléctrica Española, for the year 1915, which shows that supply for lighting has undergone an enormous increase. The company supplies Cartagena, Alicante, Alcoy, Valencia and Madrid, and the output in 1915 was 103,254,203 units, contrasted with 96,707,646 units in the previous year. With the object of increasing the hydroelectric production, a new intake of water has been made on the River Guadazaon, a feeder of the Cabriel, which will make it possible to regulate the production at the Villora station. The available profits were 2,003,250 pesetas, the dividend being 8 per cent., and the carry over, 83,284 pesetas, after allowing sums to sinking fund, reserve, and employes' compensation.

Darlington.—The Electricity and Light Railways Committee has under consideration the question as to whether the price of electricity should be increased still further to meet the increase in the cost of coal. The Committee has decided to make a trial of seats for lady conductors on the tramway cars.

Ealing.—**PRICE INCREASE.**—The Corporation has decided to raise the charges for electricity by 33½ per cent. in September next; already the charge has been increased by 20 per cent.

French Indo-China.—An American Consular Report mentions that only the important cities of Saigon, Cholon and Phnompenh in the south, and Hanoi and Haiphong in the north, are adequately supplied with electricity. The work is practically in the hands of La Compagnie des Eaux et Electricité de l'Indochine, a company with about 6,000,000 fr. capital. A plant of 5,000 H.P. at Cochin supplies both Saigon and Cholon, and includes a 2,000-H.P. turbine and high-speed engines. Small plants exist at Mytho, Battambang, Kompeng-Cham, Kratie and Ventiane; the Phnompenh plant is of 615 kw. The Hanoi plant is of 1,000 kw., and the Haiphong plant of 1,200 H.P. There are a number of private installations in use, and the Wolfram Co. of Tonkin, is installing a 1,000-H.P. hydro-electric plant at its mine.

Heywood.—**YEAR'S WORKING.**—The report of Mr. R. B. Leach, the Corporation's electrical engineer, for the year ended March 31st last, states that the total income was £8,565, against £7,121 in the previous year. There was a debit balance of £940

plus £112 disallowed by the L.G.B. inspector at the last inquiry against a debit balance of £927 in 1914-15. The cost of energy purchased from the Bury Corporation was £1,714; and the units purchased were 405,077 for lighting and power, and 392,805 for traction, making, with the energy generated by the Council's plant, a total of 1,776,497 units. The engineer estimated that, except for the operation of the bulk supply scheme, the loss on the undertaking would have exceeded £3,000.—*Bury Guardian*.

Ilford.—**REFUSE DESTRUCTOR.**—The U.D.C. has instructed the engineer to prepare specifications for a H.T. alternating plant, with a view to utilising the steam at the refuse destructor. The cost is stated to be about £7,000.

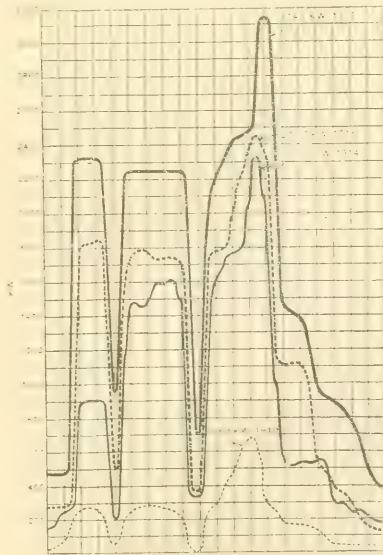
The Electricity Committee proposes to discontinue the discount of 5 per cent. at present allowed on accounts in cases of prompt payment. The electrical engineer has been instructed to communicate with certain authorities regarding the B. of T.'s circular re coal economy and inter-working.

India.—As expert opinion from the Tata Electric Works has been obtained to the effect that the city of Hyderabad is very favourably situated for an electrical installation to be worked by water power, the scheme will now be proceeded with.

The Darjeeling municipality proposes working out Mr. Stonebridge's hydro-electric scheme initiated by the late Mr. Robertson, at a cost of more than 4 lakhs; the power station will be established at Singla, from where current will be supplied to Darjeeling town, the neighbouring tea gardens and Kurseong.—*Indian Engineering*.

The Government of Bengal has appointed a Committee to inquire into the rates charged for electric current in Calcutta, and the general question of supply. It is composed of the Hon. Mr. Y. Donald (president) and Mr. J. W. Meares, Electrical Adviser to the Government of India; Mr. A. K. Taylor, Electrical Inspector, Bengal; and Mr. Hales, Registrar of Public Companies, Bengal.—*Indian Textile Journal*.

Keighley.—**YEAR'S WORKING.**—The report of Mr. Webber, the borough electrical engineer, contains as usual much interesting information regarding the last year's working of the electricity undertaking, which continues to make substantial progress. The bare figures show revenue amounting to £24,253 as against £18,394 in 1914-15; a gross profit of £8,689 against £8,013, and a net profit of £759 against £1,025 in 1914-15, this despite increased coal cost and financial charges. The total output sold was 6,769,612 units, of which power absorbed over 6,000,000 units; the previous year's total was 4,942,850 units. Lighting units fell from 311,482 to 280,513, and Mr. Webber mentions that lighting supply has only increased about 168,000 units in 10 years, while power units have increased by 5,900,000 units during the same time. The tramway supply, however, increased from 311,710 to 424,393 units, due to the railless trolley system being in full operation. Some 8,852 H.P. of motors (exclusive of tramways) are connected, and we note that 22 H.T. and 35 L.T. large power consumers



KEIGHLEY LOAD CURVES, 1910, 1914, 1915 AND 1916.

now have 5 or 10-year agreements with the department. The generating plant capacity was 4,750 kw., but preparations are advanced for installing a further 5,000-kw. turbo-alternator, which will have the effect of reducing the present low capital cost per kw. of plant installed, of £22 to £18. The maximum load was 3,148 kw., and we note that the plant has been running night and day with pro-

tically no interruptions. The works and management cost amounted to 55d per unit, an increase of 50d, and the "all-in" cost to 58d per unit; the average price obtained for supply was 89d per unit, and private supply (which, in this case, practically means power supply) gave an average revenue of 79d per unit. Mr. Webber advises the installation of an induced draught plant to enable the five big boilers to give their full output; he also mentions that negotiations are probable with the Yorkshire Power Co., with a view to a linking-up scheme. We reproduce a set of load curves for various years, which show concisely the excellent progress made by this undertaking.

Keadby.—**ELECTRICALLY-OPERATED BRIDGE.**—A recent issue of the *Railway Gazette* briefly describes the new Keadby electrically-operated bridge, of the Scherzer rolling lift type, which was brought into use by the Great Central Railway Co. in May last. The lifting span weighs about 3,000 tons, and is said to be the heaviest bridge of the type constructed in Europe. The bridge carries both a railway and roadway, and is provided with a generating plant and battery houses on either side of the river, one for working the bridge mechanism and one for supplying the signal circuits which are interlocked with the latter.

Kendal.—**YEAR'S WORKING.**—There was a gross profit of £880 and net loss of £390 on the working of the electricity undertaking for the twelve months ending March 31st last. The units generated amounted to 167,298, and 139,403 were sold. Notwithstanding the increased price of fuel, the cost per unit generated was reduced from 2'42d. to 2'37d.

Liverpool.—The City Council has approved the recommendation of the Electricity Committee that the provisions as to minimum supply in Messrs. Lewis's agreement be waived until 12 months after the termination of the war, subject to the agreement being extended for a corresponding period from that date. Similar concessions have been made to the railway companies.

London.—**BETHNAL GREEN.**—The Borough Council's electric supply scheme is now nearing completion: as a matter of urgency, and informally, the supply of electricity was commenced to a limited extent on June 19th.—*East London Advertiser*.

FULHAM.—The B.C. has received the sanction of the L.C.C. to the borrowing of £2,500 for electricity purposes.

L.C.C.—The Finance Committee recommends the Council's sanction to the borrowing of £3,728 by the Battersea B.C. for electricity purposes, and £650 by the Hammersmith B.C. for the purchase of a site for electricity purposes.

Manchester.—**RATE RELIEF AND INCOME-TAX.**—The large contributions of certain of the municipal trading departments to the relief of the rates are to form the subject of consideration, notice having been given of a motion that, in view of the present high rate of income-tax, &c., a Special Committee be appointed to review the basis on which the Gas, Electricity, Tramways and Markets Committees have hitherto contributed to rate relief.

Merthyr Tydfil.—**STREET LIGHTING.**—Owing to the increased cost of fuel, &c., the Traction and Lighting Co. has informed the T.C. that the price of energy for public lighting will be increased by 1d. per unit on the contract price.

New Zealand.—**WATER POWERS.**—According to an article in the *Commonwealth Engineer*, there are available in New Zealand water powers of a total of 3,800,000 H.P., of which 3,305,000 H.P. is in the South Island. Among the most noteworthy powers in the latter may be mentioned Lakes Te Anau (750,000 H.P.) and Manapouri (420,000 H.P.), both on the seaboard; Wakatipu Lake (500,000 H.P.), 140 miles from Dunedin; Tekapo Lake (400,000 H.P.), 40 miles from Timaru, and Ohau Lake (250,000 H.P.), 52 miles from the same town. There are also possible developments of 100,000 H.P. within 50 and 88 miles respectively of Invercargill and Christchurch.

Rickmansworth and Chorley Wood.—The B. of T. has extended the provisional order for one year.

Rotherham.—**PLANT EXTENSIONS.**—The T.C. is recommended to extend the generating plant at the electricity works, at an estimated cost of over £50,000.

Rowley Regis.—**PRICE INCREASE.**—The U.D.C. has been informed by the Midland Electric Corporation for Power Distribution, Ltd., that the charges for energy will be advanced by 10 per cent., a total increase of 20 per cent. since the war started. The clerk is to advise the Council on the company's powers to make the increase.

Salford.—An additional supply of energy is to be given to the works of the Broughton Copper Co. The Electricity Committee has given instructions that the two remaining reciprocating engine sets at the generating station shall be sold, and the money realised credited to the depreciation and renewals fund. The Committee has accepted the offer of Mr. J. Heaton to supply 2,000 tons of Tyldesley slack at 17s. 11d. per ton.

Sevenoaks.—The Electricity Co. has applied to the U.D.C. for permission to run wiring for the supply of current to small dwellings on the "fixed-price" system, and the Council has decided to obtain information from Wimbledon, where a similar plan has been adopted.

Shipley.—**LINKING-UP PROPOSAL.**—The Electricity Committee reported, with regard to the proposed linking-up with the Bradford electricity undertaking, that from particulars submitted it was thought that at present there was very little to be gained by interconnection; definite figures had not been submitted, and the Committee has deferred consideration pending its engineer's report.

Watford.—**PRICE INCREASE.**—The Council has decided to raise the flat rate for lighting to 5½d. as from the commencement of the September quarter until December 31st, when the matter will be reconsidered.

Willesden.—**YEAR'S WORKING.**—The working of the Council's electricity undertaking for the year ended March 31st last, showed a gross revenue of £37,646, and expenditure amounting to £26,463, leaving a gross profit of £11,182. Loan and other charges amounted to £12,900, and the result was a deficit of £1,276, as compared with the previous year's deficit of £3,094. The output sold amounted to 4,829,979 units, or over 800,000 units in excess of 1914-15. The engineer estimates a surplus of £1,618 on the year ending March 31st next.

Wimbledon.—The chairman and vice-chairman of the Electricity Committee, with the town clerk and the borough electrical engineer, are to interview the L.G.B. respecting the Board's refusal to sanction loans for mains, house-services, meters, and transformers since March 31st, 1915. The question of increasing the price of electricity to ordinary consumers has been referred to the Standing Sub-Committee for consideration.

Worthing.—The T.C. has decided to have a Diesel engine at the electricity works fitted for the use of tar oil as well as petroleum residue. The cost is placed at £269.

TRAMWAY and RAILWAY NOTES.

Australia.—**NORTH SHORE RAILWAY ELECTRIFICATION.**—The Deputy Chief Commissioner of Railways in New South Wales, in replying to a deputation, foreshadowed an early start in connection with the electrification of the Bankstown and Milson's Point-Hornsby lines. The Commissioner considered that funds would be available shortly for a start to be made, and stated that the Railway Department desired that a fair mileage of line might be in operation electrically before the opening of the City Railway, so that it might serve as a training ground for the staff which would be required for operating the more complex system within the city.—*Sydney Daily Telegraph*.

VICTORIAN SUBURBAN RAILWAY ELECTRIFICATION.—Owing to the difficulty over the fulfilment of the electrification contracts, some of which are under negotiation for transference, and in view of the magnitude of the interests, the Government has authorised Mr. E. B. Jones, one of the Commissioners, to proceed to London to interview the Agent-General, Mr. Merz, and the contractors with a view to deciding on the course of action to be followed in the best interests of the State and of the electrification scheme. Any course of action recommended by Mr. Jones will be subject to the concurrence of the Government.

Bradford.—**ELECTRIC VEHICLES.**—The Corporation is applying for permission to borrow £3,700 for the purchase of three electric tipping wagons.

Continental.—**FRANCE.**—A new electric tramway line from Neuilly to Suresnes, *via* Puteaux, in the department of the Seine, has just secured official approval as a work of "public utility."

HOLLAND.—An American Consular report says that an electric railway is proposed from Amsterdam through the "Zaanstreek," a district traversed by the River Zaan. Fourteen towns will be joined by this new electric road. Its length and other particulars are not yet definitely settled.

Another new electric line is projected in the Provinces of Groningen and Drenthe, extending from the city of Groningen some 20 miles southward and touching several prosperous towns. As at present planned, the project will cost about £100,000. Both freight and passenger cars will be operated.

SWITZERLAND.—An electric railway lately opened at Lenkerbad, in Canton Valais, was begun in 1912. The line is 12½ km. in length, and is constructed on the rack system.

Halifax.—**LOAN SANCTION.**—The Tramways Committee has received a letter from the Treasury agreeing to the borrowing of £2,700 for extensions at the tramcar depot, Skircoat Road.

India.—Works are to be carried out on Chamundi Hill, Mysore, for a sanatorium. In this connection an electric tramway to the top of Chamundi is to be put in hand. The project is to be on similar lines to the Hong-Kong tramway, electrical power being used, so that before long this will be one of the most delightful attractions of Mysore City. It will represent a rapid climb of 1,000 ft. in roomy cars on the same principle as the line over the bluff at the Sivasamudram Falls.—*Indian Engineering*.

Iford.—**HALFPENNY FARES.**—The manager of the tramways undertaking has reported in favour of the abolition of the halfpenny fare; he points out that the receipts have not increased in proportion to the expenditure; the reserve fund is totally inadequate for future needs, and a loss is made on every halfpenny passenger carried. The manager is also of opinion that the undertaking has nothing to fear from the bus company continuing halfpenny fares; their schedule, the manager points out, will be ruined, and their long-distance passengers crowded out, therefore they will be bound to follow the Council's lead.

London.—**L.C.C. TRAMWAYS AND WAR SERVICE.**—The Highways Committee has reported on the services rendered by the Council's tramways in connection with the war; the redistribution of the services has been of the greatest assistance to the large numbers of workers engaged in certain industries of national importance. More than 11½ millions of passengers are being carried weekly by the Council's cars, the majority of whom use the tramcars in connection with the industry and commerce of London, and for travelling to factories in various parts of the area. In the Woolwich section in July, 1914, before the war, the maximum number of cars arriving at a certain point during the busiest half-hour was 41; this number has now been increased to 86, an addition of 110 per cent. The number of cars arriving at the same point each day before the war was 975, the number is now 1,595, an increase of over 63 per cent. During the busiest hour to-day accommodation is provided for 13,688 people, compared with 4,094 before the war, an increase of over 234 per cent. The accommodation provided by motor-omnibuses in this district, compared with that provided before the war, shows only a slight increase. To meet the present additional services the tramways sub-station at Woolwich has been enlarged, and additional cables installed; one section of the tramway track has been doubled, and at three additional points further doublings are in progress.

To-day 1,072 women conductors are employed on the Council's cars; the services of officers and employés have been lent to the Government for national work; substantial allowances have been made to the men enlisting involving a charge of over £168,700, which will be increased to over £260,000 by the end of the current financial year, if the war continues until March 31st, 1917.

The Highways Committee has recently received a report from its consulting engineers pointing out that to supply the new turbine plant it will be necessary to fit 10 boilers at the power station with larger grates. This will also enable a cheaper class of fuel to be used, and the Committee considers that an experimental installation should be made on four boilers immediately. The cost of the complete scheme is estimated at £5,000, which, it is expected, will be justified by the saving in cheaper fuel.

HALFPENNY FARES.—The Highways Committee has been in communication with the Leyton and West Ham Councils on the question of halfpenny fares, which these Councils wish to abolish. The Committee has agreed to negotiate on the matter, which affects through running arrangements.

The Highways Committee recommends that application be made to the B. of T. for an extension of the time allowed for the construction of tramways authorised, and which have not been commenced, the powers for which will expire in August, 1917.

WOOLWICH.—The L.C.C. is to be informed that the Council is prepared to re-open negotiations for the laying of a double line of tramway track between Beresford Square and Parry Place, Plumstead, provided the County Council agrees to carry out the necessary street widenings within one year of the conclusion of peace.

Middlesbrough.—**TRAMWAY PURCHASE INQUIRY.**—The General Purposes Committee of the Corporation has had under consideration the position with regard to the local tramway—the powers of the Imperial Tramways Co. expiring in 1918—and has appointed a Sub-Committee to go into the whole question, and report to the Council as to the advisability of giving the company six months' notice of its intention to acquire the undertaking.

Newcastle.—**WAGES.**—The Tramways Committee, last week, refused to grant its employés an advance of 2s. per week, on the ground that the change suggested would interfere with the arrangement ratified by the Committee on Production. The tramwaymen have accordingly decided to apply to the Committee on Production for an increase of wages of 5s. per week for all grades not catered for by skilled workmen's organisations, and also for women to be placed on the same wage basis as men.

North London Railway Electrification.—Further successful trial runs have been made over the recently electrified section of the North London Railway Co.'s system between Broad Street and Richmond; electric trains are to commence running on October 1st, and to save 15 minutes on the old time table.

Portsmouth.—**YEAR'S PROFIT.**—The Corporation tramway undertaking secured a net profit of over £21,000 during the year ended March last; £13,000 is to be given towards rate relief.

Wolverhampton.—**YEAR'S WORKING.**—The accounts of the tramway undertaking for the year ended March 31st last show a gross profit of £24,893. To this has been added the balance of £14,59 on the motor car-bus account, making a total of £26,353, which has been disposed of as follows:—Interest, £6,666; income-tax, £518; loans, £5,346; renewals account, £5,141; additions and improvements, £1,685; cost of repair work in 1916-17 (work suspended during 1915-16, amount carried forward), £2,477; in aid of borough rate, £1,018. The number of

passengers carried during the twelve months shows an increase of just over a million, although the number of miles run shows a falling off of 24,718.

Wallasey.—**WAGES.**—The proposed increases to the tramway drivers and conductors were confirmed at a meeting of the T.C., on July 27th, and an amendment that the women conductors should also share in the higher rates was defeated by a large majority.

TELEGRAPH and TELEPHONE NOTES.

Bolivia.—Radiotelegraphic communication has been experimentally established between Belem (Brazil) and Riberalta (Bolivia). *Journal Telegraphique.*

Canada.—Four new cables have been laid in the Bays of Passamaquoddy and Fundy, from Eastport (Maine) to the Canadian Isles of Deer, Grand Manan, and Campobello.—*T. and T. Age.*

German Wireless Communications.—Wireless traffic between the United States and Germany, which has been interrupted during the past month owing to atmospheric disturbances, has been reopened.

Russia.—In the Government's Budget for the current year, provision is made for the expenditure of a sum of 5,140,000 roubles on the erection and repair of telegraph lines, as against 4,116,000 roubles in 1915. Similarly, the provision for the erection and repair of telephone lines has been increased from 2,890,000 roubles to 3,325,000 roubles.

Telegraph Construction Bill.—The first clause of the Telegraph Bill recently introduced into the House of Commons gives the Postmaster-General increased power to erect poles on, and carry lines over, private property, and the London County Council, considering that its rights as an owner of property would be seriously prejudiced, has decided to oppose the passage of the Bill. The Bill passed its second reading on Wednesday.

Time Signals.—The United States Naval Observatory states that the difference in the time signal between the Isthmus of Panama and the Arlington station is about '02 second, and there is a lag of 0'27 second between the Isthmus and Key West, the latter being due to the various relays used in the commercial telegraph lines over which the signal comes from the Observatory. The error in the time signal sent from the radio stations is usually less than 0'1 second.—*T. and T. Age.*

Trans-Pacific Wireless.—With the satisfactory conclusion of the official tests between the high-power wireless stations at Funabashi, Japan, and Honolulu, the trans-Pacific scheme of wireless intercommunication is now complete. This service, stretching across some 6,300 miles of ocean, will be conducted between Funabashi and San Francisco, the station at Honolulu acting as a relay. The service between San Francisco and Honolulu has been in operation for some months. The Honolulu-Funabashi section, which has just received official approval, spans an interval hundreds of miles greater than the distance between Berlin and New York.

Wireless Direction-Finder.—According to the *Electrical World*, the U.S.A. Bureau of Standards has developed a simple apparatus for determining the direction of origin of wireless signals, of great sensitiveness, and less affected than ordinary apparatus by atmospheric conditions and by waves emanating from other stations. The device is used indoors and has no antenna, no earth connection, and no communication with the exterior. Besides its use on board ship for determining the direction of a lighthouse or lightship equipped with wireless apparatus, it is suitable for military purposes as a receiver, being perfectly portable, and can be used for determining the position of amateur wireless stations which fail to observe the regulations, and thus interfere with official messages.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—**SYDNEY.**—August 24th. P.M.G. Automatic switchboard and apparatus for North Sydney Exchange. Schedule No. 511.

September 20th. N.S.W. Government Railways. One 50-ton electrically-operated overhead travelling crane for Zara Street power house, Newcastle. October 11th. One motor-driven air compressor for Zara Street power house. Electrical Engineer, 61, Hunter Street.

PERTH.—October 4th. Deputy P.M.G. Telegraph and telephone measuring instruments and parts. Schedule 501 W.A.*

Barking.—August 15th. Electricity and Tramways Committee. Cables, switchgear, and transformers. See "Official Notices," July 28th.

Castlebar.—August 5th. U.D.C. Street lighting by electricity. — Cork to the corner.

France.—August 18th. The State Railway authorities in Paris require an electric transporter for locomotives at Valenciennes depot.

Glasgow.—The Clyde Navigation Trustees have decided to invite tenders for three 1-ton electric cranes and grabs.

London.—L.C.C. The Highways Committee recommends that tenders be invited for the provision of additional switchgear required in connection with the third new turbo-generator at the Greenwich generating station, and that the chairman and vice-chairman be severally authorised during the summer recess, 1916, to open any tenders that may be received for the work.

New Zealand.—**INVERCARRIGILL.**—September 28th. Borough Council. Steam turbo-alternator, condensing plant, and switchgear. Specifications from the Tramway Office. Contract No. 40.

DUNEDIN.—September 6th. City Council. Oil filtering and drying plant. Plans and particulars from City Electrical Engineer. *New Zealand Spectator and Commerce.*

Rochdale.—August 9th. Electricity Committee. Steam coal. Mr. C. C. Atchison, Engineer and Manager, Dane Street.

St. Asaph.—August 16th. Guardians of St. Asaph Union. Renewal of accumulators. See "Official Notices" to-day.

Spain.—August 29th. Municipal authorities of Porzuña (Province of Ciudad Real). Concession for the electric lighting of the town for 30 years.

September 1st. The Departamento de Fomento and the Mancomunidad de Catalunya, at the Palacio de la Generalidad, Barcelona. Establishment of interurban telephone lines between Granollers and Vich, and also between Igualada, Santa Coloma and Vallfogona.

Tenders are also about to be invited for the establishment of interurban telephone lines between Crida, Balaguer, Tremp and Sort, and between Manresa, Cardona and Solsona.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The following tenders have been accepted:—

P.M.G.'s Department, Queensland

One Gardner oil engine and generator; Phoenix dynamo, £237; power board, £145; 330 Chloride accumulators, 65 a.h. capacity, £415. — United Electric Light Co., Ltd.

P.M.G.'s Department, South Australia:—

Two motor-driven Wheatstone transmitters, £99 10s. India-Rubber, Gutta Percha & Telegraph Works Co., Ltd.
One common battery multiple switchboard. Western Electric Co. (Australia), Ltd., £5,449.

P.M.G.'s Department, West Australia:—

Twelve miles twisted pair O.S. distributing wire, £281. — Western Electric Co. (Australia), Ltd.

P.M.G.'s Department, Victoria:—

Four tons Wheatstone tape, £464. — Creed, Bille & Co., Ltd.

Victoria. State Coal Mine:—

Electric lamps, half-watt 6.6 amp., 10s. each. — Australian General Electric Co.

Metropolitan Board of Water Supply and Sewerage, Sydney:—

Electric motor for Prospect & Sherwood pumping plant, £340. — N. Guthridge, Ltd. — *Tenders.*

Barrow-in-Furness.—Accepted tenders:—

Switchgear. — Ferranti, Ltd., £185.

Sub-station switchgear. — British Thomson-Houston Co., Ltd., £470 and £239.

Rotary converter. — British Westinghouse Co., Ltd., £735.

Overhead crane. — Herbert Morris, Ltd., £68.

Sub-station at Walney Island. — Mr. J. Neal, £380.

Bolton.—Tramways Committee. Hadfields, Ltd., for points and crossings.

Bradford.—Tramways Committee. Messrs. Clay and Atkinson are to continue to supply phosphor bronze castings until December 31st next, at an increase of 4d. per lb. on the schedule price.

China.—According to the *North China Daily News*, Messrs. Anderson Meyer & Co., Ltd., have received an order to supply a complete lighting plant for Urga, the capital of Outer Mongolia. The engines are to be delivered by the British firm. Messrs. Reader & Co., while the boilers are to be supplied by Messrs. Babcock & Wilcox, of the United States, and the electrical equipment by the General Electric Co. of the United States.

Kendal.—Electricity Committee:—

Wigan Coal & Iron Co.—Twelve months' supply of not more than 150 tons of best Arley nuts, at 23s. 6d. and 21s. 6d. per ton according to the place of delivery; the rest to be John washed nuts, at 22s. 7d. and 23s. 7d. per ton.

London.—**FULHAM.**—The B.C. is recommended to accept the offer of Messrs. Cory Bros., to supply 2,500 tons of small Welsh Dylas coal, at 26s. 3d. per ton for the Electricity Department.

Manchester.—The following tenders for stores, &c., required by the Electricity Committee during the ensuing 12 months, have been accepted:

Asbestos sheeting. — B.I.F. United Asbestos Co., Ltd.
Rubber insulated cables. — W. T. Glover & Co., Ltd.
Paper insulated cables. — Western Electric Co., Ltd.
Earthware bridges. — Doulton & Co., Ltd.
Electrical accessories. — General Electric Co., Ltd.
Incandescent and radiator lamps. — British Thomson-Houston Co., Ltd.
Radiator lamps. — Dowling Radiant Heat Co., Ltd.
Cable protectors. — Doulton & Co., Ltd.
Tape. — L. Andrew & Co., Ltd.
Paper sleeve tape. — W. T. Glover & Co., Ltd.
Brass tape and iron tape. — W. T. Henley & Telegraph Works Co., Ltd.
Rubber strips. — Macintosh & Co., Ltd.
Service boxes. — Hardy & Radmore, Ltd.
Transformers. — British Electric Transformer Co., Ltd.
Frigoriferous boxes. — W. Luby & Co., Ltd.; British Insulated & Helsby Cables, Ltd.
Rubber-covered wire. — Liverpool Electric Cable Co., Ltd.
Flexible cables. — C. Macintosh & Co., Ltd.
Copper binding wire and fuse wire. — A. F. Goodwin & Co., Ltd.
Tin fuse wire. — British Insulated & Helsby Cables, Ltd.
Tubing and accessories. — Brotherton Tubes & Conduit, Ltd.
Recorder paper. — Elco Recording Press.
Stoker links. — Babcock & Wilcox (three months only).
Hessen cells. — A. H. Hunt.
Varnish. — Pinchin, Johnson & Co.
Nickel-iron wire and strip. — H. Wiggins & Co., Ltd.
Armature wire. — W. N. Brunton & Son.
Enamelled wire. — Connolly Bros., Ltd.
Box compound and tetric tape. — Callender's Cable Construction Co., Ltd.
Boiler tubes. — British Mannesmann Co., Ltd.
Cable troughing. — Coalbrookdale Co., Ltd.
Lion jointing and packing. — J. Walker & Co., Ltd.
Air-cooled transformers. — British Electric Transformer Co., Ltd.
Cable. — British Insulated & Helsby Cables, Ltd.; C. Macintosh & Co., Ltd.
250-kv. and 500-kv. transformers. — Ferranti, Ltd.
Five 1,000-kv. transformers. — Ferranti, Ltd.
Coal unloading plant. — Hydraulic Engineering Co., Chester, with licence to Dick sublet turntable to Dick, Kerr & Co., Ltd.
Valves. — J. Hopkinson & Co., Ltd.
Low-pressure circulating water pipes. — Aiton & Co., Ltd.

Oswestry.—For electrical installation at the new Arcade Theatre. — W. H. Kay. Blackpool (accepted).

Salford.—The following tenders have been accepted by the Electricity Committee for the supply of materials during the period ending March 31st, next:

J. Heaton.—2000 tons of Tydesley slack.
Le Carbone.—Motor carbon brushes, £100.
Reason Manufacturing Co., Ltd.—Maximum demand indicators, £40.
L. Andrew & Co.—Cable accessories, £76.
Dussek Bitumen Co.—Joint box compound, £16.
North British Rubber Co.—Rubber overshoes and rubber caps for cables.
Baxendale & Co., Ltd.—Steam tubes and fittings.
Job Holland & Co.—Engine oil, £36.
J. Cookson, Ltd.—Waste, sponge cloths, &c., £90.

The offer of the British Westinghouse Co. to supply a 1,000-KW. rotary converter and transformer, has also been accepted.

The Tramways Committee has accepted the tender of Messrs. J. Russell and Sons, Ltd., for 40 tramway poles, at £12 17s. 2d. per pole.

Wolverhampton.—Electricity Committee:—

H. Morris, Ltd.—Forty-ton travelling crane, £1,450.

J. E. Perry & Son.—Steel chimneys at the electricity works, £540.

FORTHCOMING EVENTS.

North of England Institute of Mining and Mechanical Engineers.—Saturday, August 5th. At 2 p.m. At the Wood Memorial Hall, Newcastle-on-Tyne. Annual general meeting.

NOTES.

Electrolytic Iron.—In a paper read before the AMERICAN ELECTROCHEMICAL SOCIETY, Mr. O. W. Storey states that electrolytic iron, when deposited by the usual methods, is brittle, due to the hydrogen present. In this form it can be easily broken into small pieces, and even ground into a powder. By heating the iron to a red heat the hydrogen is driven off, and the iron becomes ductile, the ductility increasing with the temperature of annealing.

Brittle electrolytic iron, as deposited, is highly soluble in acids, being much more readily soluble than zinc. Annealing the iron makes it become more resistant to acid attack than ordinary irons and steels. This property of the brittle iron has resulted in the suggestion that it can be used for the manufacture of hydrogen by acid attack, in place of zinc, and other forms of iron.

The brittleness of the iron and its purity make it an ideal material for melting in crucibles, the hydrogen content having the additional virtue of forming a reducing atmosphere. The brittleness also allows it to be readily broken into small pieces for introduction into the crucible.

The high purity of the iron makes it possible for it to be used in competition with Swedish iron, and at approximately the same cost. It may also be used for pharmaceutical purposes as a base for compounds of which iron is a constituent. Here again its purity is of value.

The much-suggested use of electro-deposited iron for electromagnetic purposes appears to be becoming of commercial importance. While the magnetic qualities of electrolytic iron seem to be superior to those of the commercial silicon irons, its high electrical conductivity counteracts this favourable property.

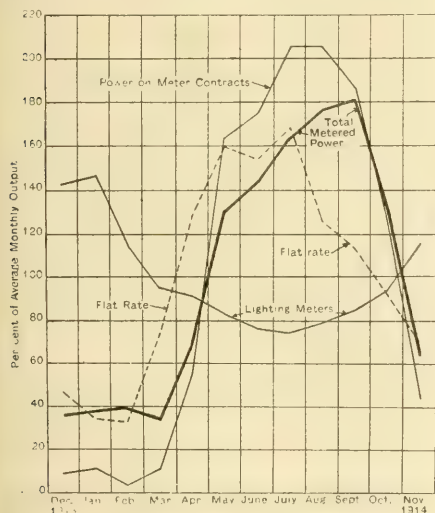
Electrolytic iron is used as a basis for scientific experimental work on the various properties of iron where the purest available iron is needed to secure the most accurate data. It is also used as a basis for "pure iron" alloys.

The materials that have been produced, and which seem to give the most promise for direct production without further mechanical working, are sheets and tubes. By producing these directly by deposition in such a manner as not to require further operations, it would be possible to make thin sheets and tubes of great uniformity. In tubes having thin walls, made by mechanical processes, these often vary in thickness, and it is hoped that this defect will be overcome by making them electrolytically.

The cost of producing electrolytic iron on a large scale, according to Mr. C. F. Burgess, the plant being of 1,000-KW. capacity, with an output of 8,640 tons per year of 360 days, would be about \$10 per ton of refined iron. This is believed to be a liberal estimate. The operating costs, however, do not include interest on investment.

The cost of raw material is taken at \$20 per ton, thus making the cost of the electrolytic iron approximately \$30.

Electricity in Agriculture (California Data).—A recent issue of the *Journal of Electricity, Power and Gas* recorded some data regarding the agricultural use of power, supplied by the Mt. Whitney Power and Electric Co., California. This shows that of a total of 2,505 motors of 17,500 H.P., some 1,666 motors of 14,316 H.P. were used for agricultural purposes, and in view of the fact that the domestic use was largely on farms, and that the industrial use was mainly for packing and canning factories, over 90 per cent. of the load was directly connected with agriculture. A total area of 67,481 acres was irrigated by pumps. In 1914, 54 per cent. of the load was supplied under a flat rate of \$50 per H.P. per year; 18 per cent. on a meter rent with a minimum of \$24 per H.P.



AGRICULTURAL LOAD CURVES.

per year, and 14½ per cent. on a meter rate with a minimum monthly charge of \$1 per H.P. of installed capacity.

Farmers usually install as small a plant as possible for continuous operation, in order to reduce the bill, which depends on the maximum rate of use; the ratio of the average demand to the rated capacity of pumping motors is 94.3 per cent., and the average consumption per H.P. installed is 3,595 KW.-hrs. per year, representing a price of 1.39 cents per KW.-hr. to the farmer. It may be noted that in the cases of Citrus and Alfalfa, from four to six acres per H.P. were irrigated, and the average farm bill per year was \$340 to \$530.

The flat (or fixed) rate charge secures the company's revenue in bad years. There is an average of two consumers per mile of distribution line, which line costs the company \$500 per consumer. Not more than one mile of extension is made to secure a 7½-H.P. motor, and this rule has resulted in a service density of 13 H.P. per mile of primary distribution line.

Thin-Plate Batteries for Reserve Service.—With the advent of large generators and boilers, the capacity of which can be greatly increased by forced draught, the necessity for battery discharge on the peak loads has diminished, so that now storage batteries are usually employed only for emergency reserve. At the present time the use of the long-lived and comparatively small-capacity batteries formerly employed has been discontinued, and a shorter-lived and higher-capacity type has been adopted by the New York Edison Co. The first experimental battery of this type was installed in the Thirty-ninth Street station in 1908.

It was decided to adopt 14/64 in. and 12/64 in. as the standard thicknesses for emergency-service positive plates and negative plates respectively. The capacity of the 14/64 in. positive plate, which is 15 in. wide and 31 in. long, is 150 amp. for one hour.

By adopting these plate thicknesses for central-station service a distinct gain is made in the amount of battery capacity that can be installed in a given space, since at the emergency rate of discharge, the capacity obtainable with a pasted-plate battery is as much as three times as great as from a Manchester-Box type battery occupying the same space. Another advantage accruing from the adoption of the pasted-plate battery is that interruption of electric service is made a more remote possibility.

The batteries installed on the New York Edison Co.'s system will carry the yearly peak load of the direct-current system for about seven minutes, which would ordinarily be long enough to correct any trouble which might happen to all the generating stations. As the yearly peak load exists for only a few hours, the ratio of battery capacity to load is much larger than stated during the greater part of the year.

The regulating or end-cell switches are located in a separate room immediately in front of the battery room, copper bars being run from the end cells to contacts on the switches. Four end-cell switches are provided with each battery, two for each side of the three-wire system, so that if one switch should fail to operate, the battery would not be disabled. The two switches on each polarity are normally operated in parallel.

A booster set is used in conjunction with each battery for charging purposes; each booster is connected in series with the station bus to produce a voltage high enough to charge the battery. Extending over all the cells is a special bus to which leads may be clamped for charging the individual cells. Whenever the battery is being charged, ventilating apparatus is employed to change all the air in the battery room once every ten minutes. The apparatus consists of a motor-driven exhaust fan and acid eliminator. The acid eliminator neutralises the acid fumes before discharging them into the atmosphere.

CAPACITY OF BATTERIES EMPLOYED BY NEW YORK EDISON CO. TO ENSURE RELIABLE SERVICE.

Total ampere-hours	373,800
Batteries in service at present {	
Waterside No 1 and No 2	4
Sub-stations	44
Total	48
Total ampere rating of sub-station batteries for one hour	357,800
seven min.	1,311,200

The practice of holding all batteries in reserve for emergencies is universal throughout the system. With the exception of weekly charges and test discharges which are made at intervals of three months on each battery, all batteries float on the system continuously in readiness to take any load that may be thrown upon them. Incidentally, the batteries regulate the voltage and assist the balancer to furnish some of the unbalanced current in the three-wire system, especially at times of short-circuits on one side of the system. The weekly charging and test discharging are performed from 12 o'clock midnight to 8 a.m., when the load is lightest, or at a time when the battery to be charged or tested may be taken off the system without lessening the protection to the consumer.

The weekly charging of each battery is of about one hour's duration, and is for the purpose of determining the state of charge of the battery generally and giving the inspector opportunity for examining each cell for trouble, such as a low condition of charge due to internal or external short-circuits.—Philip Torchio, in the *Electrical World* (abstract).

Iron and Zinc in German Electrical Work.—A little light on the cost of the metals used in Germany in substitution for copper was recently shed by W. Weehmann in the course of a paper read before the Association of German Mechanical Engineers. As is well known, the electrical engineers in that country have had recourse to iron and zinc, owing to the comparative scarcity of copper for industrial purposes, and rules for the use of these metals were approved some time ago by the Union of Electrical Engineers, as previously mentioned in this journal. The author of the paper in question points out that in consequence of the greater cross section of the iron which is needed, the cost of an iron conductor is 20 per cent. greater than that of a copper conductor in order to obtain the same conductance for short distances, whilst in the case of long distances, where the cross section is so thick that the iron conductor has to be made in the form of a stranded cable, the difference in the price is much greater. This comparison relates not to existing conditions, but to the normal prices which prevail in peace periods. Special precautions have to be taken to prevent the rusting of the conductors, and soldering of the wire has strictly to be avoided, joints and branches being effected by means of clamps. In the case of zinc conductors, particular measures have had to be adopted in the rolling and drawing of the wires, the jointing of which has also to be carried out with clamps instead of with solder; but the wires cannot be used in exposed positions—that is, in the open air. As compared with prices in times of peace, the cost of zinc conductors is stated to be about equal to that of copper conductors of the same cross section. But as the conductivity of zinc is about 30 per cent. of that of copper, the zinc conductors are considerably dearer.

The question of electrical machinery was also discussed by the author, who remarked that zinc conductors could be utilised in machinery, especially in magnet coils. Motors which have a zinc winding, however, have an efficiency of only 60 to 70 per cent. of that of machines having copper coils, although it is claimed that the output of the latter can be reached by increasing the speed of the zinc coil machine by 10 per cent. Transformers have a yield from 50 to 60 per cent. of that of transformers provided with copper coils. From the rules laid down by the

Union it would appear that machines up to a fairly large size can be made with the windings. A further matter in connection with the comparative scarcity of copper is the fact that machines which were constructed some 15 or 20 years ago contained substantially more copper than those which were being built immediately before the war. The recognition of this circumstance has led to the idea of substituting new machines for old, with the object of recovering a large quantity of the copper. One large firm, for instance, is reported to have obtained 6 to 7 tons of copper in this way from the dismantling of 66 transformers which were constructed 15 years ago; and a large quantity of copper can also be derived from switchboard installations. Not only so, but the reorganisation of a complete installation is capable of yielding copper, as has been shown by the conversion of that at the Lehigh railway station from the two-wire 100-volt direct-current system to the three-wire three-phase system.

The problem whether the use of the present metal substitutes will be continued after the conclusion of the war has already been answered by the comparisons of cost previously given, which are wholly in favour of copper. At the same time, it is considered that iron and zinc will remain in use for high-pressure branch conductors which carry a light load, while the question whether zinc would offer advantages for the manufacture of cables for very high pressures has yet to be investigated, similarly to the inquiry which formerly led to the use of aluminium for this purpose.

Inquiry.—The electrical engineer of Fleetwood, Mr. W. H. Miller, would like to hear from other station engineers of a good serviceable lock for slot meters. The address of the maker of the "Tourtel" lock would also be useful.

Institution and Lecture Notes.—**The Institution of Electrical Engineers.**—A conference has taken place between the Electricity Supply Committee of the I.E.E. and the Joint Committee of the I.M.E.A. and the Incorporated Association of Electric Power Companies, with regard to co-operation between the Committees. These Committees are constituted as follows:—

I.E.E. Committee:

R. A. Chattock (Chairman).	G. W. Partridge.
C. P. Sparks (President I.E.E.).	T. Roles.
C. H. Merz.	S. L. Pearce.
	W. B. Woodhouse.

Joint Committee of the I.M.E.A. and I.A.E.P.C.

I.M.E.A.	I.A.E.P.C.
J. H. Bowden.	W. A. Chamen (Chairman).
R. A. Chattock.	J. S. Highfield.
W. W. Lackie.	C. H. Merz.
S. L. Pearce.	D. A. Starr.
H. Faraday Proctor	A. D. Turckheim
(<i>ex officio</i>).	(<i>ex officio</i>).
T. Roles.	W. B. Woodhouse.

In order to avoid overlapping and to ensure co-operation and co-ordination, two members common to both Committees have been delegated as intermediaries, so that the two committees will be in continuous touch with each other's work.

It has been agreed that the I.E.E. Committee will devote its attention to the question of Electricity Supply from the point of view of the requirements of the country as a whole, and will deal with the engineering aspect of the matter, while the Joint Committee will go into more immediate questions of organisation and linking-up of existing undertakings, &c.

It will be seen from the above that the work of both Committees is of national importance.

Natal Engineers' Association.—Mr. John Roberts, the first chairman of the Engineering Section of the Natal Society for the Advancement of Science and Art, in his inaugural address dealt with "The Engineer in his Relation to Business," and referring to the saying that a man might be a good engineer, but was no business man, said that an engineer without "business" capacity was an engineer in name only, and could never achieve success. The business man was generally in control, and would claim that he was called upon to exercise powers of organisation; but that was the very first essential of the engineer—organisation was the indispensable factor to success in his work. The lay-out of the plant, the processes of manufacture, &c., all required organisation. The reason why the engineer occupied a position of inferiority was because he was the lineal descendant of the artisan, but he must struggle to secure control as well as responsibility.

Canadian Electrical Association.—The annual meeting of the Canadian Electrical Association was held on the steamship *Toronto* Canada Steamship Lines, on June 21st and 22nd, and was very well attended. The arrangement made permitted the Western members to take the boat to Toronto, and proceed thence to Prescott, where they were joined by representatives of the Eastern part of the country. In the absence of Col. D. R. Street, the president, who had just left on active service, the chair was taken by D. H. McDougall, vice-president, who was elected president for the ensuing year.—*Electrical World*.

Physical Society of London.—At the meeting held on June 30th, a paper, entitled "A Sensitive Magnetometer," by Dr. P. E. Shaw and Mr. C. Hayes, was read by the former. A torsion balance of extreme delicacy carries a pair of pure silver balls, each of 3 gm. weight. A solenoid with its horizontal axis passing through one of the silver balls is brought close to the balance. On exciting the solenoid, divergent fields of known strengths are obtained in the region of the ball. The resulting attraction of the ball to the solenoid is shown by a mirror reflecting a distant scale to a telescope. The couple on the torsion beam required to produce 1 mm. scale deflection is 4.5×10^{-7} dyne-cm., and this torsion

balance is 10^6 times as sensitive as any known to have been used previously in this kind of work.

The magnetic properties of the silver have been ascertained even for weak fields of 1—10 gauss. The silver has a pronounced retentivity; this effect is presumably due to the small trace of iron impurity.

The relation of the susceptibility of silver to the field used has also been found. The susceptibility of each of the constituent materials (a) pure silver, (b) residual pure iron, appears to be greatly modified by the presence of the other material.

"Some Experiments on the Thermoelectric Properties of Fused Metals" were shown by Mr. Chas. R. Darling. The experiments related to observations made during the progress of a research, having for its object the production of a thermoelectric pyrometer with a liquid element. If such a pyrometer could be made of suitable materials—such as graphite and molten copper—it might be possible to extend the useful range of base-metal pyrometers up to or beyond the melting point of platinum, as the boiling point of copper is $2,310^\circ\text{C}$.

It was noted that when tin was partnered by iron, nickel, copper, constantan, or graphite, no abrupt change occurred at fusion, the E.M.F.-temperature curves showing no break.

On substituting lead, zinc, and bismuth in turn for tin, and using a variety of wires, it was again found that the change of state caused no alteration in thermoelectric properties. In the case of bismuth, however, three instances of thermoelectric "halt" were noticed, the E.M.F. attaining a maximum and then remaining unchanged over a considerable range of temperature. An iron-bismuth couple reaches a maximum of about 18 millivolts at about 250°C . (M. Pt. of Bi = 269°), which remains constant to within 3 per cent. up to 550° , beyond which it has not been investigated. Copper and bismuth behave in the same manner, the E.M.F. being practically the same as in the former case; whilst aluminium and bismuth furnish a third example, the E.M.F. (about 15 millivolts) being remarkably constant over a range of 300° . This steady E.M.F. might also be used in work for which a constant, low E.M.F. was required.

American Institute of Electrical Engineers.—The annual convention of the Institute was held at Cleveland, Ohio, at the end of June. The President, Mr. J. J. Carty, read an address on "The Relation of Pure Science to Industrial Research." He showed that out of the stupendous upheaval of the European War, with its startling agencies of destruction, arose a growing appreciation of the importance of industrial research, not only as an aid to military defence, but as an essential factor in the development of every industry in time of peace. While many concerns in America had well-organised industrial research laboratories, particularly those engaged in metallurgy, and dependent upon chemical processes, the manufacturers of the country, as a whole, had not yet learned of the benefits of industrial research, and how to avail themselves of it. He considered it the high duty of the Institute to impress upon the manufacturers of the United States the wonderful possibilities of economies in their processes and improvements in their products, which were opened up by the discoveries of science, through the medium of industrial research conducted in accordance with scientific principles.

"Once it is made clear to our manufacturers that industrial research pays, they will be sure to call to their aid men of scientific training to investigate their technical problems, and to improve their processes. Those who are first to avail themselves of the benefits of industrial research will obtain such a great lead over their competitors that we are warranted in looking forward to the time when the advantages of industrial research will be recognised by all."

In distinguishing between industrial research and purely scientific research, President Carty likened the investigator in pure science to the explorer of new lands, and the investigator in industrial research to the pioneer who surveys the newly-discovered territory to locate its resources, and in other ways prepares for the peaceful and profitable occupation of the new territory.

"Industrial research supports itself or it fails of its purpose, and, therefore, it will not lack for generous encouragement and support. Scientific research, on the other hand, must have encouragement and financial support."

Mr. C. le Maistre, general secretary of the International Electro-technical Commission, read a brief paper, in which he outlined the development of engineering standards in Great Britain, and showed how order and system are essential to modern production.—*Electrical World*.

We are informed that the SOCIETY OF ENGINEERS is experiencing considerable difficulty this year in arranging its usual visits to engineering works during the summer. Recently, however, Messrs. Johnson & Phillips were able to show the members a portion of their works at Charlton including a large plant for the manufacture of telephone cables capable of dealing with cables up to 1,000 pairs of small wires for local lines, and also trunk cables consisting of fewer, but heavier wires.

Enemy Firms Winding Up.—The issue of the *Board of Trade Journal* for August 3rd contains a consolidated list of enemy firms which have been ordered by the Board of Trade to be wound up. The list comprises the names of 279 firms, and is complete up to the Orders issued on July 31st. The date of the Order, and the name and address of the Controller appointed in each instance, are also included in the list, to which an alphabetical index is appended.

Patents and Alien Enemies.—The Board of Trade has granted licences to Messrs. Watson & Sons (Electromedical), Ltd., in respect of Patents Nos. 9499/12 and 13903/13, granted to Siemens and Halske A.-G.

Fatality.—The *Daily Chronicle* says that, through falling down a lift shaft at 22 Golden Square, London, an electrician named Galpin lost his life.

The Metric System.—At a meeting of the National Federation of Building Trades Employers at Brighton, last week, reported in the *Contract Journal*, the following resolution was proposed on behalf of the London Master Builders' Association:—"That this meeting considers that the present is an opportune time to revise our system of money, weights and measures, so as to bring them into harmony with the metrical system prevailing among the rest of the Allied nations, in order to facilitate trade relations between them and us after the war, and requests the Administrative Committee to make representations on behalf of the Federation to the Government accordingly, co-operating, if practicable, with other bodies which are moving in this direction." Several speakers urged that the adoption of the system would greatly tend to simplify quantities, and it was pointed out that the building trade had a system of measurements which was practically unknown in the schools of the country. The resolution was carried.

Educational Notes.—THE SOUTH-WESTERN POLYTECHNIC (Manresa Road, Chelsea) will re-open on September 25th, for day and evening classes. The Engineering courses include lectures in electrical and mechanical engineering, physics, chemistry, and mathematics, and practical instruction in the laboratories. Students are prepared by recognised teachers of the University of London for the B.Sc. degree in Engineering, for the examinations at the engineering institutions, and those of the City and Guilds of London Institute. The evening courses also include classes in electrical wiring and other trade subjects. In the Electric Wiring Department an advanced course has been arranged for the preparation of candidates for the Final Wrenem's Examination of the City and Guilds of London Institute. Arrangements have been made for placing students who have passed satisfactorily through the three years' day course in positions with large engineering firms, and hitherto such firms have offered more vacancies than the Institute has been able to fill with its students. The prospectus may be obtained on application to the Secretary.

NORTHAMPTON POLYTECHNIC INSTITUTE. Particulars of the Engineering day classes and courses in Technical Optics for the next session appear in our "Official Notices" to-day.

Parliamentary.—ELECTRICITY SUPPLY INTERCONNECTION SCHEMES.—In the House of Commons, Mr. Healy asked the Secretary of the Board of Trade whether a circular had been issued by his department urging an arrangement to merge electrical supplies, with a view to saving coal; had he considered that new cables and other expense might be necessary to enable such plans to be carried out, involving capital expenditure; and would enabling legislation be introduced to render possible the desirable economies which the Board of Trade wished to effect in cases where statutory authority would be required? Mr. Harcourt replied that the answer to the first two questions was in the affirmative. In issuing the circular, the Board of Trade had not in mind any large schemes of interconnection involving heavy capital expenditure and a large use of material, but rather contemplated arrangements between undertakers whose areas of supply adjoined, or nearly so. He did not think that legislation for the purpose was necessary, but should the necessity for it appear to arise, he would give the matter full consideration.

Engineering Research on the North-East Coast.—The North-East Coast Institution of Engineers and Shipbuilders recently appointed a Research Committee, which has already made a start with its work by acceding to the request of a well-known firm in the North to carry out exhaustive tests of apparatus having for its object the more economical production of power by marine steam engines. The Institution claims to be the first of its kind actively to promote the progress of the industries with which its members are associated, by officially making and recording tests of new apparatus developed by them. Such work has been repeatedly called for of late, notably by the Council for Organising British Engineering Industry, and by the Scientific and Industrial Research Committee appointed by the Government, and we congratulate the North-East Coast Institution on its decision, which will certainly prove of great assistance in achieving the desired end.

Lifting-Magnets for Loading Pig-Iron.—In the *Electrical Review* and *Western Electrician* some particulars are given of the use of electromagnets for handling pig-iron on the American lakes. The freighter *Cicva*, the first ship to carry its own equipment of magnets, can load up with a cargo of 4,000,000 lb. of pig-iron, at a cost of £20, as compared with £100 to £120 for manual labour. Three 36-in. Cutler-Hammer circular magnets are provided, each controlled by one man, with one attendant for the generator. The three magnets, working simultaneously, lift 4,500 lb. of pig-iron.

Engineering Standards Committee.—At a special meeting of the Main Committee (Sir John Wolfe Barry, K.C.B., chairman), held on July 27th last, Mr. Charles le Maistre, A.M.Inst.C.E., M.Inst.E.E., who has been in charge of the work of the Electrical Section since 1903, was appointed secretary to the Committee in succession to the late Mr. Leslie S. Robertson, M.Inst.C.E., who was lost with Lord Kitchener in the disaster to H.M.S. *Hampshire* whilst on an important Government mission. We congratulate Mr. le Maistre on his appointment, which, we are sure, will be regarded with approval by all who are interested in the work of the Committee.

Volunteer Notes.—1ST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place. Orders for August by Lieut.-Col. C. B. Clay, V.D., Commanding.

The Headquarters will be closed during August except on Tuesday evenings. The range will be open on Thursday evenings only. Instruction Classes at Regency Street will be held as usual for Platoons Nos. 9 and 10. The Camp at Otford will be available until August 31st. Members wishing to attend should enter their names at Headquarters.

Sunday Entrenching Parades. Parade in Uniform at Victoria Station (S.E. and C. Railway) Booking Office, 8.45 a.m.

MACLEOD YEARSEY, Adjutant.

3RD BATT. (OLD BOYS) CENTRAL LONDON VOLUNTEER REGIMENT.—Battalion Orders by Capt. W. Ridd (Sub-Commandant), Thursday, August 3rd, 1916:—

Week-End Parades.—Saturday.—The Battalion will Parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 8.40 a.m., for entrenching duties. Those who cannot take the early train will parade at 1.20 p.m.

Sunday.—The Battalion will Parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 9.30 a.m., for entrenching duties.

Marking.—The *Holland Cup Competition*.—This competition was closed on Sunday, July 30th. The following is the result:—

1st Prize	G. S. Burge	... 93	T. R. Renfree	... 90
2nd	S. T. Hammer	... 92	A. G. Howell	... 88
	H. Locke	... 91	F. W. Vincent	... 88
Highest score possible -100 points.				
Range -200 yards.				
Target—Figure class marking.				

There will be no shooting at Bisley on Saturday and Sunday next 5th and 6th inst.

Recruits will Parade at Lord's Cricket Ground on Saturday at 3 p.m., and on Sunday at 11 a.m., for recruit drill.

Wembley Park.—There will be no week-end parade at Wembley Park.

CLARENCE T. COGGIN, Acting Adjutant.

Appointments Vacant.—A technical assistant is required for the sub-station of a large supply undertaking: fitter for power station in the West Riding; junior shift engineer for Erith; shift engineer for a West of England municipal works; charge engineer for the Llandilo U.D.C.; man for X-ray work and male nursing (£2) for the Royal Berkshire Hospital, Reading; station superintendent for Barking Town U.D.C. Electricity Department. See our advertisement pages to-day.

Manchester Corporation Tube Contracts.—The chairman of the Manchester Corporation Electricity Committee, on Wednesday, mentioned to the City Council an awkward dilemma in which the Committee are placed. Their minutes contained a recommendation that a tender for the supply of boiler tubes should be accepted from a certain firm, 99 per cent. of whose capital, the chairman said, was German. The difficulty was that the firm in question were the only manufacturers of these tubes, which were essential to the carrying on of the electricity department. The Committee, therefore, asked the Council to say what was to be done in the matter. The English works of the company were a controlled establishment under the Munitions of War Act. Alderman Kay, chairman of the Gas Committee, said the gas department were in exactly the same difficulty, all due to the lack of backbone of the Government in not taking the works over lock, stock and barrel. The Council, in the exceptional circumstances, suspended the Standing Orders, which would have prevented the acceptance of the tender, and agreed to accept it.—*Morning Post*.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—Mr. S. H. FOWLES, chief assistant electrical engineer to the Aylesbury U.D.C., has been appointed resident electrical engineer to the Leek Urban District Council, on the advice of Prof. Watkinson, of Liverpool University.

The Wimbeldon Borough Council is recommended to make the following payments in respect of special services rendered in connection with the laying of mains and services and wiring installations, viz., to Mr. H. TOMLINSON LEE, borough electrical engineer, £75; to the assistant electrical engineer, Mr. W. J. OSWALD, £15; and £20 to Mr. B. A. LARNEY, clerk to the borough electrical engineer.

The Wolverhampton Corporation is recommended to grant increases in salaries to the following employees in the Electricity Department: Mr. E. STUBBS, chief assistant, from £225 to £250 a year; Mr. E. FORDER, engine-room superintendent, and Mr. C. BELLHOUSE, boiler-house superintendent, both from £165 to £180; Mr. J. H. ROTHWELL, chief clerk, from £185 to £200.

The salary of Mr. F. SCHOFIELD, commercial manager to the Stalybridge, Hyde, Mossley and Dukinfield Joint Tramways and Electricity Board, is to be increased to £400 per annum, with two further annual increments of £25 to £450. Mr. Jagger, accountant to the Board, has resigned on receiving another appointment.

In answer to an inquiry from the Ministry of Munitions, asking whether Mr. J. W. FOSTER, permanent-way engineer to the Bradford Tramways Committee, could be spared to take up a post under the Ministry of Munitions, the Committee replied that it was essential that Mr. Foster should be retained in his present employment.

General.—The *Bulletin Militaire* states that Signor MARCONI has been promoted from lieutenant to captain for exceptional services.—*Times*.

A young electrician, named HENRY HOWELL, dived into the Thames between Westminster and Charing Cross on July 27th and rescued two drowning children.

Mr. GEORGE VERITY, chairman of Verity & Co., Ltd., was married on Wednesday, at the Brompton Oratory, to Ada Hamilton Walter, of Hyde Park Gate, S.W. Congratulations!

Roll of Honour.—Lieutenant A. E. HEAD, of the Northumberland Fusiliers, who added to their fame in storming the German trenches on July 1st, has been "reported missing, believed killed." The deceased officer was 23 years of age. He served as a private in a Territorial battalion of the Northumberland Fusiliers, and subsequently was appointed to commissioned rank in a Tyneside Scottish battalion, in which he early got his second star for proficiency in scientific examinations relating to telephony, signalling and bombing, and at the front was given command of the Brigade Bombing school. He was the son of Mr. W. J. Head, manager of the India-Rubber and Gutta-Percha and Telegraph Works Co., at Newcastle.

The *Times* states that Lieutenant THOMAS CHALLONER, R.E., who died of wounds on July 25th, a short time ago did most excellent work, for which he was awarded the Military Cross. He was a highly popular officer, and was well-known in Cardiff as an electrical engineer.

Signaller JAMES OLIVER, of the Manchester Regiment, an employé of Messrs. W. T. Glover and Co., Ltd., cable manufacturers, Trafford Park, has been killed in action, aged 28 years.

Captain R. C. MATHER, of the Manchester "Pals," who is connected with the firm of Messrs. Mather and Platt, Ltd., has been wounded and is in hospital in London.

Private HARRY WALDRON, who has died of wounds, and Signaller ALEXANDER SMITH, killed in action, were serving in the Manchester "Pals," and prior to the war were both employed by Messrs. Baxendale and Co., Ltd.

Private J. BRADSHAW, reported missing, was an employé at the British Westinghouse works, Trafford Park, as was also Private H. D. STRACHAN, reported wounded and missing.

Private F. RICHARDS, of the Border Regiment, who was employed at the cable works of Messrs. Rickard, of Derby, has been missing since July 1st.

Private A. L. CASTLE, of the Birmingham City Battalion, Royal Warwickshire Regiment, who was engaged as an electrical engineer at Hetchford, fell in action on July 21st.

Signaller W. H. HARRIS, of the West Yorkshire Regiment, who was on the York Corporation Tramway staff, has been killed in the advance in France.

Lieutenant WALTER KELL, late of the Barnsley Corporation Electricity Department, has been seriously wounded in France, and has lost a leg.

Sergeant ALBERT HOLLINS, of the Somerset Light Infantry, who was with Messrs. Siemens, of Stafford, has been killed in action. He was in the battle of Loos, gaining promotion there for gallantry.

Private W. PEMBLE, of the 8th Leicestershire Royal Engineers, an electrical engineer, has been wounded in action at Bezanine le Petit, and is in hospital at Liverpool.

Private HARRY LANCASTER, of the 6th Battalion, Northumberland Fusiliers, who has died of wounds received in action in France, was an electrician, aged 27. When war broke out he held an appointment at Gibraltar. He returned to England and joined his regiment over a year ago.

Private H. ROBINSON, of the Scots Guards, who has died of wounds received in action in France, was on the Preston Corporation tramway staff.

Rifleman ERNEST SCOTTON, of the Rifle Brigade, who has fallen in action in France, was, prior to the war, engaged in the production department at the Rugby works of the British Thomson-Houston Co., Ltd.

Trumpeter F. W. HYMERS, Royal Field Artillery, who has died from disease in India whilst on active service, was before the war engaged with Mr. Edmund Dunn, electrical engineer, of Broadstairs and Ramsgate.

Private EDWARD COMAR, formerly employed at the British Westinghouse Works, Trafford Park, has been killed while serving with the Cheshire Regiment.

Private HAROLD TOPHAM, formerly employed at the Middleton electricity works, has been killed in action.

Private SYDNEY CRAWSHAW, of the Royal Scots, killed in action, aged 20, was formerly employed on the clerical staff of the manager of the Oldham Corporation Tramways.

Lance-Corporal ROBERT LYON, Royal Scots, who is wounded, was employed as an electrician in Edinburgh.

The *Times* records the death, on July 30th, at the age of 23, from wounds, of Second-Lieutenant KENNETH RICHMOND COOK, Black Watch, eldest son of Mr. David Cook, M.Inst.C.E., of Richmond and Westminster.

Corporal GEORGE BANKS, of the King's Own Shropshire Light Infantry, who has been wounded in action, was employed at Darwen Electricity Works.

Private CHARLES PAPE, of the Bradford "Pals," killed in the advance on July 1st, was an employé at the Bradford tramway headquarters.

Private W. C. NINNESS, of the King's Liverpool Regiment, wounded and now in hospital at Devonport, was employed before the war by Messrs. Drake and Gorham, at Manchester.

Sergeant JOHN W. ADAMS, 2nd Border Regiment, employed by Messrs. F. Thornton and Co., electricians, of Burnley, has been recommended for the D.C.M.

Lance-Corporal H. MEECH, of the King's Own Royal Lancaster Regiment, an employé of the Lancashire Dynamo and Motor Co., Trafford Park, has been wounded in France.

Sergeant HARRY BRANSTON, of the Manchester "Pals," formerly employed by Messrs. Baxendale and Co., Ltd., has been killed, along with his brother, Private W. BRANSTON.

Captain CHARLES SKAIFE WOLSTENHOLME, of the Durham Light Infantry, who was killed on July 17th, was the assistant superintendent engineer at the Leeds Post Office Telephone Department. He was 43 years of age, and had had a long connection with the Territorial Force before the war.

A large number of our readers, particularly those in the London district, will learn, as we do, with very deep regret, that Company Sergeant-Major E. C. LAUGHTON, who for nine years was associated with the Lamp and Fittings Department of Messrs. Siemens Bros. Dynamo Works, Ltd., has been killed in action. He joined H.M. Forces in September, 1914, and sailed for France early in May, 1915; he had therefore over 14 months' active service to his credit. Commencing as an ordinary Private, he gained promotion to Corporal before leaving for France, the remaining steps having been attained while on Foreign service. No details are available regarding the circumstances of his death, official notification of which was made last week, although the records show that he was mortally wounded in the very early stages of the Great Offensive. He was serving with the 8th East Surrey Regiment, which, according to newspaper reports, suffered heavily in the attack on the Ercourt section of the line. He was intimately known to many members of the electrical industry, who will deplore the loss of a valued friend and colleague.

NEW COMPANIES REGISTERED.

Phillips' Magnetos, Ltd. (144,456).—This company was registered on July 26th, with a capital of £1,250 in £1 shares, to adopt an agreement, dated June 24th, 1916, with I. Phillips, for the purchase of the business of a manufacturer of magnetos and all parts thereof carried on by him at Birchett Road, Aldershot. The subscribers (with one share each) are: I. Phillips, Falmouth House, Aldershot, cycle manufacturer; C. Melton, 30, Queen's Road, Aldershot, accountant. Private company. Table "A" mainly applies. Solicitor: N. Clinton, Aldershot. Secretary (pro tem.): C. Melton. Registered office: 10, Birchett Road, Aldershot.

New Peto and Radford Accumulator Co., Ltd. (144,436).—This company was registered on July 24th, with a capital of £30,000 in £1 shares (12,500 10 per cent. preference, to carry on in the United Kingdom and elsewhere the business of electricians, accumulator manufacturers, founders, manufacturers of mining, agricultural and other machinery, electrical and water supply engineers, manufacturers of and dealers in electric meters and other electrical instruments, etc., and to adopt the agreements, the parties to which are not named. The subscribers (with one share each) are: W. Peto, 12, Heddon Street, W., electrical engineer; C. K. N. Minchin, 149 Banbury Road, Oxford, engineer. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first. Remuneration (except managing director or other salaried officials), £105 each per annum. Solicitors: Mayo, Elder and Co., 10, Drapers Gardens, E.C.

Carbic Italiano, Ltd. (144,400).—This company was registered on July 28th, with a capital of £30,000 in £1 shares, to take over from Carbic, Ltd., the business which that company carries on or is authorised to carry on in Italy and in Italian Colonies, together with the Italian patents and trademarks connected therewith, to adopt an agreement with the said company and H. Fonseca, to carry on, in Italy, in colonies or elsewhere, the business of manufacturers and producers of and dealers in acetylene, carbide of calcium, and oxide of calcium, and chemical and electro-chemical productions of all kinds, mechanical, electrical and general engineers, electricians, metallurgists, motor manufacturers, suppliers of light, heat and power, manufacturers of and dealers in accumulators, generators, installations, lamps, apparatus, appliances and fittings, etc. The subscribers (with one share each) are: H. Fonseca, Geneva, engineer; A. Jackson, 51, Holborn Viaduct, E.C., secretary. Private company. The number of directors is not to be less than two or more than five; the first are H. Fonseca and another to be nominated and appointed by Carbic, Ltd. The said company has the right, while a member of the company, to nominate and appoint a director. Solicitors: Bristows, Cooke and Carmichael, 1, Copthall Buildings, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Troup, Curtis and Co., Ltd.—Particulars of £3,000 debentures, created July 6th, 1916, filed pursuant to Section 93 (3) of the Companies Consolidation Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Vaughan Engineering Works, Ltd.—A mortgage dated July 19th, 1916, to secure £1,600 and £300 as compound interest charged on moneys to be received under a War Office contract, has been registered. Holder: J. Gee, Carlton House, Regent Street, W.

Highfield Co., Ltd.—Particulars of £750 second debentures, created June 27th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

A debenture dated July 19th, 1916, to secure not more than £500, charged on the above-mentioned property, has also been registered. Holder: J. H. Bland, 25, Stirling Road, Edgbaston, Birmingham.

A memorandum of satisfaction in full on July 19th, 1916, of a debenture dated December 4th 1914, securing £300, has also been notified.

Parsons and Hodges, Ltd.—Particulars of £600 debentures, created June 30th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled and unpaid capital. No trustees.

Rushmore Lamps, Ltd.—A memorandum of satisfaction in full on June 27th, 1916, of a charge dated May 27th, 1914, securing £2,000 has been filed.

Elliott Brothers (London), Ltd.—Particulars of £30,000 debentures, created June 28th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future including uncalled capital. No trustee.

CITY NOTES.

German Electrical Companies.

The Nitrit Fabrik, A.G., of Kopenick reports net profits of £8,800 for 1915, as compared with a loss of £7,000 in the previous year. It is proposed to pay a dividend of 4 per cent. on the share capital of £75,000.

The C. Lorenz A.G. of Berlin (telephone and telegraph works) has just issued new capital amounting to £75,000, and thus increased the ordinary shares to £225,000. The additional capital is destined for the development of the undertaking.

The Fabrik fur Isolierter Drahte A.G. (Vogel Telegraph Works), which recently declared a dividend of 15 per cent. for 1915, has now secured the sanction of the shareholders to an increase in the share capital to £262,000 by the issue of new shares for £87,000, which have been taken over by a banking syndicate at the price of 130 per cent., and are to be offered at 138 per cent. The new capital is intended for the extension of the works, and particularly for the establishment of a lead-covered cable factory.

The Continentale Gesellschaft fur Elektrische Unternehmungen, of Nuremberg, which is the financial trust of the Nuremberg Schuckert Co., and owns or is otherwise interested in tramways and lighting undertakings, states that the working results of its concerns did not experience any improvement in 1915, the tramways in particular having suffered from existing circumstances. As net profits the accounts indicate the sum of £44,000, as compared with £60,000 in 1914, and a dividend has been declared at the rate of 2½ per cent. on the preference capital of £1,556,000, as compared with 3½ per cent. and 6 per cent. in 1914 and 1913 respectively. The report states that no direct information is available concerning the company's French and Russian interests.

The report of the *Wolfram Lampen, A.G., of Augsburg*, which relates to the financial year ended with March 31st, 1916, states that it was possible to maintain working notwithstanding the scarcity of labour and of raw materials, and sufficient orders were on hand for the ensuing months within the existing possibilities of manufacturing. The accounts show net profits of £7,100, as compared with £800 in 1914-15, and the available surplus permits of the payment of the arrears on the preference shares, the ordinary capital again receiving no distribution. It is added that the Court of Appeal has not yet decided the patent action in relation to the manufacture of the tungsten drawn-wire filament.

Mr. J. G. B. Stone, presiding at the **Electric Supply** annual meeting held last Friday, said that **Corporation, Ltd.**, the increase in the number of lamp connections had much exceeded the average growth, the advance being from 214,715 to 254,700 during the year. About 75 per cent. of this was due to demands for power in Dumbarton, leaving to their other towns approximately their usual growth, which in these times was not unsatisfactory. The Hendon Co., in which they were the largest shareholders, had increased its dividend by 2 per cent., whilst the Dumbarton Tramways Co. again paid them a small dividend of 1½ per cent. Apart from the normal capital expenditure, which had been chiefly on mains, they had had to provide £5,185 for Dumbarton, mainly on account of the converter plant necessary in connection with bulk-supply arrangements. The war had increased the demand for power but reduced that for lighting, particularly street lighting. The latter was especially the case at Chelmsford, but under the terms of their contract with the town, and in view of a recent decision in the Appeal Court, they understood that they were entitled to recover the full amount of the contract, and that had been included in the accounts. The contract concluded last March, and they were now negotiating with the Town Council for a renewal on the basis of their making that body a considerable allowance in regard to the payment due for 1915, when the lighting was so very much restricted. They raised prices generally for the last half of the year, and this year a further increase had been made to meet the heavier costs. The net

result in the revenue account was that Chelmsford, Exmouth, and Falmouth showed increased profits; Hitchin, St. Andrews and Totnes were practically the same as last year; while Dalkeith, Dollar, Dumbarton, Jedburgh and Melrose showed a decrease. At Dumbarton the decrease was nearly £700, due to the costs being exceptionally heavy during the transfer of the load from their plant to that of the Power Company, they having to use both. The change over was now completed, and they would therefore only have one set of costs in future. The coal market was a very difficult one, and the effect of the Coal Prices Limitation Act left much to be desired. At Dumbarton, though they had a bulk supply, the price paid by them varied according to the price of coal. The new Summer Time was making serious inroads into their revenue this summer, but they were not yet in a position to say to what extent the yearly revenue might suffer. They proposed to pay 2 per cent. dividend, as against 2½ per cent. last year, their policy being to let the year's dividend bear part of the reduction in profit, and their carry-forward bear the balance. The Chairman referred to the excellent services rendered by the staff under war conditions.

STOCKS AND SHARES.

TUESDAY EVENING.

This week two years ago was the first of the long series through which the Stock Exchange remained closed. Its doors were shut by the Committee that governs the House, not by the Government. The Committee's action was undoubtedly influenced by an appeal from the late Lord Rothschild urging this course. Since those far-off days new history has been woven in a thousand directions. So far as this particular column is concerned, the Stock Exchange has emerged from a precarious position on the slopes of panic-stricken bankruptcy to a condition of safety and stability by comparison with what might well have been expected as the result of European war upon a scale so unique.

Electric-lighting shares and Home Railway stocks are still for the most part standing at prices lower than those prevailing upon the outbreak of war. The electric-lighting industry has suffered blow after blow during the war. Home Railway stocks have come down because of the influences undermining all securities that lean upon the money market. But Underground Electric Railway Income Bonds are two or three points higher. Telegraph issues are better on the whole, though Indo-Europeans form an exception. The Eastern group stands substantially better. Marconis also have risen. Mexican descriptions are very much lower, and so are the British Columbia Electric Railway stocks.

During the past week the markets have taken on a summer-like condition that all the excellent news from the various fronts has failed to enliven. Probably the weather plays some part in the listlessness; it is hard to arouse enthusiasm over investments what time the thermometer stands 13 points above Consols—taking the reading of both in the shade. Liveliness characterises the Shipping market, a full-dress gamble having sprung up in certain favoured shares. All shipping stocks are strong, however, and the speculation might well receive a little friendly attention from the Treasury.

Several more interim dividends are announced by the supply companies. The Metropolitan repeats its previous performance of 2 per cent., and the Chelsea declares 3 per cent. against 4 per cent. a year ago. Both the City of London and the County of London, it may be recalled, pay the same rates of 6 per cent. and 5 per cent. respectively, as they did this time last year. County ordinary continue to improve, and have gained another 2s. 6d. London Electrics also are firmer, a rise of 1/16 making them 1½. St. James' and Pall Mall are ex their dividend.

Electric Constructions put on their regular threepence per week. Edison and Swan drooped to 9s., but recovered to their former price of 9s. 6d. British Westinghouse preference have receded 1s. to 50s. 6d.

The Home Railway market is disposed to droop. Most of the Steam stocks are lower, and their example has been followed by those of the Undergrounds. Metropolitan is a point down. Districts lost 1, and the Underground Electric group is a shade easier, except as regards the shilling shares. For this dulness there is no further reason than that afforded by the decline in the price of Consols, which is having its effect upon all stocks and shares influenced largely by considerations of the money market.

The interim dividends are out, and can fairly be regarded as satisfactory in every case. They matched anticipation too closely, however, for them to bring about, by themselves, any particular improvement; and, with nobody anxious to deal, quotations have sagged in sympathy with Consols. Even the revival of the Channel Tunnel scheme has failed to save Southern passenger stocks from pursuing the same track as the rest.

Brazil Tractions are again better at 6½, the fraction marking the extent of the rise on the week. The Rio exchange keeps steadily above 1s. per milreis. Argentines, on the other hand, are slightly easier; and Anglo-Argentine Tramways second preference shares have lost another 2s. 6d., the price

being lowered to 3. As the interim dividend was postponed in respect of the last half-year, we have taken out temporarily from our columns the yield on the shares.

British Columbia Railway stocks are a little better, following upon the advance of last week; but most of the issues connected with Mexico have a very dull appearance, and the 5 per cent. bonds of the Mexico Trams and the Mexican Light and Power Companies are both lower at 40. New York being in the midst of a heat wave apparently more severe than our own, the Wall Street operators have ceased to take any interest in this group, with the result that some of the shares in the Latin-Canadian electricity companies have gently sagged in price.

The telegraph list is a little irregular. Cuba Submarines are 15s. up, thanks to a small demand, but otherwise what changes have occurred are mostly in the downward direction. The Eastern group has gone back a trifle. Great Northern's are 10s. lower, Westerns lost $\frac{1}{2}$, and West India and Panamas 1/16, while Anglo-American stocks keep steady. Marconis at $3\frac{1}{2}$ are easier, but Marconi Marines have risen to 24 on the Board of Trade order that all ships over 3,000 tons shall be fitted with wireless apparatus. Americans are firm at 18s., and Canadians at 11s. British Insulated Wires at 12 are 5s. higher, repeating their rise of last week. Henleys gained 10s. at 16, but India-Rubbers, on the other hand, reacted to 12. Callenders preference at 44 are a little easier.

The Rubber market continues quiet, with business unexciting. Another drop in rubber took the price to 2s. 2d. per lb., which is not conducive to immediate bullishness. The shares in the group of chemical companies keep exceedingly firm, and there has been a fair rally in some of the copper issues, thanks to another substantial recovery in the price of the metal.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend		Price Aug. 1, 1916.	Rise or fall this week.	Yield p.c.
	1914.	1915.			
Brompton Ordinary ..	10	10	63	—	47 18 2
Charing Cross Ordinary ..	5	5	86	—	6 18 0
do. do. 44 Pref. ..	44	44	8	—	6 8 7
Chelsea ..	5	5	9	—	6 19 4
City of London ..	9	9	124	—	6 8 0
do. do. 6 per cent. Pref. ..	6	6	104	—	5 14 8
County of London ..	7	7	124	—	6 8 9
do. do. 6 per cent. Pref. ..	6	6	104	—	5 14 8
Kensington Ordinary ..	9	9	74	—	6 16 7
London Electric ..	4	4	13	—	6 19 5
do. do. 6 per cent. Pref. ..	6	6	44	—	6 13 4
Metropolitan ..	34	34	23	—	6 6 4
do. do. 44 per cent. Pref. ..	44	44	8	—	7 10 0
St. James' and Pall Mall ..	10	8	62nd	—	6 19 4
South London ..	5	5	24	—	6 10 10
South Metropolitan Pref. ..	5	5	14	—	6 4 6
Westminster Ordinary ..	9	7	64	—	6 14 3

TELEGRAMS AND TELEPHONS.

Anglo-Am. Tel. Pref. ..	6	6	104	—	6 15 5
do. Def. ..	30/	39/6	23	—	7 10 9
Chile Telephone ..	8	8	62nd	—	6 18 5
Cuba Sub. Ord. ..	6	5	54	—	6 1 9
Eastern Extension ..	7	8	14	—	6 7 8
Eastern Tel. Ord. ..	7	8	1484	—	6 7 9
Globe Tel. and T. Ord. ..	6	7	104	—	6 8 8
do. do. Pref. ..	6	6	104	—	6 10 4
Great Northern Tel. ..	22	22	574	—	5 17 4
Indo-European ..	13	13	48	—	6 12 8
Marconi ..	10	11	48	—	3 4 0
New York Tel. 44 ..	44	44	24	—	4 10 3
Oriental Telephone Ord. ..	10	10	94	—	5 0 0
United R. Plate Tel. ..	8	8	64	—	6 18 5
West India and Pan. ..	1	1	14	—	6 18 5
Western Telegraph ..	7	8	14	—	6 7 8

HOME RAIL.

Central London, Ord. Assented	4	4	74	—	5 8 1
Metropolitan ..	12	1	254	—	3 18 6
do. District ..	Nil	Nil	19	—	Nil
Underground Electric Ordinary	Nil	Nil	144	—	Nil
do. do. "A" ..	Nil	Nil	64	—	94
do. do. Income ..	6	6	94	—	6 12 10

FOREIGN TRAMS, &c.

Adelaide Sup. 6 per cent. Pref.	6	6	5	—	6 0 0
Anglo-Arg. Trams, First Pref. ..	54	54	84	—	7 2 0
do. do. 2nd Pref. ..	54	54	8	—	—
do. do. 5 Deb. ..	5	5	774	—	6 9 0
Brazil Tractions ..	4	4	624	—	6 14 3
Bombay Electric Pref. ..	6	6	104nd	—	8 11 8
British Columbia Elec. Rly. Pfee. ..	5	5	60	—	6 14 3
do. do. Preferred ..	Nil	42	—	—	Nil
do. do. Deferred ..	Nil	44	—	—	Nil
do. do. Deb. ..	42	42	65	—	6 10 9
Mexico Trams 5 per cent. Bonds ..	Nil	Nil	4	—	Nil
do. do. 6 per cent. Bonds ..	Nil	Nil	54	—	Nil
Mexican Light Common ..	Nil	Nil	20	—	Nil
do. do. Pref. ..	Nil	Nil	39	—	Nil
do. do. 1st Bonds ..	Nil	Nil	40	—	—

MANUFACTURING COMPANIES.

Babcock & Wilcox ..	14	15	8	—	5 0 0
British Aluminium Ord. ..	5	7	254	—	5 7 8
British Insulated Ord. ..	15	174	12	—	7 5 10
British Westinghouse Pref. ..	74	74	50/6	—	6 18 0
Callenders ..	15	20	124	—	8 0 0
do. do. 5 Pref. ..	5	5	42	—	5 17 8
Caster-Kellner ..	20	20	82	—	6 6 8
Edison & Swan, 23 paid ..	Nil	Nil	9/6	—	Nil
do. do. fully paid ..	Nil	Nil	12	—	Nil
do. do. 5 per cent. Deb. ..	6	5	57	—	8 16 8
Electric Construction ..	8	74	16/9	—	3 19 2
Gen. Elec. Pref. ..	6	6	94	—	6 1 6
Henley ..	20	25	16	—	8 1 3
do. do. 44 Pref. ..	44	44	12	—	6 13 8
India-Rubber ..	10	10	14	—	4 6 8
Telegraph Con. ..	20	20	89	—	4 4 0

* Dividends paid free of income tax.

MARKET QUOTATIONS.

It should be remembered in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, August 2nd.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ..	per lb. 1/8	..
a Ammoniac Sal ..	per ton 2/75	..
a Ammonia, Muriate (large crystal) ..	" 2/54	..
a Bisulphide of Carbon ..	" 2/38	..
a Borax ..	" 2/34	£1 inc.
a Copper Sulphate ..	" 2/51	..
a Potash, Chlorate ..	per lb. 3/5	..
a " Perchlorate ..	" 3/1	..
a Shdlae ..	per cwt. 98/	..
a Sulphate of Magnesia ..	per ton 2/18	..
a Sulphur, Sublimed Flowers ..	" 2/5	..
a " Lump ..	" 1/14 10	£1 inc.
a Soda, Chlorate ..	per lb. 12/	3d. dec.
a " Crystals ..	per ton 12/	..
a Sodium Bichromate, casks ..	per lb. ..	..
METALS, &c.		
c Brass (rolled metal 7 to 12 basis) ..	per lb. 1/24 to 1/8	..
c " Tubes (solid drawn) ..	" 1/23 to 1/3	..
c " Wire, basis ..	" 1/15 to 1/34	..
c Copper Tubes (solid drawn) ..	per ton 1/63 to 1/62	..
g " Bars (best selected) ..	" 2/15	..
g " Sheet ..	" 2/16	..
g " Rod ..	" 2/16	..
d " (Electrolytic) Bars ..	" 2/15	24 inc.
d " " Sheets ..	" 2/15	24 inc.
d " " Rods ..	" 2/15	24 inc.
d " " H.C. Wire ..	per lb. 1/34	24 inc.
f Ebonite Rod ..	" 3/6	..
f " Sheet ..	" 2/6	..
n German Silver Wire ..	" 2/10	..
h Gutta-percha, fine ..	" 6/3	..
h India-rubber, Para fine ..	" 2/10	1d. dec.
l " Iron Pig (Cleveland warrants) ..	per ton Nom.	..
l " Wire, Galv. No. 8, P.O. qual. ..	" 2/36	..
g Lead, English Pig ..	" 2/29 10	5/ inc.
g Mercury ..	per bot. 2/17 15	..
e " Mica (in original cases) small ..	per lb. 6d. to 3/	..
e " " " medium ..	" 3/6 to 6/	..
e " " " large ..	" 7/8 to 14/ & up.	..
d Silicon Bronze Wire ..	per lb. 1/54	..
g Steel, Magnet, in bars ..	per ton 2/55	..
g Tin, Block (English) ..	" 2/171	£1 to 25 inc.
n " Wire, Nos. 1 to 16 ..	per lb. 2/10	..

Quotations supplied by—

a G. Boor & Co.	g James & Shakespear.
c Thos. Bolton & Sons, Ltd.	h Edward Tilt & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	j Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	k P. Ormiston & Sons.
Telegraph Works Co., Ltd.	l W. F. Dennis & Co.

Charing Cross, West End and City Electricity Supply Co., Ltd.—Interim dividend on the ordinary shares of the West End undertakings for the half-year ended June 30th, 1916, at the rate of 4 per cent. per annum. This is the same rate as a year ago.

Blackpool and Fleetwood Tramroad Co.—Interim dividend at the rate of 4 per cent. per annum (4s. per share), free of income tax, on the ordinary shares for the past half-year.

City of London Electric Lighting Co., Ltd.—Interim dividend at the rate of 6 per cent. per annum (6s. per share), less income tax, on the ordinary shares for the past half-year. This is the same rate as a year ago.

Bristol Tramways and Carriage Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum on the ordinary shares for the half-year ended June 30th, 1916. For the corresponding period last year the rate was 4 per cent.

Cordoba Light, Power and Traction Co., Ltd.—According to the *Financial Times*, the payment of the dividend on the preference shares will be postponed for the present.

Westminster Electric Supply Corporation, Ltd.—Interim dividend at the rate of 5 per cent. per annum, less income tax, for the half-year to June 30th.

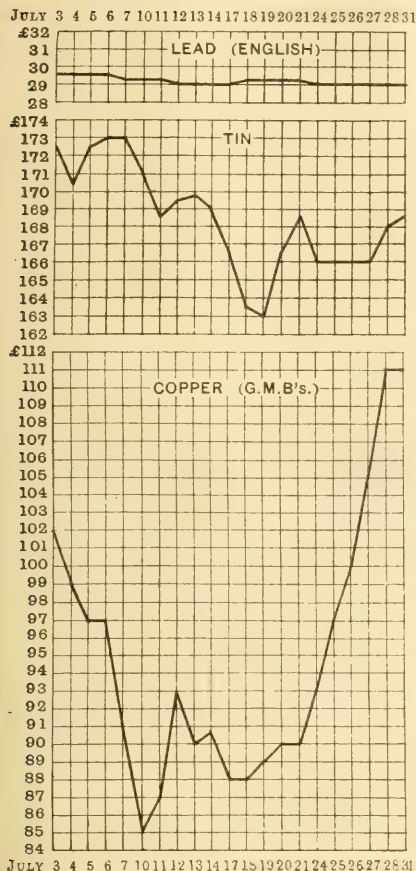
Chelsea Electricity Supply Co., Ltd.—Interim dividend at the rate of 3 per cent. per annum, less tax, on the ordinary shares, as compared with 4 per cent. declared at this time last year.

National Boiler and General Insurance Co., Ltd.—Interim dividend of 12s. per share, less tax, payable September 1st.

Vickers, Ltd.—Interim dividend 1s. per share, free of income tax, on the ordinary shares.

METAL MARKET.

Fluctuations in July.



PROSPECTS IN SOUTH AFRICA.

BY R. TURNBULL MAWDESLEY.

JOHANNESBURG, June 23rd, 1916.

THE following brief article is prompted by the appearance in your columns (issue dated May 19th) of an inquiry from a correspondent of Dutch nationality regarding the present prospects in South Africa for electrical men. Your issue of May 19th has only just arrived, and I fear that any information I am able to tender can hardly reach you in time to be of any service to your correspondent. However, others may be interested in the prevailing conditions along the Reef, and in South Africa generally; and I am giving some general information with reference to the prospects for newcomers.

I ventured to remark in these columns as emphatically as possible, some three years ago—at the time of the great strike in Johannesburg—that on no account should electrical men come to South Africa on speculation, and since that period things have not changed.

It is to be feared that matters, from the point of view of employment, have got rather worse since the outbreak of the war. It should be said at once that, although a great many men connected with electrical affairs have gone to German East Africa with General Smuts, there are positively no appointments vacant in consequence. The reason for this is not far to seek. No construction work is at present going on—partly because of the difficulty in getting material from home, and for other reasons equally obvious. Even if the sanction of the Minister of Munitions is obtained to proceed with work other than munition work, it is not to say that, in consequence, Colonial orders can be filled with any degree of speed by the manufacturers. It will be appreciated, therefore, that where drawing and designing office staffs were depleted by men "joining up" no attempt has been made—nor has it been necessary—to fill up the openings thus caused. Again, apart from construction work, where maintenance and operating staffs have been depleted, it has always been possible to fill up such vacancies locally so far.

The branch offices of the big manufacturers are practically at a standstill through the stoppage of all construction work, and therefore new-coming engineers, whether they be trained commercially, technically, or practically, have little chance of securing what I may term a staff appointment. There are at present many certificated men of undoubted ability working, practically, on the mines at an artisan's wage; and this is not an alluring prospect for any one who knows what a Rand mine electrician, or fitter, is called upon to do.

In any notes upon electrical matters in South Africa, one is forced to keep the Rand in his mind's eye. This is unquestionably the area concerned, as, apart from Cape-town, Durban, and one or two other comparatively small towns where the municipalities have electric supply undertakings, there is no electrical work at all, if we except the small "dorps" which possess tiny suction-gas plants with a staff of, probably, two white men. South Africans are keen upon saying that there must be a complete abandonment of the foolish and singularly short-sighted attitude in which the Rand is regarded as a milch cow for the rest of South Africa: but that attitude cannot be abandoned from an electrical view-point.

If we consider the diamond mines at Kimberley, the gold mines on the Reef, and one or two outlying coal mines, we have all the industries at once where electricity is applied on any great scale.

There are no great factories in South Africa which take power in bulk, and it follows that the Rand is, to all intents and purposes, South Africa, when we speak of electrical matters.

Now the Victoria Falls and Transvaal Power Co. has a recognised system of promotion from the junior ranks, which is rigidly adhered to when any opening occurs at the top. This forms an undoubted encouragement to the juniors, though distinctly hard on a newcomer; and although a "new chum" might be fortunate enough to strike a billet, either with this great company, or elsewhere, it is to be regretted that his chances are distinctly small. There is,

S.A. Institute of Electrical Engineers.—In his valedictory

address as retiring President, Mr. Bernard Price said that the most ambitious undertaking upon which the Institute had yet embarked was an investigation of the possible development by electrical means of the natural resources of the country. Consideration of the establishment of new industries had recently received an added stimulus: the war and its effects upon the importation of manufactured articles and commodities to the country had naturally directed attention to increased utilisation of local resources, and the Government had appointed an influential Committee to consider the whole matter. The formation of the Government Munitions and Industries Committee had therefore provided the necessary machinery for the assimilation and utilisation of the data and information that had been worked up by the Institute's Committee, and it was hoped that the report on electrochemical industries, which had just been completed and which was already in the hands of the Government Committee, would be the means of accelerating the establishment of such industries in the country. The present time was particularly opportune, and there was no time to be lost: If the British Empire and her Allies were to consolidate the victory which they would surely gain over their enemies, at terrible cost, it was imperative that they should organise industry on new lines. One most important factor in the problem was the education and training of engineers, because the efficiency of the industrial and commercial machine must ultimately depend to a very large extent upon the skill of those who controlled it. He was very optimistic as to the future prosperity of the Institute. Africa was a young country, possessing almost infinite possibilities, and electricity had to play an important part in the development of those possibilities. It must surely be only a matter of time before rapid strides would be made in the opening up of the vast resources now lying dormant.

two, a School of Mines and Technology in Johannesburg, where students are well educated, and where encouragement is given by the mining houses to Afrikaners to train technically and practically in the mining and engineering professions.

All resident engineers on mines must possess the Government certificate of proficiency before they can take absolute control. There are two classes of certificate, one for electrical, and one for mechanical engineers—though either is sufficient. The examination is somewhat similar to that for the Associate Membership of the I.E.E.; but when one has grown rusty, it offers some difficulties. An honorary certificate is given to engineers who have been in executive positions for a period of not less than three years.

The Johannesburg municipality has taken steps to prevent further members of its power-station staff from going either overseas, or to G.E.A., and, consequently, there is nothing doing in this direction—the present staff having grown comparatively old in its service.

Regarding the actual *practical* side of the question, it should be said that there are no electricians, fitters, or mechanics at present unemployed here. The mines offer a wide field for practical men, especially armature winders. The pay of a mine electrician varies from 18s. 4d. to 25s. per day, according to his experience, but the average is 20s. per day, with a 48-hour week.

These figures, when compared with British rates, are distinctly misleading. Notwithstanding the improvements in transportation and railways, Johannesburg, and the Witwatersrand generally, are still among the most expensive places in the world in which to live—and this quite apart from the more recent increase in the price of commodities owing to the war. It must be remembered that Johannesburg (the actual centre of the Reef) is roughly 1,000 miles from Capetown and 600 from Durban, and situated at the top of a mountain range, where it is tropically hot in the summer months (October to March) and biting cold in winter (April to September); so that, although £6 per week seems a high standard of pay, it is not worth more than 50s. per week in Great Britain—in fact, a man with 50s. per week at Home is in much the better position.

If, therefore, a man is practical, and satisfied with an electrician's job in the meantime, it might not be a bad "spec" to come to the Rand; but the cost of living is the chief item to be considered. Clothes are very expensive, 100s. to 200s. being the cost of a suit; boots are 20s. to 45s., and all food and raiment is on an equally high scale. Also house rents are abnormally high, the merest "cottage" being rented at £5 or £6 per month. Railway fares are the only cheap thing, and this is necessary owing to the long distances between towns in S.A. (the Rand excluded).

The Witwatersrand Reef, where all the big gold mines are situated, runs east and west about 50 miles, from Springs to Randfontein, with Johannesburg in the centre; and along this Reef are situated a number of towns of more or less importance. Of these, Johannesburg, Krugersdorp, and Randfontein (a suburb of Krugersdorp) each have their own municipal plant, but the remaining towns are supplied for lighting, &c., from the V.F.P. Co.

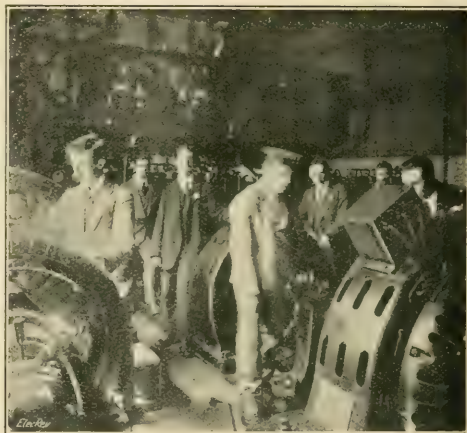
In conclusion, it is far from my intention to cast a wet blanket on the enthusiasm of any electrical man who intends coming here; but, in common fairness, it is desirable to say that neither general ability in languages nor profession can procure one employment of a suitable kind where none exists.

THE EMPLOYMENT OF DISABLED SAILORS AND SOLDIERS.

EARLY in the war, the fact that many men who had suffered permanent injury in the service of their country would return to civil life maimed and unfitted to resume their former avocations, and would need assistance to enable them to find new occupations, was appreciated by the Council of the Institution of Electrical Engineers, which accordingly invited employers in the electrical industries to take such cases into consideration (E.L.S.C. REV., June

25th, 1915). At that time, however, it was found that there were very few candidates for employment, the demand for them apparently exceeding the supply.

Obviously, this happy state of things could not be expected to last, and, with a view to forestalling the future, a small Committee was formed of members of the Council, who took the matter in hand, and accumulated a guarantee fund to cover expenses (mainly out of their own pockets). The most obvious opening for partially-disabled men in electrical work was as switchboard and sub-station attendants; certain physical disabilities, such as the loss of an arm or a leg, or one eye, would not seriously diminish the efficiency of the men for these purposes, though such cases as loss of nerve through shock, &c., were evidently unsuitable. The necessity of at least a smattering of technical knowledge for the adequate fulfilment of the duties of such posts, however, presented a serious obstacle. The Committee therefore approached, in the first instance, the Education Committee of the London County Council, as the Education Authority for London, which suggested that the work should be undertaken by the Northampton Polytechnic Institute. The co-operation of Dr. R. Mullineux Walmsley, the Principal, was invited, and he undertook, with the assistance of the Committee, to prepare a scheme for putting the men through a short course of training at the Institute; at a meeting held at the Institution of Electrical Engineers, on



SOLDIERS IN THE POWER HOUSE.

April 7th, at which Dr. Walmsley met the representatives of the Councils, it was decided that the work should be put in hand. In the first instance the classes were to be of an experimental order, and if successful results were attained, the scope of the operations was to be enlarged, and the system eventually extended to provincial centres. No fees were to be charged for the tuition, but, on the other hand, wages were not to be paid to the men during their course, the guarantee fund being intended to cover the cost of training only, and not to provide for maintenance.

Mr. F. M. Denton, Associate Head of the Department of Electrical Engineering and Applied Physics at the Northampton Polytechnic Institute, was present with Dr. Walmsley, and the nature of the training to be given was outlined. At a meeting on April 27th the matter was further discussed, and it was agreed to proceed with the organisation of training classes.

Accordingly, Dr. Walmsley obtained introductions from Sir Alfred Keogh, K.C.B., Director-General of the Army Medical Service, to the officers in command of six military hospitals in the metropolitan area, and, with Mr. Denton, visited the hospitals with a view to obtaining pupils; but at this stage a remarkable series of difficulties arose, differing in character at each hospital, for some readily afforded facilities which others could not accord, and *vice versa*. Hence it came about that though all was ready at the Institute in April, a start could not be made with the first contingent of men

until June 26th. One great difficulty, which might have been fatal to the scheme, was that of providing for the maintenance and travelling expenses of the men during their course of training; this was only overcome by the aid of the Disabled Soldiers' Aid Committee, of 40, Ebury Street, S.W., whose work has been beyond praise. The Committee undertook to defray the travelling expenses and the cost of dinners for those men whom it had been instrumental in sending to the classes. The first class numbered 14, of whom only 5 were derived from the hospitals, the D.S.A. Committee sending the rest. Accommodation was provided by the Institute for 20 men. The personal services of Mr. G. R. Buckley and Mr. R. Cunliffe are described by Dr. Walmsley as invaluable, and Mr. Buckley further encouraged the men by offering substantial prizes for competition to the first class, which closed in July, and to the second, which is now in training.

Perhaps the most serious difficulty met with in forming the classes was one to which we wish to draw particular attention, as to our mind it reflects the greatest discredit upon the Government department which is charged with the duty

pensation in a Court of Law. Surely a man who has voluntarily risked his life and lost a limb has a far higher claim for compensation than one who has merely met with an accident! Fortunately, this subject has been vigorously taken up in the daily Press, with the redoubtable assistance of Sir Frederick Milner (whose health unfortunately has broken down completely under the strain of his arduous labours), and we hope that public opinion will soon compel the Government to abandon the paltry policy of chaffering and cheeseparing with the nation's defenders.

The course is laid out for a period of four weeks' training, from 9 to 12 and 1 to 4 daily, five days a week, making a total of 120 hours. The first class, attended from June 26th to July 21st, numbered 14; three men failed to come up to the standard tentatively set up, but 11 were passed as eligible for employment. The men were found to be, as a rule, excellent learners, interested in the work and readily picking up the novel ideas that were put before them. More applications were received from supply authorities than could be filled; the County of London Co. asked for two and took four, who were not able to leave London, and



DISABLED SOLDIERS AT WORK IN THE LABORATORY OF THE NORTHAMPTON POLYTECHNIC INSTITUTE.

of allocating pensions to our disabled heroes—men whom it should be our pride and boast to protect from injustice and oppression, and to compensate with generosity, and by every means in our power, for the voluntary sacrifice which they had made for their Motherland. Far from adopting this view, it is the practice of the Government to hale each man before a Medical Board, which appraises the net value of his earning power, and deducts it from his pension. For example, it is reported that a man who had lost a limb, and was receiving a pension of 25s. a week, was held to be capable of earning about 15s. a week, and his pension was reduced to 10s. 6d. a week. Could anything be more monstrous than this iniquitous procedure, by which men are provided with direct incentives to malingering and idleness? The fact that a man, though partially crippled, is likely to be able to earn wages does not in the least affect his undoubted right to the fullest possible compensation for the injury suffered in the service of his country, and in this connection we may point out that a workman injured in the course of his employment is entitled to recover substantial com-

inquiries were received from Edinburgh, Manchester, Newcastle (3), Nottingham, South Wales (4), Cleveland and Durham (3), and a private firm. The Institute recommends the men for a month's probation, with wages, on the jobs where they will be employed, and urges that the full normal rate of wages shall be paid to a man who performs the whole of the duties usually attached to his post.

The second course started on July 17th with 20 men, and applications for men have been received from the L. & N. W. Ry. Co. and from Salford, Tynemouth, Liverpool, Leeds, Birmingham, Blackburn, Woking, &c. The Committee has decided that after the second course has been completed, the scheme shall be suspended for a month or two, to see how the first two squads of men get on in their jobs; a meeting will be held in September at which the whole position will be reviewed, and if the results are found satisfactory, arrangements will be made to resume the courses in October at the Northampton Institute, and, if possible, to start provincial courses.

The system of training to be adopted presented an entirely

new problem, as regards both the subjects and the objects of the training, but Mr. Denton has laid out a course of instruction, approved by the Committee, which appears to be admirably adapted to its purpose. The course includes a series of five or six lectures, or, rather, demonstrations, lasting about one-and-a-half hours each, on elementary facts regarding electro-technology. The men are required to make notes upon the most difficult part of the system to them, but soon mastered, and are encouraged to ask questions, and after each lecture they write out their notes, whilst the instructor discusses and explains the various points to them individually. Practical laboratory work with simple apparatus follows, bearing as far as possible upon the future occupations of the men; for this purpose they are paired off in groups, with an eye to the desirability of associating a man who has a right arm with a mate who has a left—a consideration that touches one's heart, but which the men, fortunately, regard as a matter for jocularity.

Simple experiments on heat and thermometry are carried out, and the men make a buzzer, wind a model D.C. and A.C. armature, and make up an elementary transformer—all actually *working* models, most ingeniously contrived to exhibit with the least expenditure of labour and material the utilisation of the great fundamental principles.

To familiarise the pupils with electrical machinery, they are divided into groups of not more than four, each of which is provided with a demonstrator, and spends, say, an hour in examining a motor or switchboard, the demonstrator answering questions and explaining the use and purpose of each part of the apparatus. Actual workshop practice is also taught as far as possible in the time available, such operations as soldering, jointing wire and cable, vice work, and the use of simple hand-tools being dealt with. Elementary testing is included in the course. No better choice of a teaching institution could be made, for the Northampton Polytechnic Institute is specially equipped for training men in station work; we have described and illustrated the excellent modern plant installed in the electrical engineering department (E.L.S.C. REV., October 21st, 1910, p. 665), which includes D.C. and A.C. generating and transforming plant, switchgear of the flat-board and cellular types, with remote-control and bench-control boards, &c., expressly laid out to represent current practice. Thus the pupils are enabled to handle apparatus of type similar to that which they will meet with later, and are taught something of the methods of synchronising and paralleling machines, regulating the voltage, &c. If the system of instruction that is under trial does not prove successful at this Institute, it is safe to say that it will not succeed anywhere.

Lastly, through the kindness of the County of London Electric Supply Co., the men are allowed to visit the company's City Road generating station and certain sub-stations; in this part of the work Mr. Dallas has rendered invaluable assistance by making the necessary arrangements. On the occasion of these visits the station staffs carry out various routine and special operations for the instruction of the men.

As a mark of the high esteem in which the work is held, we may mention that H.H. Princess Marie Louise, who is the president of the Disabled Soldiers' Aid Committee, is about to visit the Institute, to see the scheme in operation.

In conclusion, we wish to thank Mr. C. P. Sparks, chairman of the I.E.E. Committee, Dr. Walsley, and Mr. Denton, for affording us facilities to describe the working of this excellent project. The energy and enthusiasm with which they have devoted themselves to perfecting the organisation and carrying it into practice, command our admiration, and, we hope, will compel success. We may add that one factor necessary to success, which is beyond the control of these gentlemen, is the central-station manager's goodwill; without this, the system could not be given a fair trial. But we are certain, and indeed the proofs are already forthcoming, that this factor will not be lacking; and we are sure that engineers and managers will afford the men thus partially trained every opportunity to acquire further knowledge and skill in carrying out their duties, even though at first their patience may be tried by the unavoidable inexperience of their new hands. For have not these men risked their lives on our behalf? "Greater love hath no man than this"—let us show them that we are indeed their friends.

THE CHOICE OF CONTINUOUS-CURRENT MOTOR-CONTROL APPARATUS.

By W. PERREN MAYCOCK, M.I.E.E.

WHEN first investigated, there would appear to be a needless and somewhat bewildering variety of apparatus for the control of motors, but this impression is dispelled when we approach the subject from "outside," so to speak, and consider, *first*, what the motor has to do; and, *secondly*, what is the most desirable method of operating it.

If, starting on this plan, we take the simplest cases and lowest powers first, and proceed step by step to the more complicated cases, it will be found that the methods and apparatus sort themselves out into more or less definite groups.

The consideration of matters from this point of view could obviously be detailed at some length, particularly as regards the various tests to be undergone, and the details of construction and mounting; but we must certainly leave these unconsidered, and other omissions must be excused.

When any given *electric drive* is to be considered, the Motor comes first, the Method of Control next, and the Control Apparatus last. Thus the type of motor and method of control lead up to the choice of control apparatus, but cost often determines the method, and very frequently the actual make of apparatus also.

The points to be considered may be tabulated as follows:

MOTOR.	
Type (T)	<ul style="list-style-type: none"> (Tsh) Shunt. (Tse) Series. (Tc) Compound.
Power (P)	<ul style="list-style-type: none"> (Pvl) Very low (say up to 1 H.P.). (Pl) Low (say up to 10 H.P.). (Pm) Medium (say up to 100 H.P.). (Ph) High (say above 100 H.P.).
METHOD OF CONTROL.	
Motion (M)	(Ms) Starting only (s).
	(Msr) Starting (s) and speed regulating (r).
	(Msv) Starting (s) and reversing (v).
	(Msrv) Starting (s), speed-regulating (r), and reversing (v).
Inching (i) can be combined with any of the above.	
Hand (h)	(Oh) By hand simply.
	(Ohd) By hand, with one or more distant stop-buttons.
	(Ohs) By hand, with slow-motion or slow-acting gear.
	(Ohsd) By hand, with slow-motion or slow-acting gear, and with one or more stop-buttons.
Operation (O)	(Osb) By pressing one or more buttons.
	(O-same) By operating a master-controller.
	(Osar) By pulling a rope or chain.
	(Oaf) Float operation.
Automatic (a)	(Oal) Lever operation.
	(Oap) Pressure operation.
Devices (D) for protection. &c.	(Df) Fuses.
	(Dcb) Circuit-breaker.
	(Dn) No-voltage release.
	(Dnvl) No-voltage and overload release.
	(Db) Braking.
	(Dss) Speed-setting (for machine tools, &c.).

The above tabulation may be used in two ways, first, for indicating the whole requirements of a given motor application; and, secondly, for showing the character of a given control apparatus only.

As an example of the first use, let us suppose that the motor is to be series-wound, that it is of 50 H.P., that it is to be regulable as regards speed and reversible, that it is to be operated by a master controller, and that the control apparatus is to have a no-voltage and overload release.

These various requirements may then be summed up as:—

Tse, Pm, Msr, Osame, Dnvl.

This gives, in a very concise form, the main information in respect of type (T), power (P), motion (M), operation (O), and devices for protection, &c. (D).

In using the tabulation in the second way mentioned above, viz., for indicating the character of a given control, it is clearly not always necessary to give the T and P descriptions.

It is conceivable that some such tabulation would be useful in practice when all sorts of motor work have repeatedly to be dealt with.

Map of Russia.—Messrs. R. Martens & Co., Ltd., of 149, Leadenhall Street, E.C., shippers and mercantile engineers, who have branches in seven principal cities of Russia, have issued a large economic map of Russia which should prove useful to traders who are interested in the cultivation of closer trading relations between this country and Russia.

SOUTH AFRICAN MUNICIPAL ELECTRIC SUPPLY STATISTICS.

THE following data relating to South African municipal electricity supply undertakings appeared in a recent issue of the *South African Mining Journal*.

Town.	Generation.	Condensing.	Pressure of generation.	Pressure of distribution.	Alternating or direct current.	Mains.	Plant capacity.	Maximum load.	Tons sold per annum.	Number of street lamps.	Number of consumers.
Alwalal North ...	Water	—	180-510	230 & 160	D.C.	Under	—	65	60,000	80	250
Benoni ...	Bulk	—	3,000	200 & 346	A.C. 25	Both	450	350	—	250	924
Bloemfontein ...	Steam	Yes	2,000	347 & 200	A.C. 50	Both	1,700	458	1,430,000	471	1,400
Boksburg ...	Bulk	—	2,100	230	A.C.	Both	100	400	370,000	450	710
Bulawayo ...	—	—	—	—	—	—	—	—	—	—	—
Cape Town ...	Steam	Yes	175 & 2,200	440 & 220	A.C. & D.C.	Both	2,625	1,384	5,031,716	1,675	2,772
Ceres ...	Water	—	110	110	D.C.	Over	35	30	4,200	100	75
Dundee ...	Steam	No	220	210-200	D.C.	Both	100	60	—	17	200
Durban ...	Steam	Yes	6,600, 2,750 & 550	550, 100, & 200 A.C., 500 D.C.	A.C. & D.C.	Both	8,950	4,200	13,752,000	2,462	6,487
East London ...	Steam	Yes	2,200 & 550	110 & 550	A.C. 50 & D.C.	Both	950	1,000	1,355,627	546	1,475
Germiston ...	Bulk	—	—	—	—	—	—	—	—	—	—
Greytown ...	Steam	No	220	200	D.C.	Over	136	55	48,000	72	113
Harrismith ...	Steam	No	2,100	200	A.C. 50	Under	185	70	102,975	98	298
Heilbron ...	Steam	No	250	230	D.C.	Over	50	25	56,821	50	130
Johannesburg ...	Steam	Yes	500-600 460-480 3,000 3,300	200 & 400 500-600 460-480	D.C. & A.C. 50	Both	13,750	9,700	20,551,894	7,000	12,300
Kalk Bay ...	Steam	Yes	3,300	190-110	A.C. 50	Both	300	200	—	284	203
Kimberley ...	Bulk	—	5,000	220	A.C. 50	Both	—	—	838,742	191	1,078
King William's Town	Steam	Yes	2,200	220-225	A.C. 50	Both	200	101	135,374	286	502
Klerksdorp ...	Gas	—	500	230 & 460	D.C.	Over	70	50	84,000	104	200
Kroonstad ...	Steam	No	250	230	D.C.	Both	180	120	394,500	115	413
Krugersdorp ...	Steam	Yes	480	160	D.C.	Both	450	310	755,340	315	825
Ladysmith ...	Steam	No	220	220	D.C.	Over	250	600 amp	269,597	162	240
Newcastle ...	Steam	No	550	250	D.C.	Over	78	65	2,000	300	175
Oudtshoorn ...	Oil	—	410-180	220-240	D.C.	Both	180	280	127,127	258	414
Parys ...	Water	—	460	230	D.C.	Over	30	40 amp	—	100	57
Pietermaritzburg	Steam	Yes	2,950 & 550	200 & 550	D.C. & A.C. 100	Both	1,550	700	1,492,981	473	1,720
Port Elizabeth	Steam	Yes	250	250 & 500	D.C.	Both	1,200	812	—	715	1,688
Potchefstroom	Steam	Yes	250 & 500	210 & 180	D.C.	Over	150	65	108,596	120	304
Pretoria ...	Steam	Yes	550	250 & 500	D.C.	Both	3,300	2,000	4,273,000	1,470	3,500
Queenstown ...	Oil	—	230 & 160	220 & 140	D.C.	Both	140	250	80,000	240	364
Roseboom ...	Bulk	—	3,300	100 & 230	A.C. 50	Over	180	150	96,000	400	479
Salisbury ...	Oil	—	460	220 & 140	D.C.	Both	200	100	—	103	300
Springs ...	Bulk	—	—	—	—	—	—	—	—	—	—
Standerton ...	Steam	No	240	230	D.C.	Over	75	50	—	150	141
Uitenhage ...	Gas	—	440	220	D.C.	Both	270	—	—	296	180
Wynberg ...	Bulk	—	3,000	220	A.C. 50	Both	250	150	—	—	318

a Combined electric and water schemes.

b Current purchased in bulk from De Beers Consolidated Mines.

c Electric light and water supplied by Bulawayo Waterworks Co., Ltd.

d Supplied by Messrs. E. H. Gellender & Co., Ltd.

e Current supplied by Victoria Falls & Transvaal Power Co., Ltd.

f Plant installed in March, 1913.

g Current supplied by South African Railways.

TRADE OF CANADA.

A REPORT on the trading position in Canada by H.M. Trade Commissioner has just been issued by the Board of Trade (Cd. 8,270, Price 3d. Wyman & Sons). An extract is given below of such portions of the report as will be of interest to the electrical and allied trades:—

Encouraging Outlook.—Since December, 1914, orders from the Allies to Canadian manufacturers have continually increased, and, as reflected in the trade returns, there resulted a trading balance of exports over imports of over \$200,000,000 in favour of the Dominion for the calendar year 1915. To realise the full meaning of this balance, one must remember that, until 1915, Canada had not experienced for many years a balance in her favour on a complete year's trading.

Apart, however, from their intrinsic value, the orders for munitions and equipment have been of great educative value to the Dominion, and now she has a very considerable body of persons skilled in the use of machinery and in the manufacture of many articles which, but for the war, might never have been manufactured in Canada at all. The result, from this point of view alone, bids fair to be of the greatest value to the country in its future industrial development.

For the coming year, 1916, Canada offers an exceptionally strong and tempting market to those firms who are in a position to offer and supply commodities which she is prepared to purchase. In short, as a consequence of greatly increased returns from agriculture, mining, fisheries and industries in 1915, she is now a buyer of greater potential strength than she has been for years past. It is, therefore, all the more regrettable that British manufacturers, who have experienced poor trade during recent years, will be less able than ever to secure a share of her increased orders on account of inability to make deliveries.

Imports of manufactures of metal and machinery from the United Kingdom fell very seriously in 1915. The British position has been weak owing to the competition from the United States, and, for the period under review, as a result of the

demands made at home on the United Kingdom manufacturer, a substantial decrease could hardly be avoided. The percentage of imports from the United Kingdom in 1915 (7.7) showed a relative loss of position of 50 per cent. in comparison with 1913 (15.3 per cent.).

Many municipalities will ask their ratepayers early in 1916 to vote upon the question as to whether they will take part in the proposed scheme of electric railroads in Ontario. The municipalities agreeing to do so will operate the railways and the Ontario Hydro-Electric Commission will supply the power. The coming year should witness something definite in regard to this scheme.

The Ontario Hydro-Electric Commission will probably be for some time to come one of the largest purchasers in this market for motors, copper wire, insulators, sluice gates, generators, and power plant generally, and it would be advisable for the Canadian representatives of United Kingdom firms to keep in close touch with the Commissioner's offices.

Preference and its Effect.—The preferential duties accorded to United Kingdom goods entering Canada may be taken as an expression of the desire of the Canadian Government and people to give some assistance to the United Kingdom manufacturer, and they have actually been of some service in the desired direction. In practice, however, it has been found that the preference has not operated to an extent nearly as much as was anticipated at the time of its introduction.

In the quinquennial period 1901-1905, the average amount of duty per centum on dutiable goods coming from the United Kingdom was less than that on dutiable goods coming from the United States, but for the later periods the United Kingdom goods have paid the greater percentage duty. The explanation is that lower duties are payable on entry into Canada on the articles which form the staple trade of the United States with Canada, than on those articles which form the staple trade of the United Kingdom with the Dominion. For example, the average *ad val.* rate of duty paid on manufactures of iron and steel is about 21 per cent., whereas the average *ad val.* rate of duty paid on manufactures of wool is about 29 per cent.

The operation of the Freezing Clause in the Canadian tariff is not in accordance with the preferential duties granted to United Kingdom goods. The Special Duty under this Clause is levied on the Canadian home manufacturer.

United Kingdom trade gains little from the preferential rate of duty on the value of packages or coverings, as United States traders rail goods cheaply crated and, on occasion, without any crate or case whatever. It gains nothing from the provision, under the Customs Act, that duties generally shall not be charged on less than the invoice value in the case of goods sold to persons in Canada prior to their importation into Canada. Probably the larger proportion of United Kingdom goods are sold under these conditions. But, while Canadian firms with capital are able to purchase and import direct in *proportions*, although the goods may actually be sold prior to shipment), and can thus pass the goods through the Customs on "domestic value" without question, when over a little acts as an agent, and sells on commission, the price to the Canadian buyer necessarily includes the "agent's commission," on which duty is also levied.

Importation by Sea. The opening of branch works by the United States manufacturer across the border is a noticeable feature in the industrial life of Canada. The importance of the operations carried on by these branches naturally enough varies considerably, for while some branches are engaged largely in assembling plant, others carry on a genuine manufacturing business, and many manufacture a portion of an article in their Canadian works, and utilise imported parts for completing the article. The latest particulars indicate that the number of United States branch works established, and in operation, in Canada is about 409, of which 329 are situated in Ontario.

The ease with which a branch of a United States works can be established, maintained, and controlled from the parent works is, no doubt, one of the reasons for so many being established in Canada, and avoiding, by so doing, many tariff and transportation problems. It has been advocated that British concerns should act in the same manner, and though one or two have done so, the difficulties are so considerable that it is unlikely that many United Kingdom firms will endeavour to establish branch works in the Dominion. The expenses incidental to (1) ascertaining the probable success of the venture, (2) acquiring a suitable site for a factory, and (3) selecting machinery and equipment suitable to local power conditions and the class of labour available, are infinitely greater to a British concern than to an American; whilst the system used, the class of manufacture, the labour to be employed, and even the management, are all foreign to British ideas and methods. The whole subject, which is apparently so simple and easy to those who have not given close consideration to it, bristles with difficulties.

German Penetration. German methods of investigating market challenge comparison with British methods, and the comparison appears to indicate that the science of commercial penetration has not received in the past the same attention in the United Kingdom as in Germany.

One is perfectly familiar with reiterated advice to the British manufacturer to send travellers, and yet more travellers, into the Canadian market, and to publish catalogues in the currency of Canada, but it is clear that such advice is of little service unless accompanied with the necessary information as to the particular articles required by the market, and the communication of this information to those British manufacturers who are in a position to satisfy such requirements. In some such way only is it possible for British firms to judge whether an adequate return for the expense of sending travellers, and compiling catalogues in accordance with Canadian requirements, would ensue.

The German manufacturer appears to have had this advice and has attained a measure of success, as judged by the trade returns. It is clear that the considerable and carefully-trained German Consular service in Canada, coupled with a scientifically-conducted intelligence system in Germany itself, are responsible for the high average results which have been secured by those German manufacturers who have decided to establish export trade relations with the Dominion.

An actual case of the working of the German system will illustrate its efficacy. Two young Germans came to Montreal in the fall of 1912 to introduce a line of goods, and took a small office; neither had been to Canada before, but they had received advice that there would be a market for certain classes of articles. They worked hard for eighteen months, and at the end of that time had built up a considerable and profitable connection. When asked as to the reason of their success, they explained that they had come to Montreal equipped with information as to—

1. Likely buyers in Montreal, Toronto, and other towns in the neighbourhood.
2. The financial standing of such firms, and the names of men employed by these firms upon whom it was advisable to call.
3. The articles of Canadian or foreign manufacture that they would have to meet in competition, and the prices of such articles. And,
4. The customary terms of credit prevailing.

All this information had been available to them in Germany before they set out for Canada. Moreover, they were guaranteed sufficient living and office expenses, they knew that the principals whom they represented were well posted as to the details of trade, such as the preparing of invoices,

declarations, &c., in accordance with the Canadian Customs requirements.

There are no grounds whatever for believing that the average German manufacturer is more intelligently active in obtaining information as to the overseas prospects for his goods than the average British manufacturer, and one is forced to the conclusion that the German Government had a highly efficient organisation for conveying this information to such firms as could turn it to the best advantage.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

OF THE SPECIALISTS OF THE PATENT OFFICE BY MESSRS. W. P. THOMSON & CO.,
Patent Agents, 285, High Holborn, London, W.C., and at
Liverpool and Bradford.

- 10,095. "Method of producing high-frequency oscillations." I. CHORTK. July 17th.
- 10,096. "Interceptors of make-and-break devices for magnet ignition in internal-combustion engines." V. ROSSO. July 17th.
- 10,097. "Electric incandescent lamps." I. W. MEER. July 17th.
- 10,098. "Electrically-driven vibrator apparatus." F. G. BELL & SORLING. LEECH AND LEECH CO., Ltd. July 17th.
- 10,097. "Mirror reflector to be applied to electrical generating apparatus for incandescent purposes." W. F. LEE. July 18th.
- 10,099. "Electrically-actuated junction or circuit breaker of apparatus." BRITISH INSULATED AND HEATED CABLES, LTD., & C. VALENTINE. July 18th.
- 10,072. "Electric fuses or cut-outs." L. NEWITT. July 18th.
- 10,088. "Electric switches." M. BROOKS, J. E. FRANKS, A. E. READ & WATSON. HARDWARE MANUFACTURING CO. July 18th.
- 10,096. "Spoke-light for wireless telegraphy." J. BETHUNE & E. GRANGEAU. July 18th. (France, July 21st, 1915.)
- 10,099. "Multiple control apparatus for electric railways." A. L. GOS. BROWN, BOVERI & CO. July 18th. (Germany, July 29th, 1915.)
- 10,100. "Circuit-interrupting devices." BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO. (Westinghouse Electric and Manufacturing Co.) July 18th.
- 10,101. "Protective devices for electric circuits." BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO. (Westinghouse Electric Manufacturing Co.) July 18th.
- 10,103. "Generation of high-frequency currents." I. CHORTK. July 18th.
- 10,116. "Circuit-controllers." IGARIC ELECTRIC CO. (Cutler-Hammer Manufacturing Co.). July 18th.
- 10,122. "Operating means for electric circuits." I. CHORTK. (United States, July 22nd, 1915.)
- 10,126. "Sparkplugs for internal-combustion engines." G. ST. R. S. WATKINS. July 18th.
- 10,142. "Pendulum indicators for electric-bell systems, etc." I. H. PARSONS. July 19th.
- 10,102. "Electric photographic printing or copying frames." J. HALDEN & CO. and J. B. HADEN. July 19th.
- 10,174. "Incandescent lamp structure." BRITISH THOMSON-HOUSTON CO. (General Electric Co.). July 19th.
- 10,176. "Means for opening and closing electrical circuits." MARCONI'S WIRELESS TELEGRAPH CO. & R. H. WHITE. July 19th.
- 10,178. "Controls for electric motors." W. B. BENNETT. July 19th.
- 10,182. "Differentially metering electricity for lighting and heating." L. BIRKS & J. R. TEMPLE. July 19th. (New Zealand, March 2nd.)
- 10,183. "Apparatus for electro-deposition of metals." H. R. BRAD. July 19th.
- 10,184. "Insulation for electrical apparatus." E. HAEFELY & CIE. ART.-GES. (Switzerland, October 20th, 1914.)
- 10,193. "Electrolytic process for removing sulphide compounds from surfaces of articles of copper or copper alloys." P. MARINO. July 19th.
- 10,227. "Protective devices for alternating-current electric systems." A. E. MCCOLL. July 20th.
- 10,228. "Method of galvanizing copper to electric non-conducting substances." U. UNNO. July 20th.
- 10,234. "Telephone directory." W. H. ASTON. July 20th.
- 10,257. "Speed indicators and counters." EASTERN TELEGRAPH CO. July 20th.
- 10,272. "Means for cooling sparking-plugs for internal-combustion engines." J. KNIGHT. July 21st.
- 10,274. "Electrical transformers." BRUSH ELECTRICAL ENGINEERING CO. & F. W. SCOTFIELD. July 21st.
- 10,282. "Electric motor-driving gear." U. C. LEAO. July 21st.
- 10,297. "Devices for attachment to sparking-plugs for automatically cleaning and cooling sparking points." A. E. LAMKIN. July 21st.
- 10,303. "Telegraph systems." AUTOMATIC TELEPHONE MANUFACTURING CO. & S. R. SMITH & R. WOODLAND. July 21st.
- 10,335. "Thermionic devices." WESTERN ELECTRIC CO. (Western Electric Co.) July 22nd.
- 10,361. "Means of control for petrol-electric vehicles." P. F. SMITH & THILNE-STEVENS, LTD. July 22nd.

PUBLISHED SPECIFICATIONS.

1914.

- 2,530. TELEPHONE EXCHANGE SYSTEMS IN WHICH THE CONNECTIONS ARE ESTABLISHED THROUGH ELECTRO-MECHANICALLY CONTROLLED SWITCHES. F. ALDENFORD. January 20th.
- 17,022. FILAMENT SUPPORTS FOR ELECTRIC INCANDESCENT LAMPS. JULIUS PINTSCH ART.-GES. July 17th. (February 11th, 1914.)
- 17,023. INCANDESCENT ELECTRIC LAMP ELEMENTS AND THE METHOD OF MOUNTING THE SAME. JULIUS PINTSCH ART.-GES. July 17th. (February 16th, 1914.)

1915.

- 6,486. WIRELESS TELEGRAPH AND TELEPHONE SYSTEMS. L. de FOREST. April 30th.
- 9,476. APPARATUS FOR COILING WIRE. BRITISH THOMSON-HOUSTON CO. (General Electric Co.). June 29th.
- 9,496. TELEGRAPH RELAYS. UNITED TELEGRAPH AND CABLE CO. and W. M. BRUER, JUNR. June 29th.
- 9,690. ELECTRON-DISCHARGE APPARATUS AND METHOD OF OPERATING THE SAME. BRITISH THOMSON-HOUSTON CO. (General Electric Co.). July 2nd.
- 9,838. MANUFACTURE OF ELECTRIC HEATING ELEMENTS. H. J. DOWLING AND D. HENTLEY. July 6th.

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THE DEVELOPMENT OF A NATIONAL POLICY.

BRITISH industry has every reason to be satisfied with the House of Commons discussion on the resolutions of the Paris Economic Conference of the Allies. The Prime Minister asked the House and the nation to "envisage . . . the new conditions of a world-wide problem" and to take part in securing for the future true, well-grounded, and lasting economic independence, as well as protection against the possibility of military domination. We need hardly urge those who are interested in future trade and industrial policy to read the full reports of the debate from beginning to end; they will probably have done that already. The Premier explained that three of the most important resolutions were drafted by Mr. Runciman, the President of the Board of Trade, were approved by Mr. Bonar Law, the Colonial Secretary, and were heartily agreed to by the Australian and Canadian statesmen who attended the Conference. Together with the other resolutions in the series, they were unanimously and unhesitatingly accepted by the whole of the Allied representatives, and finally they have been formally and publicly adopted by both the French and the British Governments. Credit should be given ungrudgingly to Mr. Runciman for reflecting in those three resolutions our determination to refuse to grant most-favoured-nation treatment to any of the Enemy Powers for a term of years, thus ensuring the freedom of the Allies to make such commercial agreements between them, or with neutrals, as they may please; our determination to protect ourselves against dumping or unfair competition; and our intention to adopt measures to render the Allies independent of enemy countries as regards essential industries. But while credit should be accorded to Mr. Runciman, we would not be slow to acknowledge the very definite progress made by the Premier himself. His historic speeches delivered on great occasions since the outbreak of war have left no room for doubt as to the Allies' intention to crush the power of Prussian militarism. In his Economic speech of August 2nd, 1916, he was equally plain in expressing the fixed determination of the Allies, and therefore of the British Government, to guarantee our industries and trade against the penetrative machinations of Germany, and to work out a policy of common action which will ensure the stability of our industry and finance. From the intentions expressed in this speech there can be no turning back—nor will there be any such desire, for the great body of national opinion is behind the Coalition Government in this matter, and those who elect to parade under the banner of Simon, Snowden, and company will have many spectators but few followers. Our accepted epithets in

regard to the enemy become stronger as each successive act of inhumanity puts him further beyond the pale of Christian civilisation. "Barbarian" was good enough for most of us a short time ago; now we are unhesitatingly agreeing that "Beast" is the more appropriate. Whining by the Beast itself, or solicitations on its behalf, will not avail; no quarter can be allowed if the Freedom of the People is to be preserved. Mr. Asquith seems to have received convincing information respecting the preparations that the enemy is making for impeding the industrial and commercial recovery of the Allies, for attacking Allied markets, and for a vigorous and, if possible, victorious competition in neutral markets. In possession of this information, and backed by the strong convictions of his colleagues and those of the nation generally, John Bull throws back his shoulders, clenches his teeth, and is unalterably determined that in as far as it is possible for him to prepare against all this he will be ready. His strong hand is ready to enter into action; we have to see to it betimes that the weapon is there, else it may be too late. This is how we interpret the attitude of mind to which the Government has arrived. But the debate was not only acceptable because it contained the Premier's definite interpretation of the Cabinet view. It is important because it drew from all sides of the House confessions, if we may use the word, that "the war had altered everything," and that they were "prepared to alter their opinions and methods"; that Shibboleths which were useful and even sincere before the war were among the "everything" thus inevitably altered. As we have suggested already on several occasions, the old fiscal controversy should be considered buried; we shall all live in an altered world, and through a long period of reconstruction, rehabilitation, and strengthening operations, and in those years of regulation of inter-Allied economic relationships, pettifoggish discussions as to Free Trade *v.* Protection must be regarded as more or less pre-historic. The Allies have got to protect themselves against their enemies. We have recorded during the past two years all the various measures that have been taken to deal with enemy trading, and to clear out as far as practicable the very roots of Teutonic influence where it has cumbered British ground; also the efforts of the Board of Trade and the appointments of committees relating to the utilisation of Empire resources, to scientific and industrial research, to finance, and so forth. All of these matters were briefly reviewed by the Prime Minister in his summary of the steps leading up to the Economic Conference and the Governmental approval of its policy. There are to follow the efforts of the Conference, and of all these committees and Government departments, conferences at which the representatives of the Dominions and India will go into the whole question of the Empire's trade policy considered in the light of the Paris resolutions. Mr. Bonar Law, in the course of his gentle handling of Sir J. Simon, gave it as his belief that the probable effect of a tariff on the future position was greatly exaggerated by both parties in fiscal controversies, and we believe that most of our readers who endeavour to "envisage . . . the new conditions of a world-wide problem," and who remember the vast number of questions that there are involved in this great problem, will be strongly inclined to agree with him that the whole matter "is really a question of organisation more than of the method by which you are to carry out that organisation."

Ever since, owing to the stoppage of German supplies by our blockade, the importance of our manufacturers launching out upon new industries became recognised, there has been something akin to nervousness among our firms and financiers as to whether capital laid out upon such industrial

developments during the war would have to be sacrificed after the cessation of hostilities owing to weak policy of the Government of the day. Mr. Asquith, by his latest declaration, is a determined anti-dumper, and will brook no unfair competition from the enemy. Here then, unless he should eventually let the manufacturer down in a most unworthy manner—which we do not think he would do if he could, nor could he if he would against so strong a national feeling—is something in the nature of an assurance such as industry has asked for for two years. We endorse the opinion of Sir J. Randles that Mr. Asquith's statement would assure those engaged in British industries that they could with safety undertake developments and prepare for an increased production of goods for sale abroad. We hear many things, about which we are not permitted to write, proving that in a number of departments of electrical and allied activity our manufacturers are by no means neglecting the present opportunity, but we may be pretty sure that as the feeling of future security grows upon our industrial authorities they will be encouraged to take in hand many new lines, previously regarded as enemy preserves, and to complete their schemes and organisations for increased productivity for both home and export consumption.

RATHER more interest has been
centred on the position of pig lead

Lead. lately, while the market, after some further weakening, has experienced a renewed upward movement. Prices fluctuated considerably within the last few weeks. Towards the end of last month the tendency was affected by the efforts made by the authorities to keep down prices, although the sales of controlled lead were of an intermittent character. Offers from that quarter having for a time practically subsided, the general tendency improved with decidedly more interest displayed by consumers in all positions. The improvement from the lowest represents about 20s. to 30s. a ton. Prices dropped at one period to about £27 10s. for early shipment, recovering to about £29. The discount on forward metal, which had increased up to fully £2 a ton when the price for that position fell to about £26, has been latterly reduced to roughly 10s. a ton. The position of the market remains entirely under Government control, but the fact is worth mentioning that the very liberal extent to which buyers were met in the open market in recent weeks from controlled sources would appear to have reduced the available supplies to dimensions which eventually prompted the authorities to re-purchase some of the lead sold recently. This feature is rather interesting, and may possibly be due to delayed arrivals combined with the filling of additional requirements for munitions. As it is, however, the statistical position is more obscure than ever in the absence of complete returns of arrivals.

It is estimated that in the course of last month roughly 3,500 tons of Government metal were scattered on the open market, so that the latter has shown rather more resistance than generally anticipated. Consumers were evidently very short of stock, and although they have now been fairly well filled for the time being, the demand still seems to be pretty good. Export business has remained practically at a standstill since licences are virtually unobtainable, which, of course, compels some consuming countries to draw supplies direct from elsewhere. In the case of Russia, however, it is understood that a fair tonnage was recently diverted from here to that country via Vladivostok, in accordance with the special arrangements in force between the British and Russian Governments. France continues to import heavy quantities, her takings from Spain for the first five months of this year being

well over 27,000 tons, or an excess of, roughly, 10,000 tons and 21,000 tons respectively as compared with the same period for the two previous years. For the time being, there is certainly no excess of supplies on this side over current needs, and unless the arrivals again increase, the chances are that the market may improve further. There are still freight difficulties to contend with, so that no reliance can be placed on regular arrivals. The fuel scarcity in Spain still tends to impede the progress of the output, but judging from the fact that the exports from that country so far this year are considerably more than last year, operations have proceeded as well as could have been expected, in spite of the temporary labour disturbances. There has not been much alteration in the American position, where prices, though weaker, are still well above shipping parity, so far as the London market is concerned. Prices are now not a long way below the highest point recorded in the past year, although showing a big fall from the extreme highest touched some months ago., after the enforcement of the Defence of the Realm Act.

Signalling in Mines.

We are glad to see that in the further investigations conducted by Dr. R. V. Wheeler into the question of electric bell signalling with bare wires in mines, he has had as collaborator Prof. W. M. Thornton, whose knowledge of the subject of ignition of inflammable gases in mines is of unique extent and authority. The joint report, of which we give an abstract in this issue, contains additional particulars regarding the characteristics of the bells at present in use, which suggest that practice in bell design is very diversified; the same remark applies to relays, which have also been tested. In the case of the latter, the sensibility of the apparatus appears to be much in excess of the requirements, with the result that the self-induction of most of the relays is greater than that of the bells, and consequently the break-flash is more dangerous. Fortunately, both bells and relays can easily be made perfectly safe by simple means, such as the provision of a short-circuited winding or a copper sleeve on the electromagnets, the addition of non-inductive resistance to the circuit, or shunting the magnet coils with a high resistance. The authors conclude, therefore, that there is no need to reduce the battery power at present permitted, and that there is no difficulty in constructing bells and relays incapable of causing the ignition even of the most inflammable mixture of air and methane.

An interesting fact has been revealed by their investigations—namely, that the iron cores of mining bells and relays are generally small, and are liable to be saturated. With reference to this and other details, they discuss the components of the bells on mathematical lines, which are hardly convincing; apparently they adopt as a criterion of the combined efficiency and safety of the bell the ratio of the sounding-power to the minimum igniting current, and would make this ratio as great as possible. But the greater the minimum igniting current, with a given voltage, the safer is the bell, a condition directly opposed to the authors' view, and it would be interesting to know why they adopted this peculiar standard.

The Wire-drawing Industries.

VERY little change in the position of the leading wire manufacturing firms in this country appears to have taken place during the past few weeks, with the exception, perhaps, of the increased slackness in the shipping section, which has been subjected for some time past to increasing restrictions from the War Trade Department. The uncertainty caused by fluctuations

in the price of copper has necessitated increased caution among buyers of the metal in both the raw and the manufactured states. The requirements for war material continued to be good, and there is not, apparently, much reason for anticipating a serious diminution of orders in this section for some time to come. From America the information is to hand that several of the leading German wire manufacturing firms have recently displayed some important concern as to the possibility of failure to recapture the trade previously done with this country in copper wire, strip, &c., which, in 1912, exceeded £317,000. The success or otherwise of this future effort of the German firms will depend very largely upon the solidarity of principle and uniformity of purpose with which the British wire manufacturers view the question in the meantime.

Long-distance Transmission in Germany.

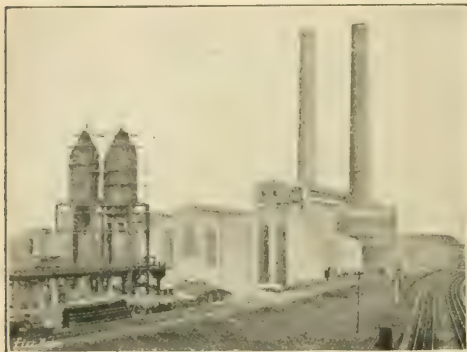
It is now a matter of recent history that the Berlin Electricity Works Co., which possessed a practical monopoly of the supply of energy for lighting and power purposes in the German capital, intended to overcome the difficulties incidental to increasing the output so as to cope with the growing demand, by the erection of a huge generating station at the lignite mines of Golpa-Jessnitz, near Bitterfeld, which the company acquired for this and other purposes, and the projected transmission of energy to the works in Berlin for conversion and distribution among consumers. But the recent purchase of the company's undertaking by the Berlin Municipal Council for over £6,000,000, which sum is now stated to have been paid over, caused the transmission scheme to be abandoned in so far as the company was concerned. The transfer of the undertaking to municipal ownership, however, has not prevented the establishment of generating plant at the lignite mines in question, although the power there produced has been requisitioned by the Government for the Imperial nitrate works for the extraction of nitrogen from the atmosphere, concerning which no information has been allowed to be placed at the service of the public. On the other hand, the Berlin Municipal Council is now confronted with precisely the same difficulty as that which applied to its company predecessor, and hopes were entertained that it might be surmounted by obtaining an additional supply from the great power station which the Prussian State Railway authorities are erecting, also in the vicinity of the Bitterfeld lignite district, for the transmission of energy to Berlin in connection with the decision to convert to electric traction the metropolitan and circle railways in the capital, which was sanctioned by the Prussian Parliament a few years ago. It is, however, to be feared that this idea will be scarcely capable of realisation, as the authorities of the province of Brandenburg, who have just acquired the Mark electricity works from the A.E.G., have already concluded a contract with the State Railway Administration for a large bulk supply of energy to be furnished by the State works at Bitterfeld to the province for the scheme of development in Brandenburg in connection with the Mark works. Under the circumstances, the Berlin Municipal Council proposes to acquire a colliery in Westphalia in order to assure itself of coal for the municipal gas works, and lignite mines for the supply of fuel for a projected generating station in one of the lignite districts. As the former is distant from Berlin by 235 miles, it would scarcely come into consideration in a transmission scheme, quite apart from the question of obtaining wayleaves, whilst only about 80 miles separate Bitterfeld from Berlin in a straight line. It is understood that offers of mines in both districts have already been made and are now engaging the attention of the Municipal Council.

THE L. & N.W. SUBURBAN RAILWAY ELECTRIFICATION.

FOR some considerable time the electrification of the suburban routes operated and controlled by the London and North-Western Railway Co. in the London area has been quietly proceeding, and the work has now reached a stage when some indication of the present position may be of interest to our readers. As far back as December, 1912, we briefly described the proposed features of the scheme, which originated with the Parliamentary powers obtained by the company in 1907, authorising the construction of a new line from Euston to Watford running alongside the main line. This scheme was subsequently amplified, and

Willesden—Richmond section, it will be only a matter of a few weeks before this route is electrically operated. The remaining portion of the scheme, *i.e.*, the original Euston—Watford line, has involved many serious engineering problems, including the construction of entirely new permanent way for the electrical service over the whole of the route, with new tunnels at Kensal Green and Primrose Hill, the former of which have been in use for the "Bakerloo" trains running to Willesden while the Primrose Hill tunnels, nearly a mile in length, are still under construction.

These tunnels are the largest yet constructed by the shield method, being 16 ft. 4 in. in internal diameter, each accommodating a single track. Contemporarily with this work the permanent way at Chalk Farm, nearer to Euston,



THE L. & N.W.R. CO.'S STONEBRIDGE PARK POWER STATION.

now embraces the electrification of the North London Railway from Broad Street terminus to Chalk Farm, and the North-Western's line from Camden Town *via* Hampstead to Willesden (high-level station), together with the connecting portions of the West London and District lines to Earl's Court; also the route from Willesden to Kew Bridge and Richmond, over the North and South-Western Junction and South-Western Co.'s lines.

A physical connection has also been made at Queen's Park Station with the Baker Street and Waterloo tube railway, with a view eventually to providing through



FIRST L. & N.W. ELECTRIC TRAIN IN RICHMOND STATION.

has been reconstructed, under the direction of Mr. E. F. C. Trench, chief engineer to the company.

New lines are being provided at three different levels, and all the existing permanent way, with the exception of the down fast track, has required alteration.

Provision had to be made for the existing slow lines between Euston and Chalk Farm to be used by electric trains as well as steam trains.

Under the scheme adopted, the down electric line is carried in tunnel from a point south of the old Primrose Hill tunnels under all the existing lines to Loudoun Road; the up electric line passes through a tunnel from Loudoun Road to the junction at Chalk Farm with the existing up slow line. The up fast line is carried over the slow lines on a fly-over bridge, and an underground junction is provided with the electrified North London line at a point north of the junction of the new electric lines with the existing slow steam tracks. Much heavy engineering work has been necessary to obtain the desired end, and it is expected that not only will it be possible to run a 10-minutes' electric service between Euston and Watford, but that greater freedom will be allowed for slow steam traffic north of Chalk Farm.

The whole of the electrical equipment in connection with the scheme is being carried out under the superintendence of the company's chief electrical engineer, Lieutenant-Colonel F. A. Contez-Leigh; the greater part of this work has been completed.

The generating station is situated at Stonebridge Park, on a 17-acre site, and has an initial capacity of 25,000 kw.; adjoining it are the main repair shops for the electric rolling stock. The general arrangement of the power station follows on usually accepted designs; the boiler house, with a central firing floor and overhead bunkers, contains 20 Babcock and Wilcox boilers, equipped with drop-link automatic stokers and coal-weighing machines, and designed to



ROUTE PLAN, L. & N.W. SUBURBAN RAILWAY ELECTRIFICATION.

travelling facilities between Watford and the Elephant and Castle—a busy traffic centre in South London.

As many of our readers are aware, the "Bakerloo" tube railway connection has been in operation for a considerable time, the trains running as far as Willesden; this also applies to the Earl's Court—Willesden section, which was the first one to be completed, and now, trial trains having given satisfaction on the North London's Broad Street—

evaporate 25,000 lb. of water each per hour, and supply steam at 200 lb. pressure, superheated 200° F.; the gases discharge through Green economisers to two 240-ft. chimneys.

Coal is delivered in wagons from adjacent sidings to two elevated coal roads, the wagons discharging their contents into hoppers underneath, which feed two tray conveyors, these in turn delivering the fuel into two bucket conveyors which pass up the end of the building and over the boiler-house bunkers, returning at practically the same level, as the ashes are removed by a separate pneumatic discharge plant in the basement delivering to the two outside storage bins shown in our view.

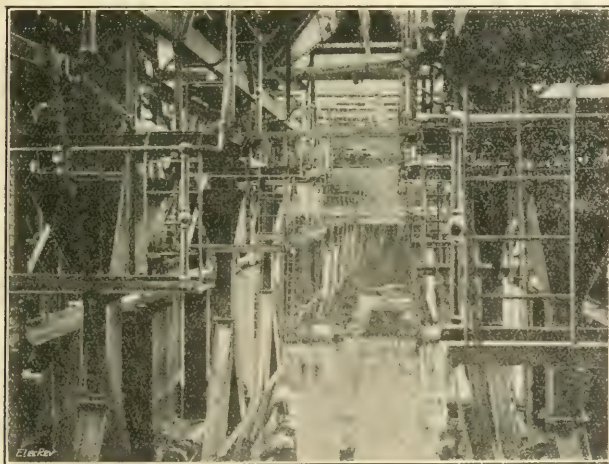


STANDARD L. & N.W. ELECTRIC TRAIN WITH OERLIKON EQUIPMENT.

A portion of the fuel discharged from the elevated coal roads is stacked, provision being made, we understand, for storing 20,000 tons outside.

The whole of the water required for the plant is obtained from two artesian wells, with compressed air lifts; this water is delivered to a large reservoir, over part of which a battery of eight Balcke cooling towers, has been erected. The same water is used for boiler-feed purposes after being passed through a softening plant.

The engine house contains five 5,000-kw. Westinghouse-Siemens three-phase turbo-alternators delivering current at



BOILER HOUSE UNDER CONSTRUCTION. STONEBRIDGE PARK POWER STATION.

11,000 volts and 25 cycles. An auxiliary low-voltage set is installed for driving auxiliary machinery and for lighting purposes; this consists of a tandem set, including a 500-kw. 440-volt alternator and exciter, and a 120-kw. 220-volt direct-current machine. In the ordinary way the auxiliary a.c. station motors will be supplied through transformers from the main bus-bars, but, when the large units are shut down, the small set can be utilised for this purpose, or for supplying through step-up transformers to the sub-stations.

There are 11 of the latter, situated at Stonebridge Park, Bushey, Headstone Lane, Kenton, Willesden, Queen's Park, West End Lane, Dalston, Broad Street, Acton, and Chalk Farm. A standard equipment is provided, consisting in each case of three rotary converters, of either 750 or 1,000-kw. capacity, nine single-phase static transformers of the Berry oil-cooled type, a storage battery and automatic reversible booster of the Entz type.

The Chalk Farm sub-station is the old gas-engine power station reconstructed; this plant has for some years



WAREHOUSE RUNNING SHED FOR ELECTRICAL STOCK

supplied energy for lighting purposes to Euston Station, for which service three rotary converters are now employed, while for traction purposes three large rotary converters are also installed at Chalk Farm. It is intended that the small generating unit at the main power station shall supply the current for lighting through this sub-station when the big units are shut down and the electric trains not running. The rotary converter equipment, including six 1,000-kw. and 25 750-kw. rotary converters of the self-synchronising type, has been supplied by the British Thomson-Houston Co., who also supplied the main H.T. switchgear at the power house.

The H.T. feeder cables, of the three-core, paper-insulated, lead-covered and armoured type, were supplied by the British Insulated and Helsby Cables, Ltd. The electrical equipment of the tracks naturally conforms to that of the various connecting electric railways over which running powers are exercised. Outside positive conductor rails are employed, at about 600 volts pressure, to supply the collecting shoes on the trains; a negative rail is provided between the running rails, and the latter may be used for track circuiting and automatic signalling. The conductor rails, of special low carbon steel, having about $6\frac{1}{2}$ times the specific resistance of copper, weigh 105 lb. per yard, and are mounted on Doulton porcelain insulators, attached to the sleepers by malleable iron clips, while special anchor insulators are provided at intervals to prevent creeping of the rails. Each rail joint is bonded by four flexible strip bonds having a copper area of 1.4 sq. in.

The trailing ramps are of cast iron, and the leading ramps on through lines are of forged steel, and in some cases, as on sidings, of special cast steel. The jumper cables are laid solid in bituminised-fibre troughing, and fitted with the Cortez-Leigh patent sealing terminal.

Three coach train units, consisting of a motor coach, trailer, and control trailer, have been adopted, either one or more units forming a train, according to traffic requirements. The motor cars are equipped with four 250-h.p. motors, two to each bogie truck, and the usual multiple unit control equipment is provided.

The first trains used on the Willesden-Earl's Court section were supplied by the Metropolitan Carriage, Wagon and Finance Co., and had Siemens equipments; the Metropolitan Carriage Co. is also building the new standard motor-coaches, while the remainder of the electric rolling



TURBINE PLANT, STONEBRIDGE PARK POWER STATION.

stock is being constructed at the London and North-Western Co.'s works at Wolverton.

Certain improvements have been incorporated in design, and the electrical equipments, while generally similar, are being supplied by the Oerlikon Co. Our views show a recently-constructed three-coach train, also the arrival of the first North-Western electrical train at Richmond station recently; other views give a good idea of the power station and sub-station equipment, which is, however, now practically completed.

In conclusion, we are indebted to Lieutenant-Colonel Cortez-Leigh and the electrical engineer's department of the company for the information and views here reproduced.

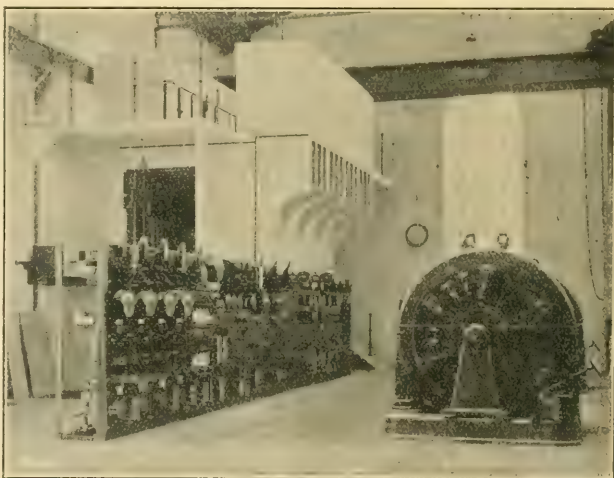
Tungsten Lamp Patent Upheld.—

The United States Court of Appeals has affirmed the decision of Judge Mayer of the United States District Court for the Southern Division of New York on the Just and Hannaman patent No. 1,108,502 for "incandescent bodies for incandescent lamps." The suit was won by the General Electric Co. against the Laco-Phillips Co., which imports all of its lamps from Holland. Both the squirted

ELECTRIC SIGNALLING IN MINES.

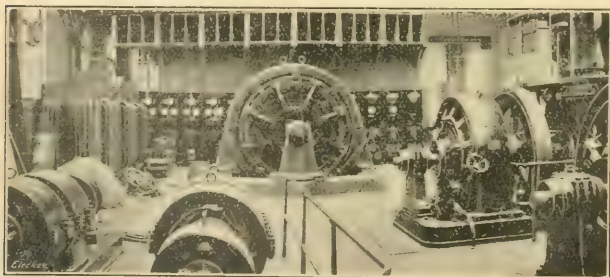
LAST week a further report on electric signalling with bare wires, with regard to the danger of ignition of inflammable gaseous mixtures by the break-flash at the signal-wires, was issued by the Home Office. The report is signed by Dr. R. V. Wheeler, of the Home Office experimental station at Eskmeals, and Prof. W. M. Thornton, of Armstrong College, Newcastle-on-Tyne, who has collaborated with Dr. Wheeler in the investigation. Particulars of the previous report were published in our issues of June 11th, 18th, and 25th, 1915; it was then shown that the break-flash could readily ignite inflammable gases, and must be regarded as "open sparking," but that the flash could be rendered harmless. The present report defines the precautions necessary to attain this result.

The conclusions of the former report have been amply confirmed by further experiments, and a large number of bells have been tested, some of which were found dangerous with a voltage as low as 4.5 volts, whilst others were safe at 25 volts. The resistances of the windings of 15 bells varied from 9 to 52



ACTON SUB-STATION, L. AND N.W. RAILWAY ELECTRIFICATION.

ohms; the minimum ringing current ranged from 0.05 to 0.29 ampere, with little relation to the resistance, and the self-induction from 0.37 to 2.43 henries. The minimum igniting current at 25 volts, 0.08 ampere, was obtained with the most inductive bell, and the maximum, 0.23, with one of the least inductive. The greatest resistance that could be inserted in the bell circuit without preventing the bell from ringing, a quantity which has been given the inappropriate title of "battery efficiency," was determined for 25 and 15 volts, with dry and wet Leclanché cells; it was somewhat greater with the dry than with the wet cells, and varied erratically with the make of bell. At 25 volts, with dry cells, the lowest inserted resistance was 72 ohms with a coil of 11 ohms, whilst 170 ohms could be put in series with a coil of 9 ohms, and another of 11 ohms; yet a bell of 25 ohms



CHALK FARM SUB-STATION, SHOWING TRACTION ROTARY CONVERTER, &c.

and drawn-wire filament lamp imported by the defendant were held to infringe the patent.—*Electrical World*.

could not ring through more than 95 ohms added resistance, whilst one of 289 ohms attained the record of 400 ohms.

One of these 15 bells (that of 25 ohms, mentioned above) had a parallel short-circuited winding to absorb the electro-magnetic energy stored in the coil, and with this no ignition could be obtained below 1.14 amperes at 41 volts. Another bell, wound to 106.8 ohms and provided with a copper sleeve for the same purpose, gave no ignition below 0.35 ampere at 41 volts; and one which was wound with brass wire of 120.5 ohms resistance gave ignition with 0.17 ampere at 22 volts. The last three bells required minimum ringing currents of 0.20, 0.07, and 0.06 amp, respectively, and two of them (those provided with a short-circuited winding or copper sleeve) were clearly safe. The mixture of inflammable gases used for the test consisted of 8 per cent. natural methane in air.

In many cases, the minimum igniting current (at 25 volts) was but little greater than the minimum ringing current; in some cases it was *even less*, and most of the bells would give dangerous break-flashes on the wires, except at distances from the bell so considerable that the resistance of the line reduced the current below the igniting value.

The use of wet cells is recommended, to keep down the maximum value of the current, and as this is already almost universal practice, no difficulty should be met with in making it compulsory; but it is not thought advisable to reduce the maximum voltage allowable below 25 volts. Some types of bell at present in use are unsafe even with three or four volts, whereas bells provided with anti-sparking devices are safe at 25 volts.

Experiments were also carried out with relays, on the same lines. Nine types, with resistances ranging from 9.8 to 250 ohms, produced ignition at the signal wires with from 2 to 10 wet cells in circuit, and minimum igniting currents from 0.05 to 0.20 amp. at 15 volts. Their inductances ranged from 0.52 to 2.50 henries, and the minimum working currents from 0.005 to 0.042 amp., whilst the resistance that could be inserted in circuit with 15 volts ranged between 240 and 1,880 ohms, quite erratically. Two other relays had parallel short-circuited windings, and no ignition could be obtained with a battery of dry cells at 25 volts. These relays, which were obviously safe, had respectively resistances of 510 and 515 ohms, and minimum working currents 0.006 and 0.015 ampere, and could work with 1,100 and 240 ohms in circuit at 15 volts. In most cases 10 volts was ample to ensure the operation of the relays, but the higher inductances brought about the result that in general the minimum igniting currents were less than those of bells.

The report proceeds to explain the general theory regarding the working of bells, and an oscillogram is given showing that the voltage across the trembler contacts of an ordinary bell may reach nearly 150 volts. When the circuit voltage is low and the inductance high, as in a bell-signalling system, the minimum igniting-current for the break-flash is inversely proportional to the inductance, so that the product Li is practically constant; the mechanical rate of breaking being maintained constant, the value of di/dt is proportional to i , and hence the inductance voltage, $L di/dt$, is also constant. The authors conclude that "ignition by a rapid break-flash at a low circuit voltage depends on the inductance voltage at which the flash is formed, and the igniting power of the flash is proportional to the product Li . When the break of circuit is made slowly, the igniting power of the flash has been found to depend upon its energy, $\frac{1}{2} Li^2$. There are thus two limiting conditions for the igniting power of the flash: at the one the inductance voltage is of importance, at the other the energy." Between these limits the igniting power of the flash may be proportional to some intermediate function of i , and the authors instance the results quoted in the previous report, in which $Li^{1.4}$ was constant; we drew attention to this point in our issue of July 16th last year.

"The inductance voltage $E_s = L di/dt = k Li$, where k is a constant. Since $i = E/L$, therefore $E_s = k LE/L$. The inductance voltage is thus inversely proportional to the resistance of the circuit when, as can be considered roughly the case in practice, the battery-voltage and inductance are constant. In so far, therefore, as the ignition of inflam-

mable mixtures is dependent on the product Li , ignition can be prevented by the use of high-resistance windings and high-resistance batteries. The energy of the break-flash, $\frac{1}{2} Li^2$ or $\frac{1}{2} LE^2/L^2$, is even more dependent on the circuit resistance, being inversely proportional to its square."

A series of experiments on the efficiency of bells was carried out, from which it was concluded that the minimum ringing current was obtained with a low tension on the spring which controlled the armature; the rate of ringing for a given current was practically independent of the tension on the spring and the length of the air-gap; of the ringing force the same could be said, this being most affected by the distance of the hammer from the gong. Hence it is advisable to use as light a spring as will suffice to maintain good contact at the trembler, and to return the armature to its first position after the ringing blow has been given. With regard to the electrical efficiency, the magnetic pull of the core upon the armature varies as the effective area of the core face and the square of the mean flux density in the air-gap; when the reluctance of the gap is large compared with that of the iron in the magnetic circuit, so that the flux density is roughly proportional to the ampere-turns, the pull is proportional to the square of the ampere-turns, and therefore inversely to the square of the resistance of the winding, with a given voltage. The number of blows per second upon the gong depends upon the duration of the current at each make of circuit; actual records from a number of bells give an average period (with ten wet cells) of $3 L/r$, so that the number of blows per second is $\frac{1}{3} r/L$. The product of the pull and the number of blows per second may be taken as the total mechanical energy expended per second of continuous ringing, and is therefore seen to vary inversely as the resistance of the circuit.

On theoretical grounds, the authors conclude that when the igniting power of the break-flash is proportional to Li , the more turns of wire the magnet coils have, the greater is the ringing power of the bell per igniting-current ampere; the same holds good when the igniting-power of the flash is determined by its energy, $\frac{1}{2} Li^2$, the voltage and resistance of the circuit being constant. This gives the "safest-efficient" bell, apart from the use of special devices. This conclusion was put to the test, and it was found that for every bell and size of winding wire there was a definite number of turns at which the efficiency of the bell combined with "safety" of the self-induction break-flash reached a maximum. Mining bells and relays have iron cores of such small cross-section that the iron becomes saturated at quite low currents, and, contrary to expectation, their inductance is controlled by this factor and not by the reluctance of the air-gap. Further experiments led to the conclusion that the most efficient mining bells should have bobbins wound with from 25 to 30 layers of fine wire, and that the diameter of the core should be between 0.4 and 0.5 that of the bobbin.

To make bells and relays safe, it is not essential to employ special devices; the resistance of the winding can be so proportioned that the maximum current obtainable on short-circuit does not exceed the minimum igniting current for the system. This can be accomplished either by including a non-inductive resistance in the circuit, or by winding the coils with a wire of high resistance; as already stated, a bell wound with brass wire, having a resistivity six times that of copper, could not ignite the most sensitive mixture with the maximum current obtainable from a battery of wet cells at 25 volts.

To lessen the break-flash voltage by retarding the change of magnetism on breaking the circuit, either a parallel short-circuited winding, copper sleeves, a shunt resistance, or layers of tinfoil can be employed, with satisfactory results.

After detailing various sources of current for the signalling system, showing preference for the wet Leclanché primary battery on the score of safety, the authors state the following conclusions:—

1. As a result of our investigations, we are satisfied that the bare-wire system of electric signalling, as commonly employed, can be rendered quite secure from any danger of the ignition of inflammable gases by the break-flash at the signal-wires or at the contacts of the signalling instruments.

2. In order to procure safety it is necessary, in the first place, to

limit the battery power that is to be employed on any one circuit; and, in the second place, to ensure that the signalling instrument, whether bell or relay, shall comply with certain requirements.

3. The present statutory voltage, 25, sets a reasonable limit to the battery power provided that wet Leclanché cells be used. Systems in which the battery used consists of dry primary cells or of secondary cells, or in which continuous or alternating current generators are employed, could be rendered safe if, in addition to the use of anti-sparking devices embodied in the signalling instruments, sufficient non-inductive resistance were permanently included in the bell circuit.

4. The signalling instruments, bells or relays, should have flame-tight covers, and must be so constructed that, when included in a circuit with a battery at 25 volts, the break-flash produced, when bare signal-wires are separated after giving a signal, is incapable of igniting an 8 per cent. methane-air mixture. There is no difficulty in constructing either bells or relays to conform with these requirements.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

The Fuller "Sparta" Battery.

On previous occasions we have described the "Block" accumulators introduced by the FULLER ACCUMULATOR CO. LTD., of Grove Road, Chadwell Heath, E., which combine the advantages of primary cells with those of ordinary accumulators, whilst avoiding

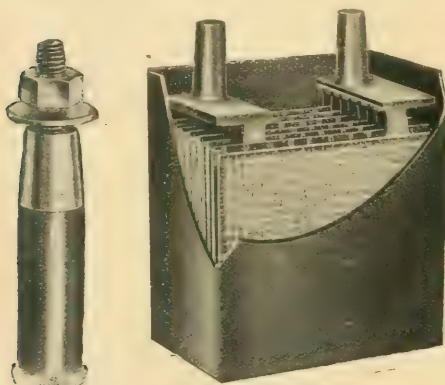


FIG. 1.—TERMINAL
OF SPARTA
CELL.

FIG. 2.—SECTIONAL VIEW OF A
7-POSITIVE-PLATE CELL.



FIG. 3.—"SPARTA" 6-VOLT BATTERY FOR STUDEBAKER CAR.

some of the drawbacks of the latter. The makers have now turned their attention to the requirements of electric starting for motor-cars, which imposes an extremely arduous duty upon the battery, necessitating very low internal resistance, to enable a large current to be developed without excessive drop in voltage; rapid recuperative power, to allow of repeated starts being made

with certainty; and robust construction to withstand the disintegrating effect of the heavy discharges without injury. To meet these conditions, the "Sparta" battery has been devised, and some particulars of its construction are given below.

The elements are of the pasted type, with heavy positives using a specially porous oxide, which enables the battery to give a heavy discharge and quickly recover; the elements are of large area, placed close together, to give low resistance, with fluted separators between the plates to allow free circulation of the electrolyte; no celluloid is used, so that acid of high density can be safely employed. The connections are massive and of ample area, specially designed to radiate heat rapidly and thus keep down the resistance; the terminals are also very substantial, of the type illustrated in fig. 1.

The construction of the cell is shown in fig. 2, part of the ebonite container being broken away to show the plates; the cells are fitted into outer cases of teak, and are made up in batteries of 6 and 12 volts, with capacities from 70 to 145 A.H. and from 35 to 90 A.H. respectively, for English cars.

Standard batteries are also made up for use on various American types of car, of which one is illustrated in fig. 3, having a capacity of 100 amperes at 6 volts, as well as batteries up to 24 volts, for every type of lighting and starting set on the market.

A "Sparta" battery rated at 6 volts, 93 A.H., gave the following results on test:—

Normal discharge	69 amps. for 30 mins.
	45 " " 60 "
	6'9 " " 10 hours
	5'25 " " 15 "
Maximum discharges	140 amps. for 12 mins.
	210 " " 4 to 5 mins.

The weight of this battery, without acid, was 49 lb. We have inspected a number of these batteries and plates, which appear to bear out the makers' claims fully with regard to substantial construction and high quality of workmanship.

"Quead" Fires.

We recently referred to the issue of the 1916-17 catalogue of electric fires by MESSRS. QUEAD, LTD., of 47-57, Marylebone Lane,

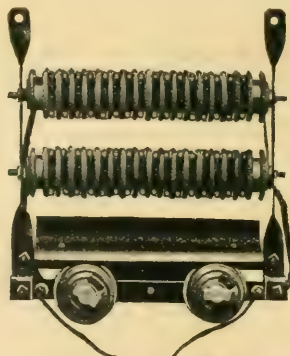


FIG. 4.—DETACHABLE INTERIOR, "QUEAD" ELECTRIC FIRE.

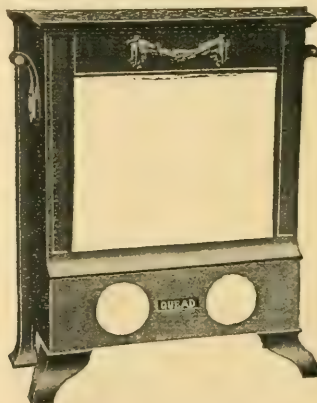


FIG. 5.—"REGENT" PATTERN CASE, WITH INTERIOR REMOVED.

W. The Quead fire is built up of special elements, standardised at 1 KW. each, and consisting of a heating spiral wound on a special composite fireclay support carried on a steel rod. The heating spiral is sunk in grooves which protect the wire and add to the heating effect of the fireclay support; these elements are supplied under a three years' guarantee, and the required number fitted on

a special interior, which also carries all the switches, wiring, &c., and is detachable from, and interchangeable with, particular patterns of cases. Figs. 4 and 5 show an interior and case, while fig. 6 shows the same fire complete and ready for use. Quead fires are con-

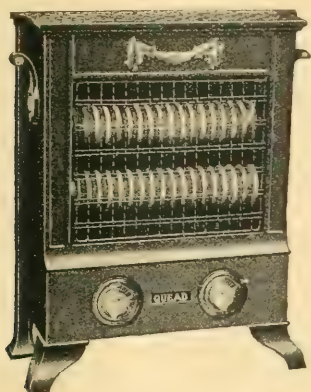


FIG. 6.—REGENT PATTERN "QUEAD" ELECTRIC FIRE.

structed in a variety of designs and finishes for standard loadings up to 4 KW. Two- and three-heat regulation is provided according to type and the switches are of the sunk rotary snap pattern. The heaters give a red heat in a few seconds.

New Telegraphic Apparatus.

Under this title, in our issue of June 30th, we described some of the inventions of Mr. Alban Roberts: these were based on two main elements—the self-exciting vibration of a receiver and transmitter electrically coupled together and to a battery; and the employment of a tube and plunger to provide resonance and enable tuning to be effected. Since then Mr. Roberts has further developed his inventions, and has applied them to the evolution of a new kind of multiple telegraphy on a single line wire.

The transmitter in this system consists of a tunable buzzer embodying the principles above mentioned (described in the preceding article), provided with adjustments, regulating rheostats,

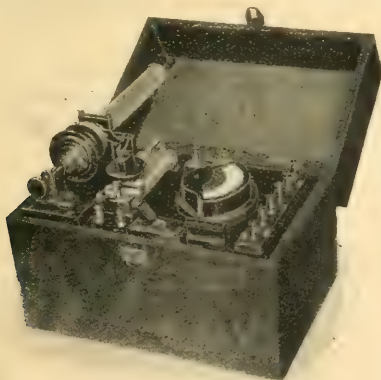


FIG. 7.—THE ROBERTS TUNED TRANSMITTER.

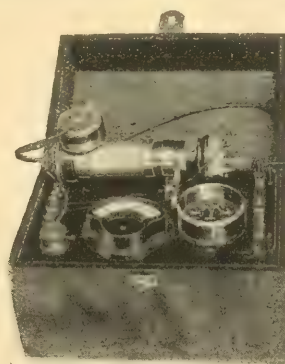


FIG. 8.—THE ROBERTS RESONATING RECEIVER.

and a milliamperemeter, as shown in fig. 1: this gives rise to electrical oscillations which can be tuned by means of the "pitch-pipe" attached to the back of the receiver, and can be heard in a telephone receiver at the receiving station as a musical note of high pitch, on the Morse system. The receiver, however, which is illustrated in fig. 2, has been greatly improved by the combination of the system employed in the transmitter with the pneumatic detector also described in previous article, and with a relay of Post Office standard pattern, together with a milliamperemeter, rheostat, and switch. The receiver is seen at the back of the figure; as in the former case, it is excited by the incoming vibratory current through the medium of a watch-type receiver, which fits into a socket on the cylindrical body of the device. At one end of the latter is a microphone transmitter, and at the other a watch-type receiver mounted on the end of a draw-tube, by means of which the length, and therefore the natural pitch of the column of air, can be tuned to correspond with the pitch of the note emitted by the transmitter at the sending station.

The resonator thus formed is connected in a local battery circuit together with the regulating resistance, ammeter and relay, and

the adjustments are so made that the resonator is on the verge of setting up a musical note, which can be started by a tap on the box, or by singing or whistling a note of the correct pitch. So sensitive is the resonator that the faintest whistle from the far end of the room, of the right pitch, causes it to "sing"; in use, this stimulus is supplied by the vibrations of the receiver set on the body of the resonator, and even when a resistance of 400,000 ohms is inserted in the line circuit, the current is sufficient to start it. Once set in operation, the resonator would continue to sing were it not for the relay, which, being in the local circuit, is actuated by the change in the current which takes place when singing begins, and is so connected that it instantly stops the singing action by short-circuiting the resonating receiver; this, of course, restores the normal conditions, and the relay contact is again opened, but if the incoming vibrations persist, as when a "dash" is being received, the singing is at once set up and the relay again operates, the cycle being repeated as long as the line current is maintained. The effect is to substitute for the continuous note a series of rapidly interrupted notes, of duration corresponding to the lengths of the successive signals.

Two very important objects are thus attained: exceedingly weak incoming currents are enabled to produce strong audible signals, or even to actuate a local recorder or ring a call bell; and the receiving apparatus is accurately and sharply tuned with the transmitting apparatus, so that a large number of such apparatus can be operated over a single line, each transmitter actuating only the receiver that is tuned to the same pitch, without having the slightest effect on those not so tuned.

The great value of these two properties needs no emphasis. An apparatus so sensitive as to enable weak wireless signals to actuate a call bell or a recorder has long been sought for, and Mr. Roberts's device appears to fill that want; while the economic possibilities of so simple an apparatus for multiplying the carrying capacity of a line conductor are obviously very great. We hope to see results of the first importance arising out of this extremely ingenious invention.

Another application of the device is to the control of any number of railway trains up to 20, with one transmitter at a central station and one telephone wire beside the railway line; it would be possible to stop the train, blow the whistle, or actuate any other type of signalling device on the locomotive on this system, without affecting any train except the one in question at the moment. Mr. Roberts has also applied the system to the control of an "aerial torpedo" by the sound of a siren. At his office he has equipped a model airship "chassis" with two motor-driven propellers for horizontal propulsion, one propeller for raising or lowering, and a bomb-dropping device, all controlled by one of his relay resonators. Each of these apparatus can be brought into action in turn by a musical note or whistle of a definite pitch. In actual practice, each motor would have a resonator tuned to a different pitch, so that any or all of the

motions could be controlled, separately or together. As sound travels upwards freely, the inventor, who is himself a skilled airman, states that his torpedo could be controlled at any distance at which it could be seen.

Mr. Roberts's address is the Bedford Hotel, Southampton Row, W.C.

Australia (Tasmania).—The Sydney Office of H.M. Trade Commissioner in Australia reports, under date June 9th, that a company has been registered in the Commonwealth, with a capital of £1,000,000, for the production of zinc by the electrolytic process and for the manufacture of high-grade spelter. The company proposes to erect works in Tasmania, and negotiations are in hand for the supply of power from the Tasmanian Government's lately completed hydro-electric plant at Great Lake. The articles of association of this company provide for its remaining entirely under British control.—*Board of Trade Journal.*

AUSTRALIAN TRADE.

AN exhaustive report on the trade of Australia for 1915, covering over 50 pages, has been compiled by Mr. G. F. Milne, J.B.M. Trade Commissioner in Australia, and issued by the "Board of Trade." An attempt is made below to present the results of Mr. Milne's report which are of more immediate interest to readers of the ELECTRICAL REVIEW. For the rest, they are recommended to purchase the report itself.

PREFERENCE AND ITS INCIDENCE.—While the cessation of German competition affected the import trade for practically the whole of the trading year 1914-15, the increase in the amount, as well as the extended application of the tariff preference to the United Kingdom, affected it for seven months only, seeing that the new tariff was not introduced until December 3rd, 1914. Comparing the respective positions of the United Kingdom and the United States in 1914-15 and in 1913, it is noted that while our share in the competitive trade decreased in value by over 6½ millions sterling out of a total falling-off in imports of this class amounting to nearly £11,700,000, the American position improved by over £300,000.

The value of the imports in 1914-15 in respect of which the United Kingdom and Possessions meet with competition from foreign countries was £48,867,011, this sum representing about 75 per cent. of the total imports, after deducting specie, bullion, live animals, and values representing goods, such as timber, oils, tea, tobacco, rice, fruit, vegetables, and other items which are either not produced in the United Kingdom or are produced of such values and in such quantities as to be negligible. With the exception of goods of the value of £3,004,419, the whole of the sum mentioned represented merchandise of a class on which a measure of preference varying from 5 per cent. to 10 per cent. *ad valorem* has been conceded to goods when of United Kingdom origin by the Customs Tariff of the Commonwealth. The principle of preference, therefore, affected over 93 per cent. of the imports which have been classified by the Trade Commissioner as competitive merchandise.

As showing the extent to which the principle of preference is now operative in the tariff, it may be mentioned that, while considerably over two-thirds of the imports of a class subject to preference regarded as competitive are embraced in the classification of metals and machinery, textiles, and apparel, only a small proportion in these groups are of a class excluded from preferential treatment. The following figures will make this clear:—

Values of Imports of Metals.

(Pig and ingot, bars, rods, blooms, machinery, and other manufactures, &c.)

Metal manufactures and machinery, £17,325,592.

	£
Of a class subject to preferential tariff ...	17,290,550
Of a class not subject to preferential tariff ...	35,042
Value of imports of textiles, £11,136,969.	
Of a class subject to preferential tariff ...	11,129,111
Of a class not subject to preferential tariff ...	7,858
Value of imports of apparel, £4,614,108.	
Of a class subject to preferential tariff ...	4,577,311
Of a class not subject to preferential tariff ...	36,797

Mr. Milne gives separate figures showing the imports of competitive merchandise into Australia during the twelve months ended June 30th, 1915, but we have already fully dealt with these matters in the ELECTRICAL REVIEW for May 12th, 1916, p. 536.

POSITION OF THE UNITED KINGDOM.—Notwithstanding the decline in the value of the imports in 1914-15, and the handicap to which British manufacturers were, and are still, subject owing to shortage of labour and raw material, difficulties in connection with shipping arising from shortage of tonnage and congestion at the seaports, and other factors incidental to the war, it is satisfactory to be able to record that in the year under review the percentage proportion of the United Kingdom in the trade in competitive imports (64.90 per cent.) has never stood so high since the tables dealing with this class of trade were first compiled.

The pre-occupation of the manufacturers of the United Kingdom with war orders, as well as the handicaps to which they have been subjected in many ways, added to the absence of German competition, have afforded American manufacturers an opportunity of which they have taken full advantage.

UNITED STATES COMPETITION.—Reviewing the figures for last year as a whole, in the metal and machinery group the value of the imports from the United States were over £214,000 in excess of those for the year 1913, although the total value of the imports in this group were £6,139,000 less than in the year cited. The most notable advance in the American position in this group was in machinery, for although the total imports of this class of merchandise declined from £4,632,100 in 1913 to £3,806,100 in 1914-15, the share of the United States increased from £1,397,098 (29.8 per cent.) in the former year to £1,446,744 (37.9 per cent.) in the latter, while the share of the United Kingdom declined from £2,546,937 (54.4 per cent.) to £1,938,409 (52.2 per cent.) during the same period. Notwithstanding a general falling off in the value of agricultural machinery imported, the share of the United

States in this trade has not suffered diminution to the same extent as that of Canada and the United Kingdom. In oil and gas engines, dynamos, electrical starting and controlling apparatus, mining machinery, such as coal cutters (in which United States manufacturers have practically the monopoly of the somewhat limited market), rotary and percussion drills, machine tools, printing presses, sewing machines, typewriting machines, and other machinery not specifically described, the American manufacturer secures a larger share of the trade year by year while that of the British manufacturer declines. The adverse position of our home manufacturers in the Australian market for machinery is not one created by the war, although doubtless greatly accentuated by it; there has been a progressive decline in the proportional share of the United Kingdom of this valuable trade for some years, accompanied by a corresponding increase in that of the United States. The rapid growth of American competition in a British Dominion in relation to one of the staple industries of the United Kingdom, merits the fullest investigation by those qualified to undertake it, particularly in view of the expansion of the engineering industry in Australia itself.

Imports of telephones, switchboards, and kindred appliances increased by about £10,000 to over £133,000 during 1914-15, and it is very satisfactory to note that the share of the United Kingdom, which has been declining since 1911 until it only amounted to about 27 per cent. in 1913, amounted to over 53 per cent. last year. Imports of tools declined considerably during 1914-15, over half of the trade representing imports from the United States.

EXHIBITIONS.—There has been a good deal of activity of an unofficial kind during the past year, having in view the capture of enemy trade and the elimination of German influence from the Australian market. The most important movement of the kind was that initiated by the Sydney Chamber of Commerce, which organised three separate exhibitions for the purpose of promoting trade within the Empire and with the Allies. In the first of these, held in July in the Chamber of Commerce offices, only samples of goods of German and Austrian manufacture, which had been collected from importers in Sydney, were displayed, and such information as was available regarding the value of the imports of each class was stated on cards. This somewhat limited display included cutlery, tools, gas and electrical appliances, besides textiles, clothing, chemicals, etc. The exhibition was followed in September by another on a larger scale of goods manufactured in the United Kingdom, Australia, and in the Allied Countries. Between 25,000 and 30,000 persons attended this "fair" or exhibition during the eighteen days it was open. Early in January the third and largest exhibition was held in Sydney Town Hall as a Trade Fair, and during the week it was open was visited by about 45,000 persons.

The Sydney Chamber of Commerce contemplates holding another fair on a more ambitious scale in September, 1916, and they hope that the British firms may be induced to exhibit more extensively than in the previous "fair."

TASMANIAN GOVERNMENT HYDRO-ELECTRIC SCHEME.—In anticipation of the termination of the work of installation, the hydro-electric department of the Government have, as already stated, initiated an active campaign of publicity in order to bring before prospective users of power the prices at which it will be sold. Mr. Milne sets out in his report the proposed rates for power.

An important contract has been arranged with the Hydro-Electric Power and Metallurgical Co., Ltd., under which they will take 3,500 h.p. with provision for further blocks up to 10,000 h.p. It is understood that this company propose manufacturing carbide of calcium. Negotiations are stated to have been in progress with the Australian Woollen Mills of Sydney with regard to the establishment of a large woollen mill close to Hobart, and a quotation for power has been submitted by the Department, while a British firm has also made inquiries with the view of establishing woollen mills. The electrolytic treatment of zinc lead ore, and the manufacture of nitrates from the atmosphere, are mentioned as possible developments. The undertaking may have a far-reaching effect on the development of Tasmania and of Australian industry generally. The Chief Engineer of the Hydro-Electric Department informed the Trade Commissioner in December last that, in his opinion, there would be an increased market in Tasmania for electrical fittings and appliances, and he urged that British manufacturers should endeavour to secure the trade by investigating the possibilities without delay.

Lamp Factories in Holland.—We read in the U.S. Daily Commerce Reports that a publication recently issued by the N. V. Philips Gloeilampen Fabrieken of Eindhoven, the Netherlands, giving the history of its plant, and elaborately illustrated descriptive material relating to its present equipment, has been forwarded from The Hague by American Commercial Attaché Erwin W. Thompson. It is explained by Mr. Thompson that before the war most of the electric lamps used in the Netherlands were imported, but that since the war started this importation has almost stopped, and that there has been a rapid development of the few factories in the country that were able to produce incandescent lamps. The Philips corporation is among those that have shared in the prosperity.

WAR ITEMS.

German Finance and German Plant: The Victoria Falls Co.'s Experiences.—Mr. Bernard Price delivered a most interesting inaugural address before the South African Institution of Engineers at Johannesburg last month. He dealt most exhaustively with the history and activities of the Victoria Falls Power Co. and its experiences in dealing with certain German firms. The matter is so important that we print *in extenso* the report just to hand in the *Cape Times*.

Mr. Price said he did not think a better example could be cited of the methods which our enemies had diligently pursued in their attempt to attain supremacy in the industrial world. The Victoria Falls and Transvaal Power Co. was promoted by British interests, and every effort was made to obtain the necessary capital in Britain. Unfortunately these efforts failed, and in the end certain German industrial banks took up debentures, on condition that the main contracts were placed in the hands of German manufacturing concerns with which they were allied. As the result, the A.E.G. obtained important contracts on favourable terms. The whole arrangement was the direct result of the German system of industrial banks, under which financial assistance rendered to an industrial undertaking, such as a power company, became the means of assisting German manufacturing firms. Needless to say, this initial arrangement was not continued; and as the power scheme grew and proved its worth, capital was raised in London at the rate of no less than a million per annum, and quite independently of German banks. The A.E.G. then became faced with competition, but this did not deter them in their effort to secure contracts for the additional plant required. On the contrary, they at once reverted to the policy of dumping their goods at a low price.

When, in 1912, certain large and important contracts had to be placed, the power companies spared no pains to induce British manufacturers to oust their German competitors; but it became clear that the A.E.G. were prepared to accept the same guarantee as British firms to undercut their competitors' bedrock prices and to give better deliveries.

It must be remembered that, although the feelings of sentiment to-day ran high, no purchaser in 1912 would have been prepared to sacrifice large sums of shareholders' money in order to avert the dumping of German goods. In the end the Germans secured most of the contracts at prices largely below those offered by their British competitors. A contract for three large compressors for Rosherville Station was finally settled with that firm at a price of little more than one-half that at which it had first tendered, but the boiler plant at each station was of British make and had given every satisfaction.

Mr. Price explained the system that had enabled the A.E.G. to dump its surplus production in foreign countries, and said he felt that powerful weapons would be required to prevent a repetition of such dumping after the war. It was no use to talk of boycotting German products. In the long run British firms must compete on price if they were to secure the market, and this would not be easy. Standardisation of product had been an important factor in the success of large German factories. The history of motor-car manufacture was an excellent example. Mr. Price could not avoid the conclusion that in the electrical plant industry German competition would not successfully be combated until British firms found a means for co-operation or amalgamation on some basis which would materially reduce the cost of production.

Mr. Price went on to say that the Power Co.'s experience of two leading German electrical firms was that they made many mistakes, and had to acquire much knowledge at the expense of their customers. He gave nearly a dozen examples, and said that, while he was ready to admit the merit of much German workmanship, design, and organising power, he did not think that the A.E.G. or their German sub-contractors had reason unduly to be proud of the record of the plant which they had installed at the Victoria Falls Power Co. with such a flourish of trumpets.

The G.E.C. Cadet Corps.—On Saturday last an inspection of this Corps, which is formally known as the 1st Cadet Battalion Sussex Yeomanry, "G" London Company, was held on Hampstead Heath. The Corps was under the command of Capt. E. A. Joyce, and gave an excellent display of company drill and field manoeuvres, culminating in an enveloping movement which was carried out with a high degree of skill and intelligence. After the manoeuvres, the Corps marched to "Springmead," the residence of the chairman of the General Electric Co., Ltd., where they were entertained to lunch and tea. The afternoon was spent in a variety of sports, including several boxing matches, which were keenly enjoyed by a number of wounded soldiers who had also been invited. The band of the 19th Battalion King's Royal Rifles was in attendance. The weather was perfect, and the members thoroughly enjoyed themselves.

The South African Siemens Company. The following report appears in a South African newspaper just received from our Cape Town correspondent:—A novel application was made to Judge-President De Villiers in the Rand Division of the Supreme Court on July 18th, when the directors of Siemens, Ltd., sought an order for the liquidation of the company at Johannesburg. It appeared from the supporting

affidavits that the directors were not prepared to continue the responsibility of office seeing that all the shares of the company were really registered in the names of enemy shareholders, or were in the possession of the Deutsche Bank. Furthermore, Siemens, Ltd., found that under present circumstances it was impossible to carry on the business of the company. Therefore they had resolved on liquidation. The application was made to the Court on the ground that it was just and equitable that the company should be wound up. Mr. MacWilliam, for the applicants, stated that although there was no necessity, the directors had notified the Treasury of the application, and the Treasury had replied that it had no objection to the course proposed, subject, of course, to all moneys realised belonging to enemy shareholders being paid over to the Treasury. The Court granted a provisional order for liquidation, but in view of the fact that the nature of the application was without precedent, his lordship thought that he should make a fairly lengthy return date—October 26th.

Unemployment Insurance.—The Board of Trade has issued notices regarding the extension of Unemployment Insurance to workpeople engaged in a number of trades, which comes into force as from Monday, September 4th. Two of the classes referred to are:—The manufacture of metals and the manufacture or repair of metal goods; the manufacture of rubber and goods made therefrom. Employers are urged to at once ascertain which of their workpeople are insurable under the Act, and to see that insurable persons obtain unemployment books as soon as possible.

German Trade After the War.—A Reuter dispatch from Amsterdam states that by a decree of the German Federal Council an Imperial Commissioner will be appointed, as director of the official board, whose task it will be to supply and distribute the raw materials which will be needed by German industry, agriculture, &c., for the transition period from war to peace. The Commissioner will be assisted by experts in all branches.

New Zealand Tariff.—Sir Thomas Mackenzie, High Commissioner for New Zealand, speaking at a meeting at Glasgow the other day, said that most of New Zealand's trade in the past had been done with Great Britain, and they were now taking steps to conserve the trade of the Empire within the Empire by placing a 50 per cent. tax upon all enemy manufactured goods entering New Zealand.

Badges for Returned Employes.—The Salford Tramways Committee, on the recommendation of Mr. G. W. Holford (manager) has issued badges to employes who have received their discharge from the Forces. The badges, marked "D.S." in white on a red background, are to be returned when the Government badges are issued.

Further Enemy Lists.—The *London Gazette* for August 8th contains further lists of persons and bodies in Brazil, Spain, Chile, Greece, Liberia, Netherlands, Sweden, and other countries with whom trading is prohibited.

Exemption Applications.—At Oldham, exemption until October 1st was granted to an electrician employed at Messrs. Platt Bros' works, and exemption until November 1st was allowed to an electrician and wireman employed by another firm. In the first case the appeal was personal, and in the second there were appeals on both personal and business grounds, the employers stating that they were engaged on important experimental work.

At Warrington, a firm of seed experts, who appealed for their only electrician and mechanic, said it was an absolute impossibility to get an electrician in these days. This man was 28 years of age and single. He was responsible for the upkeep of the whole of the plant, which included an electrically driven elevator. The latter required special attention; it ran through seven floors, and saved the firm from three to five men in the busy season. In granting two months' exemption, the Deputy-Mayor said the Tribunal did not say that that was a final exemption, but they were very much inclined that way. The man's age and the fact that he was single were the strong points against the appeal.

At Dewsbury, an electrician, married, aged 29, and in business on his own account, whose only brother is serving, and whose wife has five brothers serving, and who has himself done 18 months' service in the Volunteer Training Corps, had his claim for exemption disallowed, but was given two months' grace.

At Halifax Appeal Tribunal, Harry Smith, an electrician's wireman, appealed against the decision of the Brigbouse Tribunal that he was a British subject, he having been four years in the States prior to one year in Great Britain. He was informed that, though he had the papers for naturalisation as an American subject, he had not remained in the States long enough to complete, the time required being five years.

At the Remondsex Tribunal, Leonard Abel, commercial electrical engineer, of Southwark Park Road, applied for exemption. He explained that he had been in business 11 years as a consulting electrical engineer, and that he also supported his father, 73 years old, and his mother, 67, who lived with him. He was granted six months' extension.

Before the Bucks Appeal Court, the Military appealed against two months' temporary exemption allowed locally to Mr. R. G. Bridger, electrical engineer, engaged with Mr. Nash, of Beaconsfield. On the latter's behalf, it was stated that at the London branch there were only four skilled engi-

neers, but none of them was able to manage the business at Beaconsfield, which had been established four years. Mr. Bridger also looked after a branch at Gerrards Cross, and in Beaconsfield there were 180 customers, including Lord Burnham, whose electrician had joined the Army. The exemption was confirmed, but endorsed "final."

Before the Exeter Tribunal, Messrs. Hucklebridge & Son appealed for the retention of W. Smith, electrician, the only eligible man left out of a staff of eight. Postponement was given until the end of the year.

At Chester-le-Street (Co. Durham), an electrical engineer (33 and single), doing work for various firms, had his appeal for exemption rejected; and a wireless telegraphy student was given until the end of August to enable him to pass his final examination.

At Lincoln, appeals were made by Mr. E. White for his electrician, B. C. Roe, who, he said, had entire charge of the installation at the 4th Northern General Hospital. The Tribunal allowed three months.

Mr. F. H. Baker, of Bexhill-on-Sea, appealed for his electrician, F. W. Climpson (37), the only man left. Mr. Baker said that if Climpson went he would have to close down the business, as his own son was liable to be called up at any moment for service in the Navy. Three months were conceded.

The East Ham Tribunal has refused exemption to R. F. Sitzler (33), electrician, whose mother is a native of Hanover.

At Bath, on August 3rd, the Bath Electric Tramways, Ltd., appealed for seven employees. The engineer and manager, Mr. W. E. Hardy, said that since the war started 184 men had joined the Forces, and the staff had been modified from 280 men and 30 boys and women, to 137 and 91 respectively. Six of the men were each allowed three months, and the other, a motor lorry driver, one month, with no further appeal without leave.

Exemption until October 1st has been granted to Charles Homewood (28), electrician at Heath Lodge, Ullenhall, near Stratford-on-Avon, employed by Lieutenant Crosland, of the Grenadier Guards.

On the appeal of Mr. G. Sommerville, borough electrical engineer, the Faversham Tribunal has given a month's exemption to Wallis Stanley Coe (19), a member of the staff, in order that another man might be prepared to take his place.

Before the East Kent Appeal Court, Mr. R. McStevens (28), electrician, of Deal, who is a conscientious objector, and was granted exemption from combatant service by the Local Tribunal, claimed total exemption, and said that he could not undertake any service whatever. He added that because of his conviction he refused a good appointment at Sheerness Dockyard. The appeal was refused.

The Berks Appeal Court has refused extended exemption to F. H. G. Pocock, electrician to Mr. Cain, at Wargrave Manor.

Having been medically rejected from military service, Mr. R. C. Walker, electrical engineer, of Reading, has been given total exemption by the Berks Appeal Court.

A Northampton electrician appealed for his three sons, aged respectively 25, 28, and 32, each being engaged in the business, they being the only members of the staff left. It was stated that if more than one was taken the business would have to stop. The eldest son, who is single, was given a month; the youngest a final two months, and the other three months on condition that he joins the Volunteer Training Corps.

Waford Tribunal has dismissed the appeal of H. E. Berridge (31), electric light attendant with the London & North-Western Railway Co.

Before the Westmorland Appeal Court, Mr. E. C. Thornborough (28), electrical engineer, of Windermere, appealed against exemption until the end of August granted locally. It transpired that appellant's two brothers had been temporarily exempted, and the Chairman, saying that one would certainly have to go, said the appeal would be respite for a month to see if either of the other two brothers joined up.

Wrexham Rural Tribunal has refused exemption to Leonard G. Pickering (23), electrician with Mr. Summers, of Shotton.

At Worthing, Mr. Porter, borough electrical engineer, appealed for several of his staff, but the Military representative (Colonel Browne) objected to two switchboard attendants, aged respectively 21 and 23, on the ground that they were too young to be retained in civil life, and that their work was not skilled. Mr. Porter replied that a steady hand and some training was necessary, and he pointed out that under the Factory Acts he was not allowed to put on lads younger than 13. The younger of the two was allowed one month, and three months were granted in each of the other cases.

Broadstairs Tribunal, on August 1st, refused further exemption to an electrician, aged 36, previously given one month, on the ground that there was no financial hardship in the case.

Bury St. Edmunds Tribunal has granted a certificate of conditional exemption to a member of the engineering staff, aged 26, at the Corporation electricity works.

Twelve tramcar drivers were appealed for at Southend-on-Sea on July 31st by the Corporation, it being urged that it was impossible to find substitutes, and that the maintenance of the service was a public need. Mr. Birkett, for the Corporation, said that it was not in the interests of the public

that women should act as drivers. Colonel Newitt expressed the opinion that the men should be retained during the season, and each was given until November 1st, with the proviso that they were to drill once a week; leave to appeal again, if necessary, was conceded.

On the appeal of Mr. W. E. Kidner, electrical engineer to the Barking U.D.C., two months' exemption has been allowed to J. White, motor-man, engaged on the Beekton Light Railway.

At Canterbury, Mr. H. E. Philpot, electrical engineer, appealed for E. G. Langford (36), and G. H. Fowler (28), his manager. Each was granted two months.

NEW BOARD OF TRADE REGULATIONS.

THE following new Regulations have been prescribed by the Board of Trade, under Section Four of the Electric Lighting Act, 1888, in respect of electricity supply undertakings which are working without statutory powers.

General.

(10) (a) The Owner on receipt of these Regulations shall forthwith serve upon the Postmaster-General a statement containing full particulars of every electric line used for the supply of energy, together with a plan showing the mode and position in which such electric line is laid.

(16) Where alternating current at a pressure exceeding 125 volts between any two conductors is used, the middle point of the winding of the transformer on the consumer's side in the case of single-phase supply, or the neutral point in the case of two or three-phase supply, shall be connected with earth.

(17) Where a medium pressure continuous-current supply or where alternating-current supply at a pressure exceeding 125 volts between any conductor and earth is used, one conductor consisting of one or two continuous earthed neutral wires shall be carried from pole to pole. The other conductor or conductors shall be arranged in such a manner that in the event of breakage of one of them, it must make contact with the earthed conductor or with wires connected thereto.

Connection of Alternating Current Circuits with Earth.

(26) Alternating current circuits shall be connected with earth in accordance with the following conditions:—

I.—GENERAL.

(a) The connection with earth shall be made only where energy is delivered to each circuit, that is to say, at a generating station, sub-station or transformer, and shall be made at a neutral point in the circuit and in such a manner as will ensure at all times an immediate and safe discharge of energy.

(b) The connection with earth shall be efficiently maintained, except when it is interrupted by means of a switch or link for the purpose of periodical tests for ascertaining whether any current is passing by means of the connection with earth.

(c) The insulation of the mains shall be efficiently maintained at all other parts.

(d) Tests shall be periodically made to ascertain whether any current is passing by means of the connection with earth, and if at any time the current so passing exceeds one-thousandth part of the maximum supply current of the circuit, steps shall be immediately taken to improve the insulation.

Connection of Concentric Mains with Earth.

(27) Concentric mains used either for continuous or for alternating current shall be connected with earth by means of the external conductor in accordance with the following conditions:—

(a) The connection with earth shall be made by means of the external conductor.

(b) The connection with earth shall be made only at the point or points where energy is given to each distinct circuit, namely, at a generating station, sub-station, or transformer.

(c) The insulation of the external conductor shall be efficiently maintained at all other parts.

(d) The external conductor shall form a complete metal sheathing round the inner conductor.

(e) The connection with earth shall be efficiently maintained except when it is interrupted by means of a switch or link for the purpose of periodical tests for ascertaining whether any current is passing by means of the connection with earth.

(f) Tests shall be periodically made to ascertain whether any current is passing by means of the connection with earth, and if at any time the current passing by means of the connection with earth exceeds one-thousandth part of the maximum supply current of the circuit, steps shall be immediately taken to improve the insulation.

Patent Restoration.—Application for restoration of Patent No. 13,719, of 1908, for "Improvements in or relating to squirrel-cage rotors for induction motors and alternators," has been made by J. C. B. Ingleby.

GERMAN PREPARATIONS FOR PEACE.

WHETHER Peace comes this year, next year or later, it will probably consist simply in exchanging one method of warfare for another—in laying down the weapons of the field and taking up those of industry. Germany was better prepared than we for the war in the field, and, with characteristic thoroughness, she is now organising every branch and phase of her industrial and economic system for the struggle to come. Acting vigorously on the policy that union is strength, German municipal, commercial, and industrial interests are welding themselves into a number of unions with definite aims and undeniable potentialities. The cases cited below may be taken as typical, and, in the light of the past two years' experience, it would be futile to assume that the details of the organisations are weak or ill-considered.

Conferences took place in Vienna during Easter week between representatives of the Verband Deutscher Diplom. Ingenieure und the Oesterreichischen Ingenieur u. Architekten Verein, with a view to establishing a Central European enduring and influential union of university-trained technologists. Complete agreement was reached as to the aims of the Union, and a working committee has been established to deal with scientific and professional questions. Steps have already been taken to secure the co-operation of academic engineering associations in other States allied with the Central Powers. How much a similar Union with the academic interests of our Colonies, to say nothing of our Allies, would mean to all the contracting parties!

The vast technical production which the war has demanded, and which will not decrease after Peace is declared, has led the great technical and scientific associations, to which Germany owes so much, to appreciate the new problems which await them and to combine for their solution. A Union of Technical and Scientific Associations (Deutschen Verband Technisch-wissenschaftlichen Vereine) has been formed with a view to serving the nation to a yet higher degree than in the past with the whole technical power of all branches of industry, and to securing to the various branches of engineering, to chemistry, and to architecture, the position to which they are entitled in the scheme of economic and State organisation and policy. Affiliated to the new Union are the Verein Deutscher Ingenieure, Verband Deutscher Architekten u. Ingenieur Vereine, Verein Deutscher Eisenhüttenleute, Verein Deutscher Chemiker, Verband Deutscher Elektrotechniker, and the Schiffbautechnische Gesellschaft. Prof. C. Busley has been elected president, Herr Bayrat Taaks vice-president, and Dr. Th. Diehl business manager. It would be unwise to underestimate the possibilities of this great Union, which represents about 60,000 members of the Associations concerned, and constitutes a powerful organisation exerting influence all over Germany. The Union has amongst its aims the safeguarding of industrial interests as affected by existing or new laws, and the improvement and unification of technical codes and technical education. The Union will be at the disposal of State, municipal, and other bodies in all matters relating to technical problems, sub-committees of suitable composition being appointed to deal with individual problems. As might be expected, the Union does not propose to confine its activities within the borders of Germany. It will establish close relations with technical and industrial organisations in countries now allied to Germany, and, "with the support of the authorities, it will demonstrate by its actions that the representatives of technics are ready to work in

unison with the representatives of other callings to solve the problems which will arise after the war." There is a certain amount of bombast in these sweeping claims, but one has not far to turn to find examples of German "penetration," the number and extent of which has only been fully appreciated since the outbreak of war. The long experience of the above Associations, each in its own sphere, places the new Union in a position to deal effectively with the most diverse problems, and makes it an organisation which must be reckoned with seriously.

Germany is counting a great deal—doubtless far too much—on her relative immunity from war losses of merchant vessels. From German shipping journals reaching this country, it is clear that elaborate plans have been made to utilise interned shipping the moment Peace is declared. Even such details as the best way to advise captains in remote ports of changes in navigation marks have been discussed! Naturally, in all this Germany is reckoning without her hosts, but the point is that organisations have been constituted and plans laid so that German recovery from the war may be as rapid as possible, and so that full advantage may be taken of any laxity or weakness on the part of the Allies.

Another phase of German activity lies in advising all interested parties in Germany of the measures that are being taken by the Allies for the present elimination of enemy trading and the future limitation of German influence. This work is being carried out by every Chamber of Commerce and Verein—each in its own sphere—and the distribution of this information naturally facilitates the arrangement of future policies and forms the stepping-stone to retaliatory measures. To cite only a few examples, the Institute for Sea Commerce and World Economics (of the Kiel University) informs applicants gratis whether the Board of Trade has sanctioned the working of specified German patents by English firms, or whether an application is under consideration or rejected. Wide publicity is given to the fact that we have now followed Australia's lead on the matter of quashing contracts made by German smelters in the Broken Hill and other mines, so as to free the Australian zinc and lead industry from the German control under which it has hitherto existed. Again, a list is being kept at the offices of the "Nachrichten für Handel, Industrie u. Landwirtschaft" (Berlin) of the names of enemy firms compulsorily wound up under our "trading with the enemy" regulations. Immediately following this announcement is one to the effect that the British-owned electricity station at Usingen has been placed under *zwangsverwaltung* (compulsory administration).

Under present conditions, and owing to the care with which details of plans are concealed by the enemy, it is impossible to give a comprehensive survey of German plans for after the war. It would be futile to believe that those plans are ill-considered, or even that they are not based on a recognition of the very difficult position in which Germany will find herself. The leaders of German industry and commerce are under no illusions as to the military situation. Their plans are not likely to presume victory in the field, but, rather to provide for a stern uphill fight, first to recuperation, later to another bid for supremacy. Perhaps it is not necessary that we should know the details of the enemy's plans. Their general aim is clear enough, and every manufacturer, financier, and trader should know how, in his own particular field, that aim could best be realised. That being determined, we may safely assume that that way will be the one which the enemy will endeavour to follow. Our policy must be to dam the percolating streams of enemy trading so that they never again sweep through our factories and markets or float the stranded wreck of Prussianism. For the rest, we need a strong constructive policy of co-operative development, the

energy and guidance for which must come first from within our industries, so that they may then compel adequate assistance from without.

AMERICAN ELECTRIC COOKING NOTES.

PAST issues of the American papers have contained many references to electric cooking methods, admitting the extreme interest which is being taken in this class of business. The Electric Range Committee of the N.E.L.A. in its convention report predicted that the companies on the Pacific Coast and adjoining areas would sell 10,000 electric ranges this year, and great efforts are being made to justify this forecast. In a paper dealing with the development of the electric range load, Mr. P. L. Miles, of the Globe Stove Co., classified 2,884 American towns according to the rates charged, and it would appear that more than half the number have rates of 4 to 5 cents per kw.-hr., while only 835 have adopted a rate as low as 3 cents or less—which the author hints must contain a profit margin, as it is, scarcely likely that all these managers have miscalculated their rates.

It must be admitted that the bulk of the rates mentioned appear prohibitive to English eyes, but then, as we have previously pointed out, American conditions are widely different from our own. Mr. Miles's firm was called on to investigate the attitude of consumers towards electric cooking, and canvassed the views of housewives in 20 cities and towns with this object in view. The following data was obtained: 26 per cent. had considered buying electric stoves; 11 per cent. were willing to pay 100 per cent. more than at present; 37 per cent. were willing to pay 50 per cent. more. Mr. Miles takes this as an indication of willingness of the American housewife to pay more for electric cooking. As to the proved advantages of electric cooking, it was found that 37 per cent. of those canvassed knew electric cooking was clearly, but only 1 per cent. knew that it would save on the meat bills; 24 per cent. knew it was more convenient; 6 per cent. that it was cooler, and 3 per cent. that it was safer than gas. Whether the data collected is of a really reliable nature is open to question, but we admire the enterprise of our American friends in this matter, and their evident determination to leave no stone unturned in the endeavour to obtain new business.

Mr. Miles, however, argues at some length on the question of the comparative costliness of the electrical stove—which he says is about twice as expensive as a gas range in the States—with a view to proving that not reduced first cost but efficient salesmanship is the necessary factor for securing the more extended use of electric cooking appliances—this notwithstanding that, as he admits, the bulk of the central-station commercial men hold an opposite view on the price question. At the same time his remarks on the rate question seem to indicate that he would have these same central-station men reduce their rates to the 3 cent level.

Mr. George Hughes, the well-known American electric stove manufacturer, expresses the opinion that the cost of the electric cooking range always will be higher than that of its gas prototype, because of superior construction and higher efficiency—according to Mr. Hughes, 85 per cent. as against 15 per cent. for the gas range—but that increased production will naturally result in diminished cost. He also explained that electric ranges were being sold in face of the competition of cheap natural gas, and laid stress on the point that electricity was being sold on a quality, not a price basis—all of which indicates that money is much more plentiful, and the business instincts of the gas undertakings much less keen, in America than in this country.

Whatever may be the American conditions, in this country, at any rate, electric cooking will only come into its own through the agency of general hiring-out arrangements; the great majority of domestic users do not wish to be saddled with the possession of costly apparatus, which may require to be moved from one supply area to another where supply conditions differ; the habit of obtaining domestic cooking "service" from the local supplier for a rental charge is ingrained, and it has many advantages.

The *Electrical World*, in discussing recently the question of using electricity in bakeries, pointed out the exceptional value of this load, which comes on at midnight, to the central station.

Our contemporary says:—"Experience on the Western Coast indicates also that the initial cost of the electric equipment is lower than that of brick ovens now usually applied, and it is claimed that the cost for interest is not prohibitive. Operating costs depend, as is often the case, on the intelligent use of the electric oven by the operator. One bake-oven installed at Portland made the first baking with a consumption of 15 kw.-hours. This was disappointingly high. On the second day the baker regulated the heat more carefully and the baking was equally well done with a consumption of 35 kw.-hours. On the third day the heat was regulated according to the more intimate knowledge of the manufacturers' representative who was present. The consumption for the same baking on the third day was 24 kw.-hours. If the consumption had been 3 kw.-hours lower than this minimum the current cost would have just equalled the cost of the wood formerly used in the

same shop. In point of revenue the bake oven is one of the most, if not the most, desirable kind of load that has yet appeared in the Western field. One bake oven installed on the Pacific Coast increased the power company's current income in the ratio of \$3,000 per year. Not the least important factor in the development of this business, aside from the engineering and cost questions involved, is the advertising value to the baker of electricity for baking and other purposes. Cleanliness and certainty of temperature control are factors which can be suitably advertised to the public. With electrically-driven mixing machinery and electric delivery wagons the baker has a basis for a striking advertising campaign of his own."

It is astonishing that so little progress has, to appearance, been made in this country in bakery supply, apart from motor applications, although under the conditions prevailing in London and other large English cities, where space is valuable and labour dear, there would appear to be every incentive to push this particular class of business quite apart from hygienic considerations. Electrically baked bread, turned out on a small scale, has proved a most satisfactory product, and we do not doubt that specialisation in the larger field would lead to equally satisfactory results. An electrical cooking equipment has been installed at a restaurant in Sacramento, Cal., to provide 20,000 meals a month. Electrical heat is used for all purposes, including water heating, and the total loading for cooking purposes amounts to 105 kw. An average of 623 unit per meal is required, costing 1.2 cents per person served, and an actual saving of 90 dollars per month in the restaurant's meat bill has been effected through the lessened shrinkage of meat while cooking, as compared with oil and gas cooking. Amongst new American range designs is a somewhat novel combination gas and electric stove which has been developed by the Westinghouse Co. (U.S.A.). This is equipped with gas burners on the top and an electric oven, it being claimed to be particularly adapted to localities where the cost of energy is high, and therefore stove top heating, requiring continuous application of heat, is rather expensive with electricity. The oven is equipped with an automatic time switch for turning on current and thermostatic temperature control, and it will be seen that the design is dictated by price rather than the quality consideration emphasised by Mr. Hughes.

The conclusions arrived at by the Electric Range Committee of the National Electric Light Association regarding American practice in tariffs for electric cooking, etc., were that no definite form of rate could be recommended for general use since local conditions exercise such a great influence on the business. The Committee did not believe that electric cooking in the average sized home could be secured on a three cent rate, while a lower rate would be necessary for hotels and large installations. A combination rate should be either a load factor rate or some modification, such as a room rate, so as to protect present lighting earnings, and should have a minimum monthly bill of two dollars or more.

Information was obtained from companies supplying some three million consumers in various parts of the country, and these reported only 21 per cent. as many electric water heaters in use as electric ranges. It was found that if a water heater was used as well as a cooking stove, the average monthly energy consumption of the latter fell from 100 units to 80 units, showing that the range without a separate water heater is used for heating water sufficiently to increase the monthly energy consumption by 25 per cent. The majority of companies supplying water heating use a double-throw switch, and find the maximum energy consumption per month for a range, allowing a satisfactory water heating flat rate service for an average family to be:—600-watt water heater, 125 units on range; 750-watt water heater, 150 units on range; 1,000-watt water heater, 200 units on range. With the double-throw switch arrangement, either the water heater or the range is on the system peak, and a long-hour range user does not obtain as much hot water from a flat-rate water heater as does a short-hour range user, although he probably wants more.

One concern estimates that a water-heating flat rate of three dollars per kw. month, with the double-throw switch arrangement, so that the heater is not on with the range, is equivalent to a price of $\frac{1}{2}$ cent per unit.

While the advantages of a combination rate for domestic service are appreciated (as in this country) it is pointed out that during the development stage it is sometimes better to have separate bills for different services; an objection mentioned is the difficulty of securing proper registration of lighting loads on a meter large enough to handle the electric range. The Southern California Edison Co. has adopted a combination lighting and heating rate in which there is a primary charge per unit, on a certain number of units depending on the active rooms in the house and a secondary charge for excess consumption. The Pacific Gas and Electric Co., at San Francisco, has a heating and power rate based on the active connected load, with a primary unit charge for initial energy consumption and a low secondary rate for excess units. Active load consists of the first 2 kw. installed and half of any excess load. Minimum charges of 2-24 dollars per month are imposed with both these rates. The Wilmington and Philadelphia Traction Co. adopts a fixed rate for heating of 14 dollars per month per kw. of prearranged demand, plus a charge of 6 c. per unit for energy used if this demand is exceeded. Thus the consumer can make unlimited use of his apparatus at a fixed price, providing the prearranged demand is not exceeded; he can also fix his own demand in accordance with

domestic requirements, the company being safeguarded by the excess charge. It is found in practice that a 3.6 kw. range rarely exceeds a demand of 2 kw. One advantage of such a rate is the incentive to long-hour use, with corresponding improvement in load factor; the company is also secure of a certain income in advance, a consideration which has met with appreciation on this side. Any discussion of electric water heating in this country usually raises the bath-water bogey; but it would appear that there is scope for water heating on a small scale for cooking purposes in conjunction with the electric stove, using the throw-over switch arrangement, so that the water heater or the stove is always connected to the supply; if in addition the limited kw. demand and excess charge system adopted by the Wilmington and Philadelphia Co., or its equivalent, could be incorporated, it is possible that the long-hour load resulting would justify a low average price per unit.

LEGAL.

STEALING ELECTRICAL GOODS.

At the Mansion House Police Court, on the 28th ult., Stanley Arthur Keeley, 26, clerk and stock-keeper, and Wm. John Dupuy, 42, carman, were charged before Mr. Alderman Moore with stealing and receiving, on July 20th, from 16, Queenhithe, Upper Thames Street, a quantity of electrical appliances, value £7 10s., the property of the General Electric Co., Ltd. Keeley was charged further with stealing an electrical table cloth and plugs and an electric standard and other articles, value £110. In consequence of complaints of the loss of electrical appliances from the company's premises, observation was kept by the police, and on the 20th ult. the defendant Dupuy was stopped as he was in the act of driving away in a van in which a number of stolen articles had been placed by Keeley, who had been three years in the employ of the company. Both men were arrested. At Keeley's address the police found a number of electrical appliances, including an electric table cover and an electric standard lamp. When shown the property, Keeley said, "These are articles I have stolen, and Dupuy has taken them away for me."

JOHN WM. JONES, storekeeper to the General Electric Co., 71, Queen Victoria Street, said the articles contained in the list produced by the police were the property of the company, and were of the value of £110 17s. 9d. Keeley admitted that he had stolen the articles during the past 18 months.

MR. SAMUELSON, on behalf of the firm, said though these robberies were a serious matter, having regard to their previous good characters, they did not wish to press the case unduly against the men.

Keeley was sentenced to three months' hard labour, and Dupuy to one month's hard labour.

BUSINESS NOTES.

Trade Openings in Italy.—From the British Chamber of Commerce for Italy, at Genoa, we have received further lists of firms who formerly did business with German and Austrian houses, and are now seeking British connections. We select the following:—

No. 1,075. Representative at Genoa can place belting, industrial oils, high-speed steel, machinery, packings for engines, motors, electrotechnical materials, pumps, tubes, measuring apparatus, saws, &c. (S.G. & A.S.)

No. 1,085. Agents at Turin require engineering articles, machine tools, metals, tools, hardware, lights. (T.E.O. & C.)

No. 1,088. Engineer, with office at Cagliari and Rome, would act as agent for electrical, scientific, and telephonic apparatus.

No. 1,108. Merchant at Como would buy glassware, porcelains, earthenware, articles for electric, gas and petroleum illumination. (C.C.E.)

Trade Tour in Spain.—A movement to improve our trade with Spain has been started by the Foreign Office. In Spain, there is probably a good opportunity of replacing many German by British products, and arrangements are being made for representatives of British industries to spend a month visiting the principal commercial towns of Spain. The Foreign Office suggests that the party should not be too large, that it should as far as possible consist of actual partners of large firms, and that the trades concerned should agree upon a joint representative rather than send a member of each firm. The object would be rather to lay the foundations of better relations and to discuss the questions applicable to a whole trade than actually to secure immediate orders. Mr. Gonzales y Gordon, a Spanish subject, who is strongly recommended to the Department, will assist in making arrangements, and possibly will accompany the party. The tour will be unofficial. *The Times Trade Supplement.*

In connection with the above we may be permitted to draw our readers' attention to a leading article in the ELECTRICAL REVIEW for May 8th, 1908, on "British Electrical Enterprise in Spain." We there quoted with approval the suggestion of Vice-Consul Jackson that the "Institution of Electrical Engineers, or some

other representative combination of British manufacturers," should take steps to investigate the Spanish market. We proposed that the Electrical Manufacturers' Association should take action. May it not come to that even after eight years?

Book Notices.—Polygraph Rubber Trade Directory of the U.S.A. and Canada." 1916. New York: *The India Rubber World*. Price \$3.50.

"Science Abstracts," A and B." Vol. XIX. Part 7. July 25th, 1916. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each net.

"Alternating Currents." Vol. II. By A. Russell. Price 15s. net. Cambridge University Press.

The Telegraph and Telephone Journal, Vol. II, No. 23, August, 1916. The Editing Committee: G.P.O. North.

"Proceedings of the American Institute of Electrical Engineers," Vol. XXXV. No. 7. July, 1916. New York: The Institute.

"The Air Supply to Boiler Rooms of Modern Ships of War." By R. W. Allen. Bedford: From the Author.

Bankruptcy Proceedings.—R. E. CONNOLD, electrician, Canterbury.—A first dividend of 3s. 4d. in the £ is payable August 23rd, at the offices of Corfield and Cripwell, 119, Finsbury Pavement, E.C.

Catalogues and Lists.—FOSTER ENGINEERING CO., LTD., Wimbledon, S.W.—Several new illustrated price-lists dealing with various manufactures, as follows:—No. 101A: Half-watt lamp cases for positions where ornamentation or decoration is of consequence; No. 101B: Foster half-watt lamp cases for industrial lighting, munition factories, yards, &c.; No. 102A: The "Wimbledon" half-watt lamp case, solid copper, oxidised, for either outdoor or indoor service; No. 141: Foster drawn-wire metal filament lamps for motor-car lighting, pocket lamps, hand lamps, &c.; No. 140: Foster drawn-wire lamps of various shapes, styles, &c.

MESSRS. JOHNSON & PHILLIPS, LTD., Charlton, S.E.—Three new illustrated lists, giving detailed drawings and particulars, as follows:—JB 1, dealing with sealing ends of British white-glazed porcelain for use with and without rubber ends; JB 2, relating to colliery boxes, and cable accessories for mining work; and JB 3, showing inverted pole-type trifurcating boxes.

MESSRS. DYER & YOUNG, Stansted, Essex.—A catalogue, which takes an unusual form, has been issued. It consists of eight large sheets with metal top and bottom edging, the whole caught together at the top, so as to form a roll. Each sheet shows a number of clear drawings of standard tramway controller fingers of different types, including B.T.H., W.H., Brush, D.K. and others, also segments, &c.

For Sale.—MESSRS. WHEATLEY KIRK, PRICE & Co., the agents for the Controller appointed by the B. of T., invite tenders by August 28th, for the stock of electric lamps, accessories, office furniture, &c., of Krupka & Jacoby, Ltd.

By order of the Controller appointed by the B. of T., Mr. E. Owers will offer for sale by auction on the premises on August 30th, the stock-in-trade, office furniture, &c., of Isaria, Ltd., 208, Tower Bridge Road. Particulars appear in our advertisement pages to-day.

Dissolutions and Liquidations.—ANGLO-COLONIAL ENGINEERING CO., LTD.—This company is winding up voluntarily, with Mr. G. E. Corfield, Balfour House, E.C., as liquidator. A meeting of creditors was held on August 7th.

MILLER ANTI-FRICTION METAL CO., LTD.—This company is winding up voluntarily, with Mr. A. Hennings, of 3, Gore Street, Manchester, as liquidator. Creditors must send particulars of their debts, &c., by September 8th. A meeting of creditors is called for August 15th.

INSTITUTE OF INDUSTRY (OF GREAT BRITAIN AND IRELAND), LTD.—This company is winding up voluntarily, with Mr. L. W. Hawkins, Basilston House, E.C., as liquidator.

BIDDLE AUTOMATIC SIGNAL, LTD.—A meeting is called for September 8th, at 25, Victoria Street, S.W., to hear an account of the winding-up from the liquidator, Mr. W. Braby.

Copper Prices.—Messrs. F. Smith & Co. and Messrs. James & Shakespeare report: August 2nd.—No changes in prices quoted last week.

LIGHTING AND POWER NOTES.

Abercarn.—The B. of T. has extended the period under the Extension Order of 1915 (Abercarn Electric Lighting Order, 1914), of the South Wales Electrical Power Distribution Co. by one year.

Aberdeen.—NEW PLANT.—The Electricity Committee recommends that a new turbo-generating set for the electricity station be purchased from Messrs. Parsons. The Committee reports that the units generated in June showed an increase of 213,620 compared with the same month last year.

Argentina.—FUEL SHORTAGE.—The town of Bahía Blanca is threatened with the cutting off of the electric light, owing to the lack of coal. The local company endeavoured to obtain petroleum from the Minister of Agriculture, offering to pay current official prices, but without success; the trials made with wood fuel have not proved satisfactory. The stock of fuel was expected to last up to the 16th of last month, when the service would have to be suspended.—*Review of the River Plate.*

Atherton.—LINKING-UP PROPOSAL.—The Electricity Committee has had under consideration the proposed linking-up with the Lancashire Electric Power Co.'s system for the extra supply of electricity required for the district, which it is estimated will involve an expenditure of about £800, and has decided that the Council should agree with the South Lancashire Tramways Co. to pay half the cost of carrying on the work with the amount stated as the maximum.

Barking. REVISED CHARGES.—The U.D.C. has amended the charges for current for power and heating to 14d. per unit for 8,001 to 80,000 units per month, plus a war increase of 5 per cent.; 80,001 to 200,000 to 14d. beyond 1d. Subject to a loan being sanctioned, power is to be supplied to the works of the Cape Asbestos Co. for the term of three years.

Belfast.—YEAR'S WORKING.—The Tramways and Electricity Committee reports a profit of £17,492 on the electricity department on last year, partly due to the sale of a million additional units. It is proposed to give the usual £5,000 to the relief of rates. The tramway accounts show a profit for the year of £7,860.

Canada.—The Hydro-Electric Power Commission has completed arrangements with the Pine River Light and Power Co. whereby all of the transmission lines, sub-station equipments and a portion of the apparatus at the development at Hornings Mills will be taken over and utilised as a portion of the Eugenia system. These lines will be used to serve Shelburne, Orangeville and Hornings Mills, and these municipalities are already being supplied with hydro power by the amalgamation of the two systems, and preparations are being made to serve the municipalities of Grand Valley and Arthur by using the portion of the line purchased from the Pine River Light and Power Co. and by constructing approximately 12 miles of new line. (*Canadian Electrical News*.)

The Thomson-Porter Cataract Co. is reported to have submitted plans to the Canadian Government, for a 2,000,000-h.p. hydro-electric development below Niagara, which will not disturb the Horse-shoe and American falls, and will cost \$100,000,000. A charter has been asked for to construct in the rapids below the falls an international dam to raise the water 100 ft.; half the power would belong to Ontario and half to New York. (*Elec. World*.)

According to the *Canadian Electrical News*, work has been started on the Bay of Fundy tide power project at Cape Split, N.B., by the Cape Split Development Co. We referred recently to the demonstration of an experimental tide motor which it is proposed to employ on this site.

Chesterfield.—PROPOSED WORKS EXTENSIONS.—The proposal to transfer the electricity works from Brampton to a larger site has been considered by the T.C. Mr. S. L. Pearce, of Manchester, advised that it would be better to remain on the present site, and application has been made to the L.G.B. for authority to carry out the proposed extensions: in the event of this being obtained, the scheme for extensions will be submitted to the full Council for approval.

Darlington.—At a Council meeting last week, the electrical engineer reported an increase of 33.96 per cent. in the number of units generated during the three months ended April 1st.

Dawlish.—PRICE INCREASE.—The Electricity Co. has applied to the U.D.C. for permission to increase its charges for current to private consumers by 10 per cent. until such times as prices of stores again become normal. The Council has agreed to the request.

Dewsbury.—A Sub-Committee is to consider the proposed agreement with the Yorkshire Electric Power Co. for the supply of electricity to Ravensthorpe. A special tariff is to be provided for those consumers who are not eligible for the rateable value system:—Lighting at the usual rates, and heating or cooking to be on a flat rate of 1d. per unit (plus the increased percentage in force), and such consumers must guarantee a minimum of at least £2 per half-year for heating and cooking, and adhere to this system for at least 12 months.

Eland.—PRICE INCREASE.—The Electricity Committee has decided to advance the price of current from 1½d. to 5d. per unit, and the rate for power by 7½ per cent.

Exeter.—YEAR'S WORKING.—The report of the electricity engineer, Mr. H. D. Munro, on the working of the electricity undertaking for the year ended March 31st, shows that the total revenue was £20,472, expenditure amounted to £12,753, leaving a gross surplus of £7,719; sinking fund and income-tax charges absorbed £7,597, leaving a net surplus of £1,122. The increased price of coal and the loss in revenue of £524 due to lighting restrictions, and the increased charges for income-tax, interest, and sinking fund, absorbed nearly the whole of the gross surplus. Owing to the economical working of the new steam turbo-alternator during nine months there was a decrease of 368 tons in coal consumption, although 49,000 additional units were generated, also a saving of £120 in the costs of oil and water. The consumers increased by 100, and the power demand by over 240 H.P. £2,474, the costs for mains extensions, and £785 for accessories for the new turbine, were paid out of the reserve and renewal funds, as the T.C. was not permitted to draw on the loans sanctioned for these purposes.

Frome.—STREET LIGHTING.—On account of restricted lighting the public lighting account of the U.D.C. has been reduced by £250 by Messrs. Edmundson, the contractors.

Gelligaer.—The Board of Trade has extended the time by one year under the Gelligaer (Bedling and Fochriw) E.L. order 1914.

Hale.—An end has been made of the negotiations by the Farnham R.D.C. with the Gas and Electricity Co., with reference to a supply of electricity for Hale, owing to the restrictions imposed by the Treasury upon expenditure, making it impossible for the mains to be extended whilst the war lasts.

Hereford.—On account of the diminished consumption of current, due to the operation of the Summer Time Act, the T.C. has decided to levy a minimum charge of 10s. per quarter in cases where not more than 20 units are used.

India.—The Madras Municipal Council held a special meeting recently, at which Mr. K. T. B. Tressler, the Director of Industries, Madras, explained the attitude of the Government on the subject of introducing electric lighting into the municipality. At present it would not be possible for the Government to take up the Periyar scheme, and it was necessary that the Council should have its own scheme. The total cost would be nearly a lakh of rupees, and would provide for 2,500 25-c.p. lights and 200 fans. Mr. Tressler is to advise the Council how to proceed with regard to the matter. (*Indian Engineering*.)

It is stated that the Tata Co. is engaged on a further 40,000-h.p. hydro-electric scheme, the head works of which will be 10 miles from those of the existing hydro-electric scheme. The company undertook to supply 40,000 H.P. to Bombay from the latter, and 30,000 H.P. is already being delivered, while, were all the mills electrified, it is considered that Bombay could absorb 100,000 H.P.—*Financier*.

Leigh.—COLLIERY SUPPLY.—The Westleigh Colliery Co. is to be informed that the Corporation is not prepared to allow the Lancashire Electric Power Co. to supply it with electricity, but that the Corporation is prepared to give a supply on terms to be agreed upon between the company and itself, and, failing such agreement, on terms to be fixed by the B. of T.

London.—HAMMERSMITH.—YEAR'S WORKING.—The annual report of Mr. G. G. Bell, the borough electrical engineer, for the year ended March 31st, points out that the undertaking is one of the few where the rates charged for electricity are still maintained at pre-war figures, and that a net profit of nearly £600 was earned. Owing to the lighting restrictions, and the disappearance of units purchased and resold, the total sales, 11,178,294 units, show an increase of only 1,461,042 units, compared with the previous year; but the units sold from the Hammersmith generating station show an increase of 2,000,018, entirely due to the power load. The most important item in the accounts, with the exception of the capital charge, is fuel, the cost of which has increased in two ways: first, by the increased initial cost; and, second, owing to large consignments being carted to the generating station from railway sidings instead of being delivered at Chancellor's Wharf.

The cost of pumping coal from Chancellor's Wharf by means of coal-pumping plant, and handling same, is only 457d. per ton. The saving that would have been effected if the whole of the coal delivered at the sidings (11,390 tons) had been pumped, would have been £391. The cost of cartage from sidings being £1,054, and the cost of pumping 11,390 tons at 457d. per ton, plus 9d. per ton for delivery by barge, would have been £663. The total cost of cartage would have been further increased if the coal-pumping plant (which is now in successful operation) had not been installed; 6,872 tons of coal were pumped during the year at a cost to the department of £57 for electrical energy used by the plant. With the coal tanks in use no trouble was experienced, as in previous years, from the coal stock catching fire.

The total units generated were 13,271,640; only 1,461 units were purchased. The maximum demand was 5,980 kW., and 971 motors of 9.126 H.P. are connected to the mains. The total revenue was £64,117; works cost and special expenditure amounted to £39,488, and gross profit to £24,629; while the net profit was £595, as compared with £3,717 in the previous year.

MARTLEBONE.—At the meeting of the B.C., on July 27th, the report on the working of the electricity undertaking for the year ended March 31st was presented. During this period 16,069,870 units were sold, as compared with 15,926,167 units in the previous year, decreased lighting consumption being more than counterbalanced by increased requirements for heating and cooking. The total income amounted to £182,772, an increase of £13,555; after meeting working expenses, &c., the net revenue balance was £129,192, from which the usual loan charges were met, leaving a net profit of £2,371, as against a deficit of £7,057 in the previous year. Ald. Duncan Watson, chairman of the Electricity Committee, explained the figures in detail, pointing out that generation costs had increased by 27 per cent., but distribution and management costs had decreased by 22 and 20 per cent. respectively, while taxes, &c., were up 6 per cent. The Sales and Publicity Department showed a credit balance of £479. A satisfactory linking-up arrangement with the Central Electric Supply Co. had been entered into; he had himself handled the matter of the quinquennial assessment, and the Committee came out "on top." He concluded by intimating that, owing to his private position, it had become necessary for him to resign the chairmanship of the Committee, an announcement which was received with general expressions of regret by the Council.

Maidstone.—The T.C. has decided to supply the works of Messrs. Amies & Son, at an estimated cost for mains of £120, and to apply for the electricity works to be declared a controlled factory.

Oldham.—**TWO-RATE CONSUMERS AND "SUMMER" TIME.**—It was mentioned at a meeting of the T.C. that the Electricity Committee had over 2,000 clocks in use in connection with meters, the hands of which had not been advanced on the adoption of summer time. Councillor Dixon said there was dissatisfaction among electricity consumers who were on the two-rate system as they were charged two different scales, and complained that they had been "done out" of an hour at the lower rate. Councillor Hardman (chairman of the E.C.), said they could not possibly, in the limited time allowed, alter the 2,000 clocks. If the new system were permanent something would have to be done, and some means would have to be found of dealing with the matter.

Perth.—**PRICE INCREASE.**—From the estimates of the electricity department it appears the rate of charge for ordinary consumers will be increased by 15 per cent., the trade rate by 7½ per cent., and the tramway rate by 7½ per cent.

Shrewsbury.—**PRICE INCREASE.**—Owing to increased costs in connection with the electricity undertaking, it has been necessary to increase the charges to consumers by 20 per cent.

YEAR'S WORKING.—The annual report of the electricity undertaking for the year ended March 31st last shows a total income of £9,136, working expenses amounting to £6,519, and a gross profit of £2,616. After payment of interest and sinking fund charges, there was a deficit for the year of £972, which was taken from the reserve fund. The total capital expenditure is £60,733, and the outstanding debt, less sinking fund, £24,594.

Skelton and Brotton.—The Council has decided not to accede to a request by the Cleveland and Durham Electric Power Co. to pay a higher price for the current supplied to the Council for its electric supply undertaking.

South Africa.—The Somerset West (Cape Province) installation was formally inaugurated recently by the switching on of the supply at the transformer kiosk, near the railway station, the Mayor performing the ceremony. The supply is derived from De Beers explosive works at Somerset Strand, about three miles from the village of Somerset West. The consulting engineer for the scheme is Mr. Charles G. Trevett, who is at present with the Motor Transport Corps in East Africa, and the contractors are Messrs. Herbert Davies & Co.

The new electric light installation at Worcester (Cape Province) was recently completed, and formally opened. The consulting engineer for the installation is Prof. Bohle, of the South African College, and the contractors Messrs. Siemens, Ltd.

The Boksburg (Transvaal) Council has decided to dispose of its generating plant, and has accepted the offer of the British South African Explosive Co. of £7,500 for the same, excluding two pumps and motors.

Stalybridge.—**EXTENDED SUPPLY AREA.**—At a special meeting of the Stalybridge Joint Electricity Board, consideration was given to the question of granting supplies of current to prospective customers outside the present area of supply, and it was decided to empower the Generating Station Committee to proceed with the work for the supply of current in the extended area described in Clause 37 of the Board's Act of 1915.

Stockport.—**PROPOSED LOAN.**—Subject to E. of T. consent and L.G.B. sanction to a loan, the Electricity Committee proposes to buy certain premises for £2,700, and to use the land for an electricity generating station. An alteration in the proposed minimum charge for current has been made to 30s. per annum, payable 7s. 6d. per quarter, and where the units consumed in any quarter do not amount to 7s. 6d., the unconsumed units are to be carried forward to the following quarter, but not beyond a complete year. It is believed that this will meet the complaint of those who use very little current in the summer.

Stockton-on-Tees.—**BULK SUPPLY.**—At a meeting of the T.C. last week (August 1st), it was stated that a portion of the present steam plant at the electricity works was to be shut down until November next, consequent upon an agreement having been entered into with the Cleveland and Durham Power Co. with regard to the supply of electricity. Under the agreement with the company, the Corporation is bound to pay for a minimum of 1,000,000 units per annum, with a reduced charge on all energy in excess of 1,750,000 units, providing that the maximum demand does not exceed 1,000 kW., and 500 kW. during certain restricted hours. Under the new arrangement the Council's generating plant will be under steam for only 782 hours per annum, as against 7,500 hours formerly.

Stoke-on-Trent.—**EXTENSIONS APPROVED.**—The Council has approved of the proposals of the Electricity Supply Committee to carry out extensions of plant at the central power house, in respect of which a loan of £12,000 has been sanctioned by the L.G.B.

Thirsk.—**STREET LIGHTING.**—The Electricity Co. has written to the P.C. with reference to the lighting contract for next season, offering to keep the necessary plant ready to supply requirements providing the cost, about £115, is met by the Council, and £1 a year paid for each lamp used. The matter is to be placed before the ratepayers.

Torquay.—**"SUMMER-TIME" EFFECTS.**—The deputy electrical engineer has reported that before the passing of the

Summer Time Act the daily demand was 350 kW., with an output of 2,820 units, now the daily demand was 275 kW., with a daily output of 2,010 units. The engineer stated that new connections were making good the losses due to the Act and public lighting restrictions.

Trowbridge.—**PRICE INCREASE.**—The U.D.C. has consented to the charges for current supplied by the Electric Supply Co. being increased by 10 per cent. for the duration of the war.

Turton (near Bolton).—**YEAR'S WORKING.**—Reporting on the past year's working of the electricity undertaking, the electrical engineer states that units sold to private consumers numbered 27,011. The total revenue from private consumers was £339, compared with £305. The total number of units purchased was 43,397, compared with 58,133 in the previous year, the decrease being due to the reduction of public lighting. There were now 67 consumers connected, 23 new ones having been added during the year.

Warrington.—**PRICE INCREASE.**—The T.C. has agreed to the price of electric current (except where otherwise provided) being increased 5 per cent. as and from August 1st, 1916, on the existing scales of charges.

Weybridge and Walton.—**PRICE NEGOTIATION.**—As an outcome of the recent negotiations, the U.D.C.'s have sealed agreements with the Electric Supply Co. by which, for the duration of the war, the price of current will be 7d. per unit on a flat rate; six months after the war ends, if the circumstances do not render it absolutely impossible, the price is to be reduced to 6d.

TRAMWAY and RAILWAY NOTES.

Blackburn.—The tramway manager reports a profit of £1,479 on the Corporation tramways for the quarter's working ended June 30th.

Chile.—The electrification of the Valparaiso and Santiago Railway is being considered, and a law authorising the Government to invite tenders has been passed by the Senate.

Gateshead-on-Tyne.—The Town Improvement Committee recommends the T.C. to rescind its consent to the proposal of the Gateshead and District Tramways Co. to double the track on the Bensham route. The Committee also recommends the appointment of a Committee to confer with the Newcastle Corporation Committee with regard to running cars across the High Level Bridge between Gateshead and Newcastle. There was some discussion as to the desirability of entering into negotiations with Newcastle-on-Tyne on the subject, but eventually the report was adopted.

Glasgow.—**WAGES.**—The Tramways Committee has decided not to recommend the granting of a war bonus of 6s. per week to motormen and conductors, but has agreed that employees could have the option of working six extra hours per week overtime at time-and-a-half rates.

Keighley.—The period for the completion of the overhead equipment of railless trolley route (C), under the Keighley Corporation Act, 1912, has been extended by one year.

London.—**L.C.C.**—The week ending August 2nd was a record one for the Council's tramway undertaking, the traffic revenue amounting to £52,300; during the week 729,177 children travelled at reduced fares.

Manchester.—Alderman Bowes (chairman of the Tramways Committee) stated at a recent meeting of the City Council that the military hospital authorities did not favour anything in the way of a general grant of free travelling facilities on the cars for wounded soldiers. The department therefore issued tokens, and these entitled the wounded soldiers to whom they were handed to travel free of charge.

Oldham.—The Tramways Committee's recommendation of revised charges for the carriage and delivery of parcels by car was referred back at the T.C. meeting last week, so that full details of the charges proposed may be supplied to the Council. Arrangements are contemplated to allow wounded and convalescent soldiers wearing distinctive hospital suits to use the cars free. The Tramways Committee has disposed of some chilled steel car wheels at £1 per wheel more than it gave for them.

Tilbury and Southend Railway Electrification.—The Midland Railway Co. is applying to the B. of T. under the extension of Time Act, to extend until the session of 1917 the time within which it must submit a scheme for railway electrification between Fenchurch Street and Southend to Parliament.—*Railway Gazette.*

United States.—A strike affecting the tramways in New York commenced on Saturday last. The subways and elevated railways were not affected at the time of writing, though cases are reported of tramway cars being attacked.

TELEGRAPH and TELEPHONE NOTES.

Canada.—Mr. Philip E. Edelman, of St. Paul, Minnesota, has been engaged by the Canadian Government as electrical engineer to prepare plans for wireless telephone and telegraph installations in the 7,000 square miles comprised by the Dominion Parks of Western Canada. The object of the installation is to prevent forest fires, and also for the purpose of establishing an instant means of communication for reporting, and calling for aid, in territory where ordinary means of communication are out of the question.

France.—A special department has lately been established by the French Post and Telegraph authorities in Paris, to conduct experiments in connection with telegraphy and telephony.

Telegraph (Construction) Bill.—In the Committee stage on this Bill, on Monday last, Mr. Pease agreed to substitute three months for one month as the period within which consent should be signified by the owner, lessee, or occupier of any land or building affected by the placing of a telegraph line, and a provision was added that the tribunal to which a difference is referred shall not give its consent to the placing of a telegraph line unless satisfied that the refusal or failure of the owner, lessee, or occupier to consent is contrary to the public interest. The Committee stage was concluded, and the Bill was read a third time.

The Channel Tunnel and Telephonic Communication with the Continent.—The following interesting letter from Prof. J. A. Fleming appeared in the *Times* a few days ago:—"One of the possible utilities of a Franco-British Channel tunnel, which has not yet, I believe, been mentioned, is the increased facility it would afford for direct telephonic communication between Great Britain, France, Switzerland, and Italy. There are at present two English Channel telephone cables, each with twin circuits, which, by the method of usage called phantomising, can be made equivalent to three circuits each. These cables are, of course, subject to the possibility of injury, like all submarine cables, and repairs might be costly and take time. If, however, the Channel tunnel were constructed with proper provision for it, a large number of telephonic and telegraphic cables of a certain type could be laid in it which would afford greatly increased means of intercommunication at a less cost than by equivalent submarine cables. If these were extended by suitable coil-loaded aerial lines, telephonic communication could be established between the principal cities in Great Britain and those in France, and possibly Italy. Having regard to the far closer commercial relations which will exist between the Allies in the post-war period, this improved intercommunication will be of the greatest advantage. I submit, therefore, that in any plans for such a tunnel, ample provision should be made for telephonic and telegraphic cables of the latest type for long-distance working."

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—**SYDNEY.**—September 20th. N.S.W. Government Railways. One 50-ton electrically-operated overhead travelling crane for Zara Street power-house, Newcastle. October 11th. One motor-driven air compressor for Zara Street power house. Electrical Engineer, 61, Hunter Street.

PERTH.—October 4th. Deputy P.M.G. Telegraph and telephone measuring instruments and parts. Schedule 501 W.A.*

Barking.—August 15th. Electricity and Tramways Committee. Cables, switchgear, and transformers. See "Official Notices" July 28th.

Blackburn.—August 12th. Steam coal for electricity department for 12 months. Mr. P. P. Wheelwright, Engineer and Manager.

New Zealand.—**INVERCARGILL.**—September 28th. Borough Council. Steam turbo-alternator, condensing plant, and switchgear. Specifications from the Tramway Office. Contract No. 40.

St. Asaph.—August 16th. Guardians of St. Asaph Union. Renewal of accumulators. See "Official Notices" August 11.

South Africa.—**JOHANNESBURG.**—September 4th. Municipal Council. 1,000 glow-wire metal-filament traction lamps: to be ordered 1917. Underwriters wire. Lightly insulated wire for outdoor use. Contract No. 151.

September 21st. Municipal Council. Tramcar spares. Contract No. 153.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Aberdeen.—Electricity Committee. C. A. Parsons and Co. Ltd., 5,000-KW. turbine-alternator, with condenser and auxiliaries, £18,358.

Batley. Accepted tender: Brush Electrical Engineering Co. spare armature and spare condenser tubes.

Sheffield.—The contract with the British Electric Transformer Co., Ltd., for transformers and series gear is to be extended for a further period of two years, in accordance with a revised schedule of prices.

Tramways Committee. Peckham Truck and Engineering Co., 15 Peckham trucks at £92 10s. each.

Sunderland.—Electricity Committee:—

B. L. & Holsh Cable, Ltd., cables, steel & C. & mild steel sheet.

NOTES.

The Metric System in the U.S.A.—Generations of effort by earnest advocates have not served to advance the cause of the metric system in the United States and in some other countries as have the world-war conditions of the last two years. American factories that knew only inches and feet 24 months ago, are turning out millions of shells, rifles, guns, and other war materials entirely in metric dimensions. Scores of railway locomotives are being manufactured by American plants in metres and millimetres, and in entire factories and sections of factories not a single gauge, scale, or other measuring device can be found bearing the complicated Anglo-American measures of length.

The orders in metric terms that are flowing into American factories are not alone for what might be termed primary war materials. In addition to locomotives already mentioned, orders for rails, bridge members, machinery, tools, and even fabrics and wearing apparel, are accompanied by metric specifications. Practically without exception, American manufacturers have adapted themselves to the new requirement.

The experience has been a revelation to many manufacturers, who considered the metric system complicated because they had had no experience with it. Many practical workers have insisted that in spite of the handicap of unfamiliarity it is, in a very short time, a simpler matter to apply the metric system to their work than to use the foot and inch system, with its unwieldy fractions.

The war is helping the cause of the metric system in other ways as well. It has shut off South America and other consumers of manufactured goods from their usual sources of supplies in Europe, and has awakened in American merchants the desire to supply these markets, not only temporarily, but permanently. Practically every one of these possible markets, however, is in a country using only the metric system, to the people of which price-lists in pounds and tons, yards and inches, dozens and grosses, are hopelessly confusing. Furthermore, many of the South American countries require that goods be marked in metric measures before they may pass the Custom houses.

The result of this is that exporter after exporter has recognised the need of making use of the metric system, and has quietly begun turning out two classes of products—if he fills both domestic and foreign orders—goods measured and marked in customary units, and others sized and marked metrically. Complicated as such a procedure might appear at first sight, it has proved distinctly profitable in practically all cases in which it has been tried, thus confuting the contention of opponents of the metric system that its introduction would prove expensive.—*Scientific American*.

Our Consular Service.—In the August issue of the *Times Trade Supplement* Mr. De F. Pennefather, M.P., has an informing, and suggestive article on the Past, Present and Future of the British Consular Service. He holds that in this department the necessities and outlook are greatly altered by the war, and after giving the history of the development of the Consular Service over a lengthy period, and of the investigations of, and reports made upon, it at different times, he concludes as follows:—

"There should be little difficulty in obtaining all the men required to strengthen our Consular Service. Thousands of men of business experience and proved ability have voluntarily given up good positions, both at home and abroad, in order to join the Army. Many of these must possess all the necessary qualifications—including knowledge of languages—and if they are unable to pick up their former careers at the point they laid them down, may be seeking for new openings. A short training would render such men efficient, and no cast-iron 'regulations' or 'red tape' should be allowed to stand in their way.

"It is obvious that a great deal of consideration will have to be given to the whole question of our Consular Services in the light of recent happenings and future probabilities, and much spare work will have to be done in order to investigate thoroughly many matters in regard to many places, countries, and trades, and to ascertain what our Consuls can most usefully do, and how and where they can best do it.

"The Foreign Office or the Board of Trade cannot do all this during the war, and yet if the work is only begun when the war is over, our competitors may reap great advantages.

"It therefore seems only natural and proper that our Chambers of Commerce, which have for so many years taken an active and intelligent interest in the matter, should collect through their 20,000 members, the results of experiences in all parts of the Globe, and thus furnish material which will help the Government to build up a Consular Service which will not only provide better facilities for the maintenance and expansion of the trade of the Empire, but also carry out generally the objects aimed at by the Allies, as stated in their decisions at the recent Economic Conference in Paris."

Educational.—UNIVERSITY OF MANCHESTER.—We have received the prospectus of the University courses in the Municipal School of Technology for the coming session, which opens on October 5th. Prof. Miles-Walker occupies the chair of Electrical Engineering.

The Electrical Trade Position in the United States.—Our contemporary, the *Electrical World*, says that few large orders are being booked for electrical goods. The high cost of construction materials is holding back a large volume of buying. The writer says: "One of the outstanding features of the present market for electrical goods has been the absence of numerous orders for large quantities of material. To be sure, there have been some large orders, but these have been principally brought on by the boom in metals. Iron and steel rolling mills have bought large quantities of electrical goods in single orders, but they were practically forced to it. But the large development projects scheduled for erection about this time have been held up, wherever possible, until more favourable times. Those plants that are in the course of construction undoubtedly have either been absolute necessities, owing to the condition of the load and the load expected, or else were projected, and orders placed previous to this general advance in prices. All construction costs have advanced many per cent. Labour, besides being more expensive, is very scarce. Copper wire for transmission lines has advanced to an almost prohibitive price, owing to the demand for copper by the warring nations. Practically all electrical equipment, including the necessary steam and hydro machinery, costs considerably more to-day than before the war. Although orders of large volume have been infrequent, there have been many inquiries for quantities of goods that would run into millions of dollars. All of these inquiries, it is more than likely, will develop into *bona fide* orders as soon as the price is satisfactory. It is well known that there is a vast amount of railroad electrification awaiting lower prices. One of the large eastern roads has laid plans for extending its electrified zone, but is hesitating to do anything definite at the present time, because of the abnormally high prices. It is significant that the greater part of the buying of electrical goods during the recent months has been by industrial concerns, factories, mills, &c. There is therefore to be expected, it is believed, as soon as prices warrant, a buying movement from the other large purchasers, the central stations and railroads."

Lamp Voltage Standardisation in the U.S.A.—Although in the early years of incandescent lamp manufacture it was impossible accurately to predict before the lamp was manufactured at what voltage it would operate most efficiently, with the introduction of the drawn-wire filament, it became possible to foretell accurately at just what voltage any and all of the output should be rated. Lamp manufacturers, therefore, are now in a position to standardise their output and to bring about economies in the manufacture, distribution, and utilisation of lamps. Among the many benefits which it is expected will accrue from this standardisation of incandescent lamp voltages there are others besides those of manufacture. With a smaller number of sizes, dealers with the same investment naturally will be able to carry lamps for a greater variety of services. Also there will no longer be any necessity on the part of central stations to maintain domestic-service voltages at other odd pressures.

All of the affiliated lamp manufacturers have co-operated in this movement, it is understood, although but one company, the National Lamp Works, will try it out. Should the results justify, it is understood that all of the manufacturers are prepared to adopt the same voltages which, after a careful analysis of the National output, were placed at 110, 115, 120 volts.—*Electrical World*.

Foreign Trade.—THE JULY FIGURES.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	July, 1916.	Inc. or dec.	Seven months, 1916.	Inc. or dec.
IMPORTS:—				
Electrical goods, &c.	£128,978	+ £30,730	+ £395,303	
Machinery ...	684,293	+ 212,217	+ 191,321	
EXPORTS:—				
Electrical goods ...	349,967	+ 87,916	+ 639,041	
Machinery ...	1,761,034	+ 15,825	+ 318,913	

Electric Vehicle Committee.—At a meeting of the Electric Vehicle Committee, held in London on July 28th, it was announced that the Royal Automobile Club had nominated as their representative upon the Committee, Mr. W. Worby Beaumont. Correspondence has taken place between the B. of T. and the Electric Vehicle Committee on "Import Restrictions," and the Committee has been informed that, providing a statutory declaration is made to the effect that the chassis which it is desired to import are to be used solely for commercial purposes, the matter of their importation will have consideration.

Correspondence with the Car and General Insurance Corporation, Ltd., was submitted, from which it appeared that the corporation were willing to come into line with the suggestions previously made by the Committee that their Standard Electric Vehicle Policy should be altered so as to include the risk on the battery while the vehicle is in transit by road, rail, or ship. Subject to this alteration, the Committee decided to give their approval to it.

The Committee regretted the decision of the Rugby U.D.C. not to provide charging facilities; the British Thomson-Houston Co. are, however, prepared, on certain conditions, to charge electric vehicles passing through Rugby.

The secretary reported the action he had taken in connection with the report made by the borough engineer of Southwark to the Works Committee of the Council, and his action in this matter was approved.

Scottish Engineering Organisation.—A large meeting of Scottish engineering employers, held in Glasgow on August 4th, Mr. Rowan Thomson presiding, passed the following resolution:

"That in view of the unprecedented situation created by the war and the uncertainty of the future this meeting is of opinion that all engineering firms in England and Scotland should come together under a strong central organisation, capable of dealing with important questions that will certainly arise in the near future; that the existing organisations connected with engineering should also receive whole-hearted support in order that they may be strong to achieve the objects for which they were created."

A committee was appointed to carry the proposal into effect.

Appointments Vacant.—Shift engineer, for the Woking Electric Supply Co., Ltd.; engineer-in-charge, £2, for the Bexley U.D.C.; shift engineer, 35s., for the Neath R.D.C.; charge engineer, 42s., for the Corporation of Wakefield Electricity Department. See our advertisement pages to-day.

A Good Use for Old Tracing Cloth.—One of the minor directions in which engineers can help the war is by collecting all their old cloth tracings or unused tracing cloth and sending them to Lieut. R. D. T. Jones, R.E., Ministry of Munitions, Explosives Department, Storey's Gate, Westminster. The cloth, when boiled, washed, and sterilised, makes excellent bandages, pillow cases, &c., for the wounded—things that are still badly needed. Engineers need have no fear that their designs will be copied, because all the tracings are handed to a responsible person to be treated. Many firms have already helped in this way, and it is hoped that many more will do so.

There are few works that do not destroy dozens of yards of tracing linen a year, and now that this excellent use for the waste material is pointed out to them we feel sure that they will respond to Lieut. Jones's request.

Volunteer Notes.—1ST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place. Orders for August by Lieut.-Col. C. B. Clay, V.D., Commanding.

The Headquarters will be closed during August except on Tuesday evenings. The range will be open on Thursday evenings only. Instruction Classes at Regency Street will be held as usual for Platoons Nos. 9 and 10. The Camp at Otford will be available until August 31st. Members wishing to attend should enter their names at Headquarters.

Sunday Entrenching Parades. Parade in Uniform at Victoria Station (S.E. and C. Railway) Booking Office, 8.45 a.m.

MACLEOD YEARSLEY, *Adjutant*.

3RD BATT. (OLD BOYS') CENTRAL LONDON VOLUNTEER REGIMENT.—Battalion Orders by Capt. W. Ridd (Sub-Commandant), Thursday, August 10th, 1916:—

Week-End Parades.—**Saturday.**—The Battalion will Parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 8.40 a.m., and proceed by train for entrenching duties. Members will make their own arrangements for lunch. Those who wish to return to town will reach Liverpool Street Station about 6 p.m. Those who cannot take the early train will parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 1.20 p.m.

Sunday.—The Battalion will Parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 9.30 a.m., and proceed by train for Entrenching duties. Members will carry their own lunch, and the Quartermaster will make arrangements for light liquid refreshments. The Battalion will return to town about 6 p.m.

Marketry.—Members who have sent in their names to shoot at Bisley on Saturday, 12th inst., will report in Uniform, to Sergt. J. W. S. Burmester, at 12.45 p.m., at No. 8 Platform, Waterloo Station.

Recruits will Parade at Lord's Cricket Ground on Saturday at 3 p.m., and on Sunday at 11 a.m., for Recruit Drill.

Wembley Park.—There will be no week-end Parade at Wembley Park. CLARENCE T. COGGIN, *Acting Adjutant*.

Registration of Business Names Bill.—This Bill passed its third reading in the House of Lords on Wednesday. Lord Southwark informed the House that under the provisions included in the Bill, the commercial community would be able to tell whether any firms included aliens. Amendments were approved providing that nationalities as well as names should be registered, and altering the date for the Bill to come into force from October, 1916, to January 1st, 1917.

The Fall of the Levitated.—Notices appear in the *London Gazette* of Tuesday last to the effect that the following four companies cannot by reason of their liabilities, continue their businesses, and are to be wound up voluntarily, with Sir W. B. Peat as liquidator:—

Bachelet Levitated Railway Syndicate, Ltd.
Bachelet Shipbuilding, Engineering and Ordnance Co., Ltd.
British Bachelet Flying Train Syndicate, Ltd.
Bachelet Shuttle & Loom Co., Ltd.

Board of Trade Inquiry.—The Board of Trade Commercial Intelligence Branch has received an application for names of manufacturers, or producers, of plated metal fronts and reflectors for portable electric hand-lamps.

The State and Science.—The British Science Guild has prepared a memorandum on the relations which should exist in future between the State and science. The memorandum proposes that a national statutory Board of Science and Industry, the permanent staff of which should consist mainly of persons of wide scientific knowledge and business experience, should be established, among other objects to—

Promote the co-ordination of industrial effort.

Secure co-operation between manufacturers and all available laboratories of research.

Institute a number of paid advisory committees consisting of men of wide scientific knowledge, assisted by expert investigators and technologists, who should receive reasonable fees for their services.

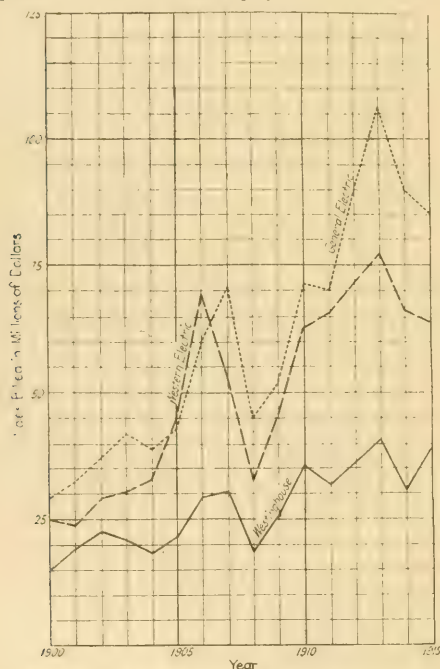
Organise scientific effort on the manufacturing side and in commercial relations with other countries.

Encourage investigation and, where necessary, give financial aid towards the synthesis and artificial production of natural products and for other researches.

The memorandum also urges that the courses at the public schools and at Oxford and Cambridge should be revised: that more attention should be given to scientific method and to educational handiwork in elementary and secondary schools; and that a knowledge of science should be essential for certain appointments in the public service.—*The Times*.

Sixteen Years' American Electrical Sales.—During the last 16 years the aggregate sales billed by the three largest distributors of electrical goods in the United States has amounted to \$2,191,937,000, or an average of approximately \$137,000,000 annually. The total for the General Electric Co. was \$963,899,000; Western Electric Co., \$792,800,000; Westinghouse Electric and Manufacturing Co., \$435,238,000. The accompanying curves, which are reproduced from the *American Electrical World*, show graphically the annual variation in the sales of these three companies starting with 1900.

It will be noticed that while the general tendency has been upward, the curve for each company contains more than one



SALES OF THE THREE LARGEST AMERICAN ELECTRICAL MANUFACTURERS.

infection. Furthermore, in each case it will be noticed that the slump in sales billed followed a particularly good 12 months. In 1907 the sales of the General Electric Co. were the largest on record, but in the following year the sales were almost on a level with those for 1905. Again, the 1913 sales took a jump to \$106,477,000, which was almost \$20,000,000 greater than any previous year. In 1914 but \$90,468,000 worth of electrical goods were sold.

The same condition is true to a different degree of the other two companies except that the Western Electric Co. had a record year in 1906 and a slump in 1907. The 1906 Western Electric sales billed were \$69,000,000, and the 1907 sales billed were \$53,000,000. The 1913 sales billed were \$77,500,000 and the 1914 sales billed amounted to \$66,400,000. Sales billed by the Westinghouse Co. in 1907 were \$30,325,000, and in the following year \$18,216,000. In 1913 they were \$40,741,000, and in 1914 but \$31,208,000.

In 1911 both the General Electric and Westinghouse Companies billed smaller sales than in 1910, but the Western Electric Co.'s sales increased by \$3,000,000. The 1910 sales of the General Electric Co. were \$71,479,000 and of Westinghouse \$35,622,000. The 1911 sales of these two companies were \$70,384,000 and \$31,223,000 respectively.

The largest year in the history of the three corporations was 1913. In that year the sales billed by the three companies were as follows: General Electric Co., \$106,477,000; Western Electric Co., \$77,500,000; Westinghouse Electric and Manufacturing Co., \$40,741,000; a total of approximately \$225,000,000.

Both the 1908 and 1914 slumps were attendant upon international financial depressions. The year 1907 opened with a liquidating movement following a year of extraordinarily good business. Before the year was ended affairs had reached such a point that credit was suspended, and in America a panic broke out. In this latest depression, says the *Electrical World*, it is not difficult to understand why business should fall off when with the greater part of the civilised world at war and international commerce practically suspended, financial operations were suspended and money was both expensive and hard to obtain.

Women's Working Capacity.—Dr. Carpenter, the chairman of the South Metropolitan Gas Co., told the shareholders, on Wednesday, that the amount of work a woman turned out was about two-thirds that of a man, and, therefore, they paid them two-thirds of the rate paid to men.—*Daily Chronicle*.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the *ELECTRICAL REVIEW* posted as to their movements.

Central Station and Tramway Officials.—The Oldham Corporation has decided to grant an honorarium of £10 to the tramways traffic superintendent for his extra services for three months following the retirement of Mr. Dugdale from the managership, and an increase of salary has also been granted to him. The works manager has likewise received an advance.

Mr. R. B. LEACH, electrical engineer and tramways manager of the Heywood Corporation, has been appointed electrical engineer and manager of the Loughborough Corporation at a salary of £300 per annum. There were 95 applicants for the position.

According to a Dublin newspaper, the Dublin Electricity Committee recommends an increase in remuneration to the shift engineers and switchboard attendants. The Committee recommends granting the men the difference between their present salaries and the maximum to which they become entitled according to their respective positions in a few years.

The salary of Mr. S. D. JONES, electrical engineer to the Batley Corporation, has been increased by £15 a year, and that of Mr. CARTER, assistant engineer, by £10 a year.

The Malvern U.D.C. is increasing the salary of the gas and electrical engineer, Mr. S. TROW SMITH, by £50 per annum.

General.—The directors of the St. James's and Pall Mall Electric Light Co., Ltd., have appointed Sir ALEXANDER B. W. KENNEDY, F.R.S., chief engineer in the place of the late Mr. S. T. Dobson, M.Inst.C.E.

Mr. NORMAN H. WOOD has left the submarine department of Messrs. John Brown & Co., Ltd., Clydebank, to take up a commission in the R.N.A.S. as Sub-Lieutenant, R.N.V.R.

Roll of Honour.—The *Times* states that Captain FRANK R. JESSUP, Border Regiment, killed in action, was born in 1887 and educated at Brentwood and Gordon's College, Aberdeen. On leaving Gordon's he entered the service of the Eastern Telegraph Co., and at the end of 1903 resigned to join his elder brother in Vancouver, B.C. He was engaged in the engineering department of the Pacific Great Eastern Co. when war broke out.

The *Times* states that Captain A. E. STONE, who was killed in action on July 24th, had been connected with Messrs. George White & Co., of Bristol, for about 20 years, and he rendered valuable services on the formation of the London United Tramways Co. He was Sir George White's private secretary for many years.

Private FRANCIS SLACK, of the Sherwood Foresters, who joined at the outbreak of war whilst engaged at the Derby Corporation electric light station, has died at Edmonton Military Hospital, of wounds received in action. Before going to France he served in Gallipoli for three months.

Sergeant ALEXANDER ROSS, of the Public Schools and University Battalion Royal Fusiliers, killed in action in France on July 20th, at the age of 23 years, studied electrical engineering at the Faculty of Technology, Manchester, and received the degree of B.Sc. (Technical) in June, 1914.

Private ERNEST HARRIS, formerly with the South Metropolitan Electric Lighting Co., was killed in action in France on July 19th.

Lance-Corporal CHARLES JONES, an employé of the Chloride Electrical Storage Works, Clifton, near Manchester, is unofficially reported to have been killed in action, aged 21.

Driver THOMAS FINNIGAN, of the Canadian Artillery, who has died in a casualty clearing station, was a Bolton man. He

emigrated to Canada five years ago with his brother, Edward, and the two were in business in the Dominion as electricians. They enlisted together, and Edward is now in the Canadian Record Office in this country.

Private JAMES CROMPTON, Lancashire Fusiliers, who is missing, was employed in the overhead equipment department of the Salford Corporation tramways.

Private J. J. HILTON, of the Lancashire Fusiliers, who has been killed in action, aged 32, was an employee in the electrical department of Messrs. Mather & Platt, Ltd.

Sergeant P. J. HARRIS, of the Royal Warwick's, of Seedy, near Manchester, who was employed by the General Electric Co., Ltd., has died in France from wounds, aged 26.

Sergeant FRANK DAWSON, of the Manchester Regiment, killed in action, aged 39, was employed by the British Westinghouse Co., at Trafford Park.

Private CHARLES J. PARRY, of Manchester, an employee of Messrs. L. Andrew & Co., Manchester, has been killed in action, aged 30.

Private STANLEY SUMMERSALES, of the Leeds "Pals" Battalion, is reported missing. He was in the employ of Messrs. Verity's, Ltd.

Sergeant A. E. WRIGHT, of the Royal Field Artillery, who is an electrician, of East Ham, has been awarded the Military Medal for bravery and devotion to duty.

Rifleman JOHN LAMBOURNE, of the Rifle Brigade, who was an employee at the Rugby works of the British Thomson-Houston Co., Ltd., has died of wounds received in action in France.

Lance-Corporal MONTAGU PEARSON, of the South Staffs Regiment, reported killed in action in France, was employed at the British Thomson-Houston Co.'s works at Rugby. He was 23 years of age, and a year ago was wounded in Gallipoli.

Two employees of the Leyton Municipal tramways department, Messrs. G. DAVIES and H. J. H. McPHERSON, have fallen in action in France.

Private THOMAS LOVELADY WOOD, of the King's Liverpool Regiment, who has died at Rouen of wounds received in action, was on the staff at the Forinby electric power station.

Corporal A. RICHARDS, Royal Warwickshire Regiment, was killed in action on July 14th.

Second-Lieutenant J. H. C. CHANDLER, 24th Battalion R.F., who, before joining up in January, 1915, was chief tester at Messrs. Mather & Platt's Park Works, Manchester, was recently wounded in France, and is in hospital at Osborne, Isle of Wight.

Lieutenant J. H. PALMER, who has been killed in action, was educated in France and at the Manchester Municipal School of Technology, and took his degree in electrical engineering at the Manchester University. He was later for several years with the firm of Messrs. Connolly Bros., Ltd., cable manufacturers.

Driver LEONARD MORTIS, who was an employee of the British Westinghouse Co., Trafford Park, has died in hospital in Mesopotamia. He was 22 years old.

Rifleman CHARLES G. J. BETTS, of the London Rifle Brigade, who is officially reported missing since the great offensive, was formerly in the showrooms of Messrs. Cunningham, Ltd., London.

Driver W. H. OWENS, R.F.A., accidentally killed on active service, was formerly employed by Messrs. Downes & Davies, wholesale electrical merchants, Liverpool.

Private BEN TERRY, of the King's Own Royal Lancasters, an employee of Messrs. Connolly Bros., Ltd., cable manufacturers, Blackley Vale, has died from shell shock.

Private ARTHUR BATEMAN, Manchester Regiment, killed in action, was an employee of the British Westinghouse Co.

Private JOHN HALEY, who was employed by the Morley Electrical Engineering Co., Stanningley, before the war, is reported killed in action in France.

Obituary.—Mr. R. I. LONGRIGG.—Mr. Robert I. Longrigg (38), electrical engineer, of Hoole, Chester, died at the Seacombe Ferry Hotel, being found in his room with a gunshot wound in the mouth. At the inquest it was stated that deceased had been hard-worked and was on the verge of a nervous breakdown, and a verdict was returned to the effect that deceased committed suicide, there being no evidence as to the state of his mind.

MR. C. W. CURTIS.—In the *Times* "Deaths" column it is announced that Mr. Chas. Wm. Curtis, Principal Medical Officer of the Eastern Telegraph and Allied Companies, passed away on August 6th at Asford, Middlesex.

Will.—The late Prof. SILVANUS PHILLIPS THOMPSON left £8,444.

NEW COMPANIES REGISTERED.

Griayer & Co., Ltd. (144,531).—This company was registered on August 4th with a capital of £5,000 in £1 shares, to take over the business of electrical and mechanical engineers formerly carried on as Griayer and Co., at Waking Street, Stepney, E. The subscribers (with one share each) are: J. McLaren, 9, Tiltolton Road, Ilford, engineer; W. R. Germain, 5, Waking Street, Stepney, E., engineer. Private company. The number of directors is not to be less than two or more than five; the first are J. McLaren (permanent chairman) and W. R. Germain. Qualification, one share. Solicitor: F. Budd, Devonshire Chambers, 146, Bishopsgate, E.C. Registered office: 146, Bishopsgate, E.C.

British Revival Manufacturing Co., Ltd. (144,501).—This company was registered on August 1st, with a capital of £1,500 in 1,000 preferred shares of £1 each and 10,000 deferred shares of 1s. each, to manufacture electrical accessories previously made and supplied by enemy countries, and to carry on business in connection therewith. The subscribers (with one preferred share each) are: P. H. Robinson, 72, Shaftesbury Road, Crouch Hill, N., clerk; W. H. Belleine, 129, Clarence Road, Lower Clapton, N.E., jeweller's assistant. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Qualification, 300 shares. Remuneration, £100 each per annum (chairman £150). Secretary (*pro tem*): P. H. Robinson. Registered office: 160, High Road, Chelsea.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Mander & Co., Ltd.—A first mortgage debenture, dated July 24th, 1916, to secure not more than £300, charged on the company's undertaking and property, present and future, including uncalled capital, has been registered. Holder: J. E. Bendell, 20, Greenhill Road, Moseley.

Small Electric Motors, Ltd.—Particulars of £3,000 debentures, created July 18th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1906, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Pitter's Ventilating & Engineering Co., Ltd.—Debenture dated July 20th, 1916, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: H.M. Ministry of Munitions, Armament Buildings, Whitehall, S.W.

Compania de Electricidad de la Provincia de Buenos Aires, Ltd.—A trust deed dated July 19th, 1916, supplemental to a trust deed dated November 24th, 1911, to secure an increased rate of interest payable on the amount secured by the principal deed (£900,000), charged on the power distributing and transforming stations in the Argentine Republic and the company's undertaking and property, present and future, including uncalled capital, and all existing and future concessions and contracts, has been registered. Trustees: *Pro tem*, Deposit & Agency Co., Ltd.

T. F. Braine & Co., Ltd.—A memorandum of satisfaction in full on July 14th, 1916, of mortgage dated March 1st, 1910, securing £2,000, has been filed.

CITY NOTES.

The report for the year ended September 30th, 1915, just issued, shows that the gross receipts were £33,462, as against £30,438 in the previous year. The expenses were £21,730, against £19,721. The net revenue was £11,732, as against £10,717. The tramways department carried 3,138,327 passengers (against 2,874,021), and 475,017 car miles were run (against 463,293). New lighting consumers connected numbered 316, making the total 1,805. During the year the capital expended was £3,632. The scheme submitted to the debenture-holders and shareholders in June and July, 1916, was adopted, and the necessary adjustments consequent thereupon are incorporated in the present accounts. The amounts written off in exchange for income certificates (issued with the sanction of the Treasury) were £37,575 in respect of arrears of debenture interest, and £16,525 in respect of bills payable, and a further £5,433 has been written off for interest waived by the holders of the bills. The total amount written off is £59,533, out of which the directors have applied £23,000 for depreciation of the company's undertaking, and the balance in extinguishing the debit to profit and loss. The directors have agreed to waive the arrears of their fees amounting to £800. They again express their appreciation of the excellent services of the manager, Mr. Murdoch, and the staff. Annual meeting: London, to-day.

Western Canada Power Co.—The First Mortgage-Bondholders' Committee of this company announces that it has approved an agreement of reorganisation formulated by the protective committee for noteholders of Western Canada Public Utilities, Ltd.—*Financial Times*.

Elmore's German and Austro-Hungarian Metal Co., Ltd.—The report for the year ended December 31st shows that, after charging debenture interest, &c., there was a loss of £4,815, thus increasing a debit balance of £21,517 brought down to £26,332. *Financial Times*.

Oldham, Ashton & Hyde Electric Tramways Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum (6d. per share), less income-tax, on the ordinary shares for the half-year.

Nairobi Electric Power & Lighting Co., Ltd.—Final dividend at the rate of 4 per cent. per annum, less income-tax, on the preference and ordinary shares for the year ended December, 1915.

Kensington & Knightsbridge Electric Lighting Co., Ltd.—Interim dividend on the ordinary shares for the half-year ended June 30th, 1916, at the rate of 5 per cent. per annum.

Paisley District Tramways Co.—Interim dividend at the full rate of 5 per cent. per annum on the preference shares for the half-year to June 30th.

Walter Scott, Ltd.—A further dividend of 10 per cent. is recommended, making 15 per cent. for the year.

STOCKS AND SHARES.

TUESDAY EVENING.

Stock Exchange markets have dropped into the placid quietude so usually associated with August. Though the Bank Holiday was cancelled, it seems likely, judged from the appearance of the Stock Exchange, that a good many members started what holidays they are able to get this year so as to include the Monday; and apparently, from the number of orders received this week, many of their clients have done the same thing. There is little animation anywhere. Electric lighting shares are steady, the telegraph market is as firm as ever, British Columbia Railway issues are better, and there is a fair amount of activity in the area of war stocks, this embracing iron and steel companies as well as those concerned with munitions, transport, catering, shipping and the like. The shipping market in particular stands out prominently; and the shake-out which followed the mad upward movement has been succeeded by a swift recovery.

It is a little surprising that the electricity supply section should maintain so noticeable a degree of strength. St. James' shares and Westminster are both wanted. In fact, the prices for the West End shares are all decidedly good, and there are more buyers than sellers. Counties and Cities remain firm. Although there are no quotable changes in the list, prices are better than they look. The Kensington and Knightsbridge Co. announce an interim dividend of 5 per cent., as against 6 per cent. a year ago.

The Stock Exchange Committee will re-institute next week the system of double quotations where such are practicable. We have already indicated a few of the pros and cons of this endeavour to bring back to pre-war conditions some, at any rate, of the hundreds of securities quoted in the Official List. Whatever may be thought of the scheme—and there are a good many people who doubt its wisdom or utility—the experiment will be an interesting one to watch; and its institution in the dog days will enable it to get into reasonably good running order by the time that Stock Exchange business revives, which it ought to do, in the nature of things, about the middle of September. The immediate nigger in the hedge is the possibility of a further rise in the Bank Rate, which is scouted in many quarters, just as a month ago the idea of the minimum rising to its present 6 per cent. was received with scoffing and ridicule.

The Home Railway market is moving extremely slowly, and when changes occur, they are mostly in the retrograde direction. This is because there is nothing of interest to sustain prices. There are no traffics, reports, meetings to galvanise the position; and though ingenious commentators work out what is going to happen after the war, the future is so obscurely wrapped that it is impossible to accept the estimates as likely to prove reliable, except by chance.

The Undergrounds are firmer than the rest, despite the severe restrictions applied to the use of petrol pressing upon the London General Omnibus services, which, of course, are the really paying part of the Underground group; and the curtailment of omnibus facilities in London affects more harshly the hard-working portion of the community than would the abolition of those monstrosities which tear about the seaside and some of the country districts, packed with rubber-necks. If the authorities were to turn their attention to unessential motor conveyances on land and water, it might force people to use their natural means of perambulation a little more, but, at the same time, it would save petrol for services of more serious import at the present time.

In the telegraph market, Anglo-American preferred has fallen a point, but the deferred is $\frac{1}{4}$ higher. Great Northern has recovered their loss of last week, and West India and Panama shares are a little better at $\frac{1}{4}$. There is a fair amount of animation in Marconis, and buyers have come along at $\frac{3}{4}$, while the Marines keep good at $2\frac{1}{4}$. Telephone shares are steady, but without alteration.

British Columbia Electric issues are good, with rises of 2 points in the preference and deferred stocks, while the preferred at 45 is 3 up. The financial position in Canada steadily improves, and British Columbia companies are sharing in the increasing prosperity of the Dominion. Just as a little while ago it was not easy to sell the stocks, so now at the present time it is just as difficult to buy them. Brazil Traction is a dull market at 62, although the Rio exchange keeps very steady. The Argentine group is neglected.

Amongst the manufacturing shares, British Westinghouse preference have partially recovered their decline of last week, and Electric Constructions are again 3d. to the good. British Insulated are a strong market at 12. Babcock & Wilcox have gone back a trifle. The chemical group is good, and rumour once more toys with the names of individual companies which are said to be looking towards one another with the idea of amalgamation or working agreement.

In the armament division, Sheffield has been something of a seller, without, however, producing any quotable change, except in the case of Projectiles, which have gone back a

little. Great firmness characterises the rubber share market. The price of the raw material shows a hardening tendency, and so far as shares of the good companies are concerned, it is once more easier to sell than it is to buy them.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend		Price		Rise or fall this week.	Yield p.c.
	1914.	1915.	Aug. 8, 1916.	Aug. 1, 1916.		
Brompton Ordinary	10	10	82	—	—	27 18 9
Charing Cross Ordinary ..	5	5	85	—	—	6 18 0
do. do. do. 44 Pref. ..	44	44	80	—	—	8 8 7
Chelsea	5	4	8	—	—	6 18 4
City of London	9	8	121	—	—	6 8 0
do. do. 6 per cent. Pref. ..	6	6	104	—	—	6 14 8
County of London	7	7	112	—	—	6 8 9
do. do. 6 per cent. Pref. ..	6	6	109	—	—	6 14 3
Kensington Ordinary	9	9	104	—	—	6 16 7
London Electric	4	4	12	—	—	6 10 5
do. do. 6 per cent. Pref. ..	6	6	98	—	—	6 13 4
Metropolitan	7	7	88	—	—	6 13 9
do. do. 44 per cent. Pref. ..	44	44	8	—	—	7 10 0
St. James' and Pall Mall ..	10	8	63 1/2	—	—	6 18 4
South London	5	5	24	—	—	8 18 10
South Metropolitan Pref. ..	7	7	13	—	—	6 4 5
Westminster Ordinary ..	9	7	62	—	—	6 14 8
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	6	6	108	—1	—	5 16 6
do. do. Def.	30	33 1/2	281	+ 1/2	—	7 8 9
Chile Telephone	8	8	63 1/2	—	—	6 18 5
Cuba Sub. Ord.	5	5	82	—	—	8 1 8
Eastern Extension	7	7	8	—	—	6 18 9
Eastern Tel. Ord.	7	8	149 1/2	—	—	* 5 7 9
Globe Tel. and T. Ord. ..	6	7	102	—	—	* 5 8 8
do. do. Pref.	6	6	124	—	—	5 10 4
Great Northern Tel.	22	22	88	+ 1/2	—	6 18 9
Indo-European	18	13	48	—	—	6 12 8
Marconi	10	11	92	—	—	3 4 0
New York Tel. 44	44	44	93 1/2	—	—	4 10 3
Oriental Telephone Ord. ..	12	10	24	—	—	6 0 0
United R. Plate Tel.	8	8	—	—	—	* 5 18 6
West India and Pan.	1	—	1 1/2	+ 1/2	—	—
Western Telegraph	7	7	14 1/2	—	—	* 5 7 8
HOME RAILS.						
Central London, Ord. Assented	4	4	75	+1	—	5 6 8
Metropolitan	12	1	25	—	—	3 18 6
do. do. District	Nil	Nil	19	—	—	Nil
Underground Electric Ordinary	Nil	Nil	13 1/2	—	—	Nil
do. do. "A"	Nil	Nil	46 1/2	—	—	Nil
do. do. Income	6	6	90 1/2	+ 1/2	—	* 6 12 8
FOREIGN TRAMS, & C.						
Adelaide Sup. 6 per cent. Pref.	6	6	68	—	—	6 0 0
Anglo-Arg. Trams, 5 per cent. Pref.	54	54	58	—	—	7 2 0
do. do. 2nd Pref.	54	54	8	—	—	—
do. do. 5 Deb.	5	5	77 1/2	—	—	6 9 0
Brazil Traction	4	4	62	—	—	6 9 1
Bombay Electric Pref.	6	6	104 1/2	—	—	5 14 3
British Columbia Elec. Ry. Pice.	5	5	62	+2	—	6 1 1
do. do. do. Preferred ..	Nil	Nil	45	+8	—	Nil
do. do. do. Deferred ..	Nil	Nil	43	+4	—	Nil
do. do. do. Deb.	44	44	65	—	—	6 10 9
Mexico Trams 5 per cent. Bonds	Nil	Nil	40	—	—	Nil
do. do. 6 per cent. Bonds ..	Nil	Nil	84	—	—	Nil
Mexican Light Common	Nil	Nil	90	—	—	Nil
do. do. Pref.	Nil	Nil	38	—	—	Nil
do. do. 1st Bonds	Nil	Nil	40	—	—	Nil
MANUFACTURING COMPANIES.						
Babcock & Wilcox	14	15	21 1/2	— 1/2	—	5 2 0
British Aluminium Ord. ..	5	5	7	—	—	5 7 8
British Insulated Ord. ..	15	17 1/2	12	—	—	7 5 10
British Westinghouse Pref. ..	74	75	51 1/2	— 1/2	—	5 17 8
Callenders	15	20	124	—	—	6 0 0
do. do. 5 Pref.	5	5	42	—	—	5 17 8
Casner-Kellner	20	—	38	—	—	5 6 8
Edison & Swan, £3 paid ..	Nil	Nil	12	—	—	Nil
do. do. fully paid	Nil	Nil	12	—	—	Nil
do. do. 5 per cent. Deb. ..	5	5	57	—	—	8 16 8
Electric Construction	6	7 1/2	17 1/2	+3d.	—	8 16 6
Gen. Elec. Pref.	6	6	95	—	—	8 1 6
Hensley	20	25	16	—	—	8 1 9
do. do. 41 Pref.	44	44	4	—	—	6 12 6
India-Rubber	10	10	12	—	—	* 8 6 8
Telegraph Con.	30	20	89	—	—	* 6 4 0

* Dividends paid free of income tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of vehicles.	Total t. to date.		Route miles open.	
		£	£		£	£	£	Inc.
Blackpool-Fleetwood	July 92	5,235	+ 577	29	17,764	+ 1,598	8	..
Bristol (Trams)	28	21,013	+ 1,041	83	149,730	+ 5,715	30 5	..
Cork	27	2,927	+ 134	30	14,746	— 81	8 9	..
Dublin	28	27,753	+ 2,420	30	173,427	+ 6,922	54 25	..
Hastings	28	4,853	+ 533	30	27,212	+ 853	19 8	..
Lancashire United	26	7,771	+ 8 8	30	62,373	+ 1,703	42	..
Llandudno-Col. Bay	28	2,074	+ 80	31 1/2	9,953	+ 213	6 5	..
Anglo-Argentine	29	20,892	+ 3,109	30	1,523,391	— 9,228	..	..
Auckland	June 31	816	+ 63	62	274,763	+ 7,515	26 59	1 17
Calcutta	July 29	18,478	+ 396	—	—	+ 6,139	..	..
Kalgoorlie, W.A.	May	2,921	—	21	12,497	—	20 5	..
Madras	July 31	4,451	+ 279	33	29,140	+ 2,112	..	..
Montevideo	July	26,220	+ 59	30	265,388	+ 14,485	..	..
Dublin-Lucan Rly.	July 28	752	+ 95	4	752	+ 74	7	..

THE ELECTRICAL EQUIPMENT OF A MODERN FOREIGN SUBMARINE BOAT.

By NORMAN H. WOOD.

(Continued from page 117.)

The main fuses for the auxiliary circuit are enclosed in the same box, which is located very close to the battery tank to ensure the main battery leads being extremely short. The cut-outs are mounted side by side in an explosion-proof steel case, with the operating handles brought through the sides. The overload and time-limit relays are mounted on the front cover and set to operate at 1,300 amps. in about two to three seconds. They are, therefore, non-operative whilst starting-up, but open should an overload last for more than the time limit stated above. In series with the solenoids is a small switch which opens with the cut-outs and releases the relays from electric pressure.

Each electrical circuit in the vessel is independently arranged with its fuses directly connected to the main battery leads, which ensures that in the event of any one set of fuses blowing no other circuit or circuits will be disturbed. The auxiliary power circuits are fed from the full battery pressure, whilst all lighting circuits are taken off the half battery pressure through double-pole change-over switches, to enable either half battery to be discharged at will, and double-pole switches to cut out the complete circuit. The general, instrument, and navigation circuits are provided with regulating resistances to maintain a constant pressure of 55 volts at any battery pressure. To prevent the boat being plunged into complete darkness, in the event of the general lighting fuses blowing, safety or police lamps are installed and fed from a separate circuit, but as no rheostat is provided in this particular circuit, the lamps are switched off during such time as the battery is on charge. Each lighting circuit is controlled from a special watertight gunmetal distribution box enclosing 6 D.P. fuses and 6 S.P. switches, and has cast on the underside three watertight sockets for portable connections; the spindles for operating the switches are brought through the front cover, which also carries a small hinged inspection flap for fuse renewals, &c.

The navigation lights comprise a masthead steaming light secured portable to the forward periscope, stern and stem anchor lights clipped to the handrails, a masthead flashing lamp secured portable to the after periscope, and the bow and stern lights. The last three lamps are fixtures built into the superstructure round about the conning tower, and fed directly from the navigation distribution box in the central station, whilst all portable navigation lamps are plugged on to the special box in the communication hatch behind the conning tower, to which is also connected the portable Morse key and condenser for the flashing lamp and the light in the portable compass which is used when steering from the bridge.

The general lighting consists of 16-c.p. metal-filament lamps enclosed in gunmetal guarded brackets bolted to the frames in the most efficient positions to avoid other internal gear, and controlled from distribution boxes in the engine room, central station, crew space, and officers' quarters; four additional 5-amp. D.P. watertight plugs are fitted in the engine room for portable lamps or small tools. Two self-contained portable magazine hand lamps, with suitable resistance to enable them to be charged from a 55-volt circuit, are carried in the central station.

Three electric hotplates of 750 watts capacity and three heats each, built into one frame, are installed in the crew space for cooking purposes; cur-

rent for these is taken from a special distribution box placed just overhead, and connected to the plates through flexible portable leads.

Four portable electric radiators of 1,500 watts consumption, with three heats each, are carried to warm the officers' quarters and crew space in cold weather and special watertight D.P. sockets are fitted in these compartments to feed them. To ventilate these quarters in warm weather, two 12-in. noiseless fans with three speeds and trunnion movement are provided.

The vessel is equipped with one stern and two bow torpedo tubes firing 450-mm. Whitehead torpedoes by means of compressed air. Firing can be effected by hand or electrically. In the latter case, the firing valve lever is released by an electric solenoid energised from the lighting circuits through platinum-tipped push buttons, which are distributed in the boat in such a manner as will allow any tube to be fired from the conning tower, the central station, or at the tube itself. In each case, when not in use these buttons are secured with a padlock, the key of which is always in the possession of the Commander, to prevent the wilful firing of any tube.

A complete submarine bell signalling plant is installed, with an effective range of 12 miles; fitted with this equipment, the submarine can maintain communication with another submerged boat or similar plant on shore. Transmitting is performed by a large bronze bell placed mouth upwards in the forward superstructure, and supported by a special mechanism so arranged that the bell can be stowed below the plating when not in use, or quickly raised from the inside of the boat, clear of the superstructure, to permit the sound waves to travel out in all directions. The bell tongue is connected to a pneumatic cylinder, the slide valve of which is operated by a Morse key in conjunction with a condenser, the supply current being taken from the distribution box in the officers' quarters. The receiving plant has two special submarine microphones placed port and starboard in the lower forward part of the boat, well below the waterline. On the face of the microphone case is a circular machined groove lined with a thick rubber packing, which forms a perfectly watertight job when pressed on to the hull, through which a small hole is drilled to ensure the diaphragms always making good connection with the seawater. Two telephone receivers mounted on the same instrument box are used to collect the signals in conjunction with a 4-volt primary battery and small-change-over switch to enable either microphone to be placed in circuit. The key, condenser, and telephone receivers are conveniently mounted in the officers' quarters just above the starter for the forward 26-H.P. bilge pump motor, which arrangement allows signals to be transmitted and received very efficiently. Should the vessel accidentally sink in shallow water, the crew inside the submarine can release the safety mechanism known as the telephone buoy, by which the position of the sunken submarine can be located and telephonic communication set up between the boat and surface. The buoy itself consists of a wooden structure covered with 1/16 in. galvanised steel sheeting, and is secured to the superstructure by a screw releasing-mechanism operated by the crew inside the submarine. On top, the buoy has a hinged cover carrying a special watertight flashing lamp; on opening the cover, access is given to a portable microtelephone and pushbutton. In the boat is a second microtelephone with alarm bell and 4-volt primary battery enclosed in a light steel case, and a Morse key to flash the lamp on the buoy cover. Electrical communication is maintained through a 60-metre long 4-core cab-tie covered cable (two cores for the telephone and two for the lamp), which enters the boat and buoy through bronze stuffing glands or deck tubes. Current for the flashing lamp is taken

from the distribution box in the crew space. When not in use, the 4-core cable is coiled up in a special cable locker just aft of the buoy.

The three electrically-driven pumps used for diving, emerging, trimming, &c., are arranged to pump from any tank of bilge through the main and auxiliary water service, or to pump out any torpedo tube through the auxiliary connections. By means of change-over cocks the small auxiliary pump can either draw from or discharge to any tank or bilge. For salvage purposes, pipes are fitted from the main and torpedo bilges to the top of the vessel to permit water inside the submarine to be blown out from the outside. The two large pumps placed fore and aft are of the high-speed double-rotor centrifugal type, capable of delivering 2,000 litres per minute against a head of 30 metres with the rotors in parallel, or 1,000 litres per minute against a head of 60 metres with the rotors in series at a speed of 2,000 R.P.M. The changing over of rotors from series to parallel or *vice versa* is performed by the manipulation of a single cock. These two pumps are directly connected to 26-H.P. shunt-wound semi-enclosed electric motors with a speed variation of 1,700 to 2,000 R.P.M. at 115 volts, the slower speed being necessary to prevent the motors being overloaded when the pumps are working against no head; for example, when the submarine is running on the surface. A temperature rise of 30 deg. C. at the six-hour rate was specified to the motor makers with a permissible total weight of 610 kg. per motor.

The auxiliary pump is of the piston type, geared to an 8-H.P. shunt-wound totally-enclosed motor with a speed variation of 500 to 1,600 R.P.M. at 115 volts, and a temperature rise of 35 deg. C. after one hour's run at full load. This pump delivers 300 litres per minute against a head of 60 metres with a speed of 400 R.P.M. The motor, which is suspended from the frames, weighs 415 kg., and has its starter placed just overhead on the watertight bulkhead; the weight of this starter is 53 kg.

The motor coupled to the after bilge pump also drives, through a reduction gear box, the high-pressure air compressor and auxiliary manoeuvring propeller; interlocked couplings are provided to prevent both units being driven at the same time with a heavy resultant overloading of the motor. The auxiliary propeller, situated right aft in the superstructure, is intended to aim the boat when a torpedo is to be fired, and to facilitate manoeuvring when the submarine is in harbour. The starter for the forward pump motor is placed in the officers' quarters on the port side, directly opposite the motor itself, and weighs 65 kg.

To enable the auxiliary propeller to be started and stopped from a position near the periscopes, and thereby directly under the supervision of the officer in charge, the controller for the after pump is housed in the central station, immediately under the main motor cut-outs. This controller, which weighs 140 kg., allows three speeds in either direction at the $\frac{1}{4}$ -hour rate with its resistance enclosed in the casing, and is fitted with a separate interlocked lever to reverse the current in the armature when a change in the direction of rotation is desired. The capstan motor is of the series-wound totally-enclosed type, with an output of 2 B.H.P. at 1,600 R.P.M. and 115 volts for 15 minutes without the armature temperature rise exceeding 50 deg. C., and has a net weight of 115 kg. It is situated in the forward portion of the vessel, just under the torpedo tubes, and drives the anchor-winch and warping-bollard through worm and cog gearing, but, as the output of the motor is too small to allow these two units to be driven at the same time, the vertical driving shaft carrying the small driving wheel is fitted to allow an upward or downward movement along its axial length. This movement is controlled

by a lever and hand-wheel, operated by hand power, placed close to the motor; when raised, the driving wheel engages the warping bollard; in the centre position it runs empty, and when lowered it drives the anchor winch. A friction clutch is inserted in the drive to prevent the motor being pulled up quickly or brought to a standstill when the submarine is being docked or the anchor housed. Despite the fact that the anchor winch is fitted with a tell-tale, experience has proved that such a clutch is very necessary, as the motor is too often left running after the anchor has been housed. The controller for this motor is secured to the frames on the port side of the officers' quarters, with its operating shaft extended through the shell into the superstructure to allow the motor to be started and stopped from the deck as well as the interior of the boat. Three speeds in either direction are allowed for, with the resistances and a small overload release enclosed in the controller casing. The net weight of this controller in running order is 52 kg.

The semi-enclosed steering motor suspended from the upper frames on the starboard side of the crew space is of the flapper brake type, designed to give 1 B.H.P. at 1,200 R.P.M. with 115 volts continuously with a net weight of 275 kg. It drives the rudder-actuating shaft through worm gearing, on which a double clutch is fitted to enable the electrical driving gear to be cut out and steering performed by hand in the usual way. The motor is controlled by two automatic contactors operated electrically, either by a small controller or portable push-buttons. The controller is of the follow-up type, with the two outer rings connected to the hand steering wheel, and the inner quick-breaking switch coupled to the rudder-actuating shaft through a small chain. The sailor turning on the handwheel in either direction causes contact to be made by one of the outer rings in the controller with the inner quick-breaking switch by sliding over the same when a current is caused to pass through one or other of the contactors, and the motor at once starts without any resistance in circuit. The motor turning the rudder-actuating shaft causes the inner switch to revolve in the same direction as was taken by the outer rings until the zero position is reached, when it quickly snaps out, and the motor is brought to a standstill by the flapper brake.

Mechanical limits are provided on the rudder shafting to prevent the sailor overturning the controller, and platinum-tipped limit switches to protect the motor and gear when the push-buttons are in use.

The contactors are of the usual vertical type, mounted side by side in a light watertight steel case and fitted with magnetic blow-outs and renewable sparking pieces; further, a mechanical device prevents them being operated together. In parallel with each contactor is a 2½-C.P. signal lamp, coloured red or green, to indicate whether the rudder is being swung to port or starboard. The controller is only called upon to deal with the current passing through the coil and lamp, about 0.55 amps., which is so small that practically no arcing takes place inside the same when in use.

The two push-buttons, mounted in a small portable bronze box, have their tops enamelled red and green, and, in common with the controller are connected to the mains by three pin watertight plugs and sockets, with the pins of varying sizes to prevent wrong connecting up. Such a socket is fitted on the bridge, in the conning tower, and in the crew space, close to the steering motor, to permit the submarine to be steered electrically from either of these positions. A very small portable motor-driven dewatering gear is carried to dry out the periscope tubes and lenses, which, when in use, is plugged on to one of the lighting distribution boxes. All fixed cables throughout the vessel are

of H.C. copper insulated with pure para rubber, taped, lead-covered, and armoured with interwoven flexible steel wires impregnated with red-lead paint. They are secured to the frames with brass clips and screws in the most suitable positions to avoid other internal gear. Cables passing through the shell are encased in copper pipes, with a stuffing-box at the lower end inside the boat, and a union connection to the fixture they are feeding. This arrangement entirely prevents ingress of seawater, and in the event of the tubes being pierced no water can percolate into the submarine. Wherever cables pass through a watertight bulkhead they are led through double-ended stuffing-boxes.

Owing to the excessive amount of moisture which is always prevalent in a vessel of this class, the Navy to whose order the boat was built specified that, as far as possible, the complete electrical gear was to be of the watertight type, and in those cases where, owing to restricted weight and space, it was found necessary to install splash waterproof gear, that, in the event of water reaching these units, their protecting fuses were to blow and isolate the circuits. These stipulations were rigidly enforced and carried out, so that should the boat sink in shallow water and fill, the battery would be immediately isolated electrically from such circuits and, provided the rubber cover over the battery tank received no damage, the cells could not come in contact with seawater and liberate chlorine gas.

The only switchboard in the vessel is the auxiliary, on which are mounted the switches and fuses for all motors, heating, and cooking circuits, also the change-over and double-pole switches, fuses, &c., for the various lighting circuits. The board is of the watertight type, with the switch handles taken through the cover, which also carries small inspection doors for fuse renewals, &c. Above the board are an ammeter for the auxiliary circuits, and a combined ammeter and voltmeter for the general lighting circuits, whilst at the after end are the ampere-hour-meters for the above circuits and regulating rheostats for the general and navigation light circuits. The projector compass, housed behind the conning tower, is provided with a drying lamp and two 6-volt interchangeable lamps to illuminate the compass card, the voltage for these being shunted from a resistance.

The greatest difficulty confronting an electrical engineer in a submarine of this size is the very limited amount of space and weight allowed. As, when running submerged, the boat depends entirely on its metacentric heights for stability, it follows that all weights must be reduced to the smallest possible limit, and that all heavy gear has to be placed as low as possible in the vessel to keep down the position of the boat's centre of gravity, and thus help to increase the metacentric heights. With this object in view, the electrical gear installed was of the very lightest possible type; wherever possible, very light steel cases were substituted for those of cast gunmetal (aluminium was not allowed owing to the corrosive effect of seawater), and the cables loaded to the utmost, particularly those feeding the main motor, where 2 amps. per mm.² was allowed as a safe working standard. All motors have cast steel yokes and end brackets to reduce weight and bulk, and in all cases (except the main propelling motor) are supplied with ball bearings. The total weight of electrical gear in the submarine is about 49,600 kg.

ELECTRICITY FOR SMALL HOUSES.

REFERRING to our abstract of a recent paper on "The Economy of Electricity in Small Houses," we subjoin some figures relating to the use of electricity in a small house in an industrial town in Scotland. The house consists of three principal apartments—a sitting-room, a dining-room (formerly a kitchen), and a bedroom—with scullery, bath-room, &c., and forms one of six dwellings in a tenement. The rent of the house is £32, which includes rates and taxes. The occupants comprise two adults and one child.

During the past three years, electricity was used for lighting, cooking, and occasional heating, while coal was used in the kitchen for hot water and heating the kitchen, and also for the heating of the sitting-room and bedroom. The annual cost of electricity and coal averaged:—

Electricity	...	...	£6	4	11
Coal	...	...	6	13	6
Total	...	...	£12	18	5

which is equal to 4s. 11d. per week, on the average.

Early in May of this year, the experiment was commenced of burning coal in the dining-room once a week for heating water for hot baths, all other heating being done exclusively by electricity. The results, as shown by the following statement of costs, have been quite successful.

The electrical equipment is as follows:—Besides the usual lighting installation, there are electric fires in each of the apartments—a 3-kw. "Carron" radiator in the sitting-room, a 1½-kw. "Magnet" fire in the bedroom, and a 2-kw. "Belling" fire in the kitchen (which is now the dining-room). These are fed on one circuit of 7/21 s.w.g. cable, the voltage being 250. In the dining room a small "Carron" cooker is in use of a capacity of about 4 kw., with oven, grill, and two hot-plates. As an adjunct to the cooker, a 2-pint kettle (700 watts), with self-contained element, and a radiant-heat "Belling" boiling ring have been provided for fast boiling. In the scullery a 2-kw. "Jackson" water boiler, with ball-cock valve, has been fitted to the water supply. The cooker and hot-water heater are connected to a second circuit wired with 7/21 s.w.g. cable. All the cooking appliances have been in daily use for all meals since they were installed, but the radiators have only been put on at intervals when heat was required on cold days. The lighting rate is 3d. per unit, and the charge for heating is 3d. per unit. On May 24th a separate meter was fixed on the heating circuit to register the energy used for this purpose, as distinct from the more regular consumption by the cooking appliances. The units used for cooking, heating, and lighting respectively, commencing from May 24th, 1916, were as tabulated below:—

To	No. of days.	Cooking units.	Average per day.	Heating units.	Lighting units.	Total units.	Average per day in units.
May 28th	...	1	21.7	5.4	5.1	0.2	27.0
May 30th	...	2	12.0	6.0	0.2	0.2	12.4
June 14th	...	4	23.1	5.8	6.6	0.4	30.1
June 18th	...	7	37.4	5.3	11	0.3	38.8
June 25th	...	7	28.1	4.0	1	0.1	28.3
July 2nd	...	7	38.3	5.5	5	0.3	39.1
July 9th	...	7	44.9	6.4	10.6	0.5	60.0
July 16th	...	7	44.9	6.4	10.6	0.5	60.0
Total	...	38	205.5	5.4	24.2	2.0	235.7

NOTE.—House closed during first part of June.

For the whole period the total costs were therefore:—

Cooking, 205.5 units at 1½d. =	12s. 10½d. =	2s. 4½d. per week
Heating, 24.2 " at 3½d. =	1s. 6½d.	
Lighting, 2.0 " at 3d. =	0s. 6d.	
Total electricity (38 days) =	14s. 10½d. =	2s. 8½d. per week.
Coal used during the same period, 1½ cwt. at 1s. 7d. per cwt. =	3s. 2½d.	
Total cost for coal and electricity (38 days) =	18s. 1d. =	3s. 4d. per week.

English Electrical Man Imprisoned in Mexico.—A Washington dispatch to the *Daily Mail* says that the British Embassy has entered a vigorous protest at the State Department against the imprisonment of a British subject, Mr. Fuller, the president of the Electric Light Co. of Mexico City. It is reported that the Carranza Government imprisoned Mr. Fuller because he refused the demands of his employees, who are on strike.

The average weekly cost of heating, cooking, and lighting thus has been only 3s. 4d. Prior to the commencement of the experiment, the average weekly coal consumption for the summer months was 2 cwt. at 1s. 6d. = 3s., to which must be added the previous cost of electric cooking only, namely, 1s. 11d. per week—a total of 4s. 11d. per week. The saving effected, therefore, by the new arrangement (allowing 2d. per week for electric lighting) amounts to 1s. 5d. per week. In addition to this, there is the further saving in the wages of a charwoman, who previously was engaged for four hours each week at a cost of 2s., and whose services are now required for four hours each fortnight. It is right also to point out that the electric water heater, while mainly used for the heating of water for washing up, has also been utilised for the washing of clothes not sent to the laundry. The consumption of energy for cooking also includes the energy taken by an electric iron of 550 watts, which is in use every day for about half an hour. It is estimated that for the summer six months a total saving of between £1 10s. and £2 will be made, and experience has already shown that the housework has undoubtedly been very considerably reduced.

During the winter months the intention is to revert to the old arrangement of burning coal for heating rooms and providing hot water, as the increased consumption of electrical energy for the heating of rooms in the winter would be prohibitive in cost. Electric cooking and occasional electric heating will, as before, be continued throughout the whole year. Excepting the kettle and iron, the apparatus has been obtained on hire from the local supply authority, the rental for the whole of the hired appliances totalling 8s. per quarter.

A NOVEL ELECTRIC-CLUTCH GEAR FOR MOTOR-CARS.

AN interesting new form of power transmission for petrol motor-cars, known as a centrifugal electric generating clutch, has recently been brought out by the Vesta Accumulator Co., of Chicago, U.S.A. The device, which may be described as a combination of the magnetic-drag principle and the friction contact as obtained in the ordinary form of clutch, replaces not only the clutch, but also the

inside and the armature on the outside. The armature, in fact, forms the engine flywheel, and is bolted direct to the flange on the rear end of the crankshaft. The armature is in the shape of a drum, in which are mounted the armature laminations and form windings, which are connected to an internal commutator fastened to the outer edge of the armature drum, as shown in fig. 1. The fields, fig. 3, are attached to the propeller shaft, which conveys the power to the rear axle of the car; they are mounted inside the armature on the crankshaft extension, and rotate freely on roller bearings.

The brushes, which are part of the field unit, press outwardly against the face of the internal commutator. The brushes are mounted in such a way that the centrifugal force of their rotation

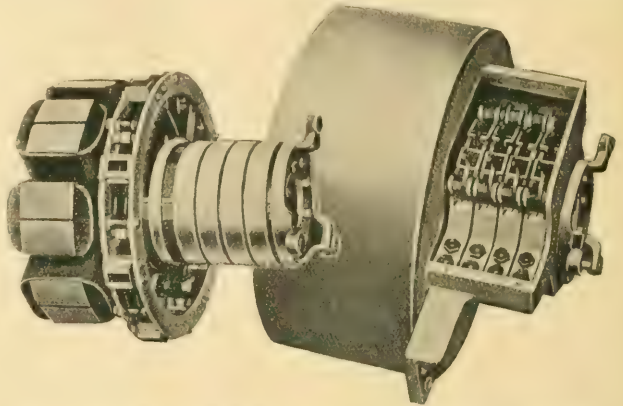


FIG. 3. MAGNETS AND BRUSHES OF CLUTCH.

FIG. 4. VIEW SHOWING COLLECTOR-RING BRUSHES.

increases the force with which they press against the commutator. When the engine of the car is at rest, the pressure is very light; but when it is running, and as the speed of the car increases, the pressure of the brushes against the commutator also increases, until, when the car attains a speed of 15 miles per hour and over, on level roads, the friction (carbon against copper) is sufficiently great to prevent any slip between the fields and the armature. That little wear takes place on the brushes is evidenced by the fact that tests made with brushes $2\frac{1}{2}$ in. long showed only $\frac{3}{8}$ in. wear on a car that had covered a distance of 12,000 miles. At lower speeds, and particularly in starting, the transmission of power is through the electromagnetic drag between the armature and fields; there is therefore no mechanical connection between the engine and the propeller shaft until the car speed reaches a predetermined maximum, which may be altered to suit different conditions.

By means of the new clutch, the makers claim that great flexibility can be obtained in starting the car or in "picking up" after a slow-down in traffic, and as the speed of the car increases, the greater the centrifugal force and the less chance of slip. The slip that does occur in starting is not wasted, the energy generated being utilised to keep the battery, used for engine starting and lighting purposes, in a fully-charged condition. For this purpose the field is provided with four slip rings with which brushes make contact. The battery consists of four sections of six volts each, of a total capacity of 200 ampere-hours, while the controller comprises a number of switches operated by push-buttons through a solenoid, and arranged to work automatically in conjunction with the engine throttle lever and accelerator pedal.

The pushing of the engine-starter button operates the series side of the controller, causing the battery to be coupled up in series in a 24-volt, 50-amp.-hour connection. The operation of the engine throttle or accelerator automatically causes the other, or multiple, side of the controller to parallel the battery to a 6-volt, 200-amp.-hour connection. The controller is so arranged that it is impossible to close both series and parallel circuits at the same time.

The operation of a car fitted with the system is claimed to be exceedingly simple. The vehicle goes through all ranges of speed, from zero to the maximum, by the simple opening of the engine throttle, the electrical and centrifugal action being entirely automatic. To start the engine, all that is necessary is to open the throttle and push in the starter-button; the fields are then held stationary by an automatic locking arrangement, and the fly-wheel armature is revolved about them. The automatic locking device renders it unnecessary to apply the brakes to hold the fields stationary in the starting operation, and prevents any chance of the car running backwards. The operation of the throttle lever or accelerator automatically makes an electrical connection between the battery fields and armature, so that, when the throttle is further opened, the internal fields immediately try to catch up with the

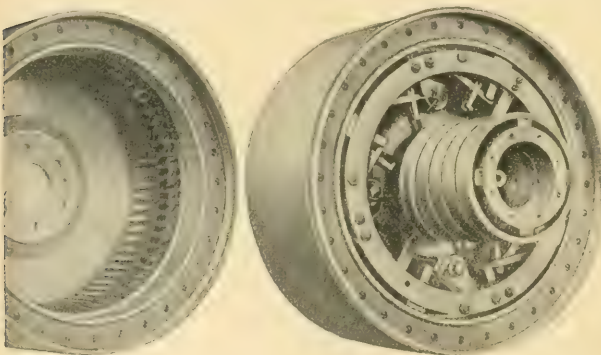


FIG. 1.—INTERIOR OF CLUTCH.

FIG. 2. COMPLETE CLUTCH.

change-speed gear box and electric generator and engine starter which at present form part of what may be termed the standard design of petrol cars. It also eliminates the use of the clutch pedal, the emergency-brake lever, and the change-speed lever, all controls in the new arrangement being by push-buttons on the steering column, and the brake pedal.

The device consists of two main parts: the armature and the fields. Unlike the average motor or dynamo, the fields are on the

held stationary by an automatic locking arrangement, and the fly-wheel armature is revolved about them. The automatic locking device renders it unnecessary to apply the brakes to hold the fields stationary in the starting operation, and prevents any chance of the car running backwards. The operation of the throttle lever or accelerator automatically makes an electrical connection between the battery fields and armature, so that, when the throttle is further opened, the internal fields immediately try to catch up with the

revolving armature through the magnetic pull, assisted by the ever-increasing centrifugal force.

Assuming that the car is approaching a hill requiring greater clutching effort, the gradient will cause a greater load against the movement of the car, consequently causing the fields to run slower than the armature which is connected to the engine, this difference of slip causing current to be generated. The current will commence to flow through the fields until the field coils have received somewhat more than their normal amount, this small excess amount being due to the fact that the cut-out is made to cut in when the voltage is higher than 8 volts.

When a still greater clutching effort is required above that which is produced by the current flowing in the fields, the current will flow through the battery, making up for the difference required in the clutching effort, since this greater amount of clutching effort will have caused the cut-out to cut the battery into circuit. When the hill has been mounted, the centrifugal clutch will cause the current to cease flowing as before, and will recommence doing the work of driving the car.

It will be seen that the centrifugal clutch can do all the work without the aid of any electrical circuit after it has once cut in, but no current would then be available for engine starting and car

This has been called an engineer's war, but he has not yet been fully appreciated and used in very many directions, of which the above is one more instance.

Justus Eck.

London, S.E., August 8th, 1916.

Induction Motors on Circuits of Different Frequencies.

The following information regarding the behaviour of induction motors on different frequencies may be of use to your correspondent "Practice."

In making changes of the kind suggested, the main point to watch is to keep the flux density in the iron the same as before the change. By so doing, the stator and rotor currents will remain unchanged when working against the same torque. To keep this density the same, however, necessitates a variation of the impressed voltage with the frequency.

The first effect of reducing the frequency is to reduce the speed; for instance, a 60-cycle motor will run at only $\frac{2}{3}$ of its normal speed if connected to a 50-cycle circuit. To keep the stator and rotor currents the same as they were before the change, the torque must be kept the same. Owing to the reduced speed, therefore, the horse-power of the motor will be less than normal—the decrease being about $\frac{1}{3}$ the rated horse-power.

It is often undesirable to alter the voltage in proportion to the change in frequency, and 60-cycle motors are often run on 50-cycle circuits of the same voltage. In such a case the magnetic densities in the iron will be $\frac{3}{2}$ of the normal densities. The iron losses will, therefore, be increased, and a warmer running motor is the result. The poorer ventilation at the lower speed tends to aggravate this heating. The efficiency of the motor will be slightly decreased on account of the increased iron losses, the actual loss in any motor being dependent on the degree of saturation of the iron at normal frequency. The higher flux density will increase the magnetising current required, and the power factor may therefore be lowered. If the voltage is corrected for the lower frequency, the power factor may be slightly increased, though this is by no means generally the case.

In running a 50-cycle motor on a 60-cycle circuit the chief consideration is generally the ability of the machine to withstand the extra stresses due to the 20 per cent. increase in speed. If the voltage remains the same, the flux density will be only $\frac{2}{3}$ of the normal. The iron losses will therefore be decreased, though the rise in frequency reduces this decrease somewhat. Since the increased speed gives better ventilation, the rated horse-power may generally be maintained, and in some cases exceeded, if mechanical considerations permit. The slip will be increased, and on this account the power factor may be lowered slightly.

Whether the machine is run on a higher or lower frequency than that for which it is designed, the actual performance depends to such an extent on the magnetic and electrical designs, that it is difficult to generalise. Two motors of equal voltage, frequency and output may behave quite differently as regards heating, efficiency, and power factor when run on a higher or lower frequency circuit. The writer hopes, however, that from the above, "Practice" will be able to form an idea as to what to expect when running motors under the suggested conditions.

A. B. J.

From the Front.

I am again writing a line of thanks to you for the weekly copy of the REVIEW, which still reaches me regularly. I wish it were possible to read it under pre-war conditions once more—with the sing of the turbine in the ear and everything comfortably loaded. I'm afraid that shift work will prove somewhat irksome to a good many when the time comes to "take over" again. But perhaps when that happy time arrives we shall find log-books, load curves and all the rest of it under the spell of the eternal feminine!

I need not add that the REVIEW is still appreciated. It is distressing to read the long list each week in the "Personal Column" of good men who have gone under. Now that we are "at the peak," may the end be not too far ahead.

J. H. Pembry, A.S.C., M.T.

British Expeditionary Force, August 3rd, 1916.

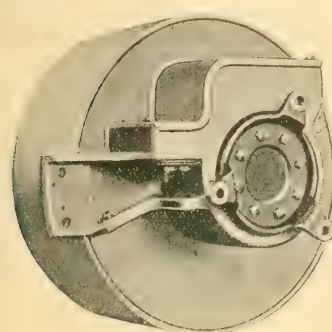


FIG. 5.—CLUTCH COMPLETE WITH COVER.

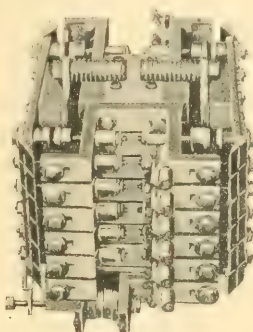


FIG. 6.—CONTROL SWITCHES.

lighting. The centrifugal action is consequently so arranged relative to the electric generating effect as to furnish the current for the charging of the battery with as little waste as possible. When the car is slowed down or is to be stopped, it is only necessary to close the trottle, this breaking all the electrical connections, the car then "coasting" until it stops by itself or by the application of the brakes.

For reversing the car, as well as for emergency purposes in very hilly districts, a small gear-box providing a reverse motion and a low forward speed is included in the transmission, this being operated electrically by push-buttons on the steering column.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

"Twenty-Two Deaths from Heat Stroke."

After seeing the following paragraph in two evening papers and one morning paper, I begin to think it's incredible and disgraceful story has some truth in it:—

The Secretary of State for India announces the receipt of the following telegram from the Viceroy of India:—

On recent voyage of hospital ship *Danoola*, from Basra to Bombay, there were 130 cases of heat stroke among British sick and wounded troops, and 17 deaths due to heat stroke occurred among troops and crew, and five other deaths were probably caused by heat.

A following wind necessitated ship being turned round every four hours for first 36 hours of voyage, so that *no* wind could be ventilated. Voyage was made under most trying climatic conditions.

The *Danoola* is a P. and O. liner of 8,056 tons, built in 1905 specially for the Indian Troop Service, in which she was employed continuously till war broke out, when she was converted into a hospital ship.

About nine years ago, as your records will show, I brought an action against a steamship company trading with South Africa for falsely representing it had electric ventilation, with the result that many hundreds of electric fans were immediately sold to shipowners, but how it comes about that a P. & O. liner specially built for Indian troop service, sailing in its own waters, and acting as a hospital ship, should lack proper ventilation is inexplicable.

This seems on all fours with the Indian troop train incident, where our brave men were allowed to suffer intolerable agonies and death due to the scandalous neglect of persons in authority, too ignorant to understand, and too callous to attend to, most obvious requirements.

A stern wind of a speed equal to that of the boat is no novelty, and is a concomitant of almost every mail steamer on its homeward journey from Capetown.

Automatic Train Control.—According to the *Electric Railway Journal*, the New Haven Railroad, which is investigating the question of automatic train control, has examined over 4,000 plans of automatic stops, and tested two trial installations during the past four years. As a result, the officials are convinced that automatic train control has not reached the degree of development that would eliminate the introduction of other and greater hazards, and warrant either universal or limited adoption by the New Haven line. The company has, however, appointed an engineer to give his whole time to the study of the problem.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

EGYPT.—Revised Tariff Valuations for use in assessing duties on iron and steel manufactures imported into Egypt have been issued, with effect from June 16th to August 15th. Duty is leviable on the Valuations at the rate of 8 per cent.

BRITISH INDIA.—The information contained in the official *Supplement to the Board of Trade Journal*, July 13th, respecting prohibitions is modified by a later announcement that the export of sickle-dressed block clear ruby and slightly-stained ruby mica of sizes Nos. 3, 4, 5, and 6 Bengal standard, is prohibited to all destinations; and all other descriptions of mica are prohibited to destinations other than the United Kingdom and British Possessions. These prohibitions apply unless a permit, signed by the Chief Customs Officer, is produced to the Customs Collector at the port of export, and the mica shipped in accordance with the terms of the permit.

ST. LUCIA.—An Ordinance has been issued providing for the amended Customs Tariff—*vide* the *Review* of July 30th, 1915—to continue in operation until June 30th, 1917. Under the amended Tariff, telegraphic, telephonic, and electrical apparatus, and appliances of all kinds for communication or illumination, are free of import duties. All other electrical machinery and electric dental appliances of all kinds are dutiable at the rate (including the 10 per cent. surcharge) of 13.2 per cent. *ad val.* under the British Preferential Tariff, and at the rate of 16.5 per cent. *ad val.* under the General Tariff. All other electrical apparatus is dutiable at the flat rate (including surcharge) of 16.5 per cent. *ad val.*

GREECE.—A Bill was introduced on June 14th providing for a general increase of the Greek Tariff rates of duty by 10 per cent.—the additional duty to be collected from the date of introduction of the Bill—and also making provision for certain other alterations in the Greek Customs régime. According to information received at the Foreign Office from His Majesty's Minister at Athens, the proposed increase has now been suppressed, and the sums already paid to the Greek Government in respect of this increase will be refunded. The other modifications proposed will also not take effect.

UNITED STATES OF AMERICA.—The Treasury Department has issued, under date June 3rd, the following Circular regarding the appraisement of merchandise in respect of which a notice of change in value has been received:—

"It appears from a discussion at the appraisers' conference that there is a lack of uniformity in appraising merchandise of which notice of a change in value has been received. Some appraising officers apply the new price on all shipments made after the change of price, and others wait until they have evidence of deliveries at the new price either in the country of exportation or the United States.

"It further appears that there are two classes of merchandise, viz., one which may be termed stock goods which are ready for delivery at all times, and the other goods which are manufactured on orders for future delivery.

"As to the first class, the Department is of the opinion that the new price should be put into effect on all purchases made after the date on which the new price is to take effect, but that as to purchases made before that date and not shipped until after the new price becomes effective the new price should not be applied unless there is evidence that sales have been made at the new price.

"With respect to the second class, the new price should be applied to old contracts only when there is evidence that deliveries have begun at the new price. When the appraising officer has no information as to whether sales have been made or delivery begun at a changed price, he should withhold appraisement until he can secure information on the subject."

A decision respecting the application of the United States Tariff Act of 1913 has recently been given by the Court of Customs Appeals, that flaming arc-lamp carbons composed of lamp black or retort carbon, with or without a core impregnated with chemical salts, are dutiable under paragraph 82 of the Tariff at the rate of 40 cents (about 1s. 8d.) per 100 ft.

Variation of Friction Losses with Temperature.

According to W. Peukert in the *E.T.Z.*, as the results of tests carried out on a D.C. motor of 11½ K.W., the losses due to friction of the journals, brushes, and air-churning diminish with rising temperature. These losses were at 18° C. 421 watts, at 40° C. 308 watts, and at 54° C. 208 watts, the corresponding efficiencies being respectively 86.68, 87.47, and 88.35 per cent. The armature losses remained constant, the resistance of the winding increasing with the temperature, whilst that of the brush contacts diminished. The magnitude of the change in the friction losses is surprising, and evidently the subject deserves further attention. The temperature of the room in each case was artificially regulated so that all parts of the machine were equally heated, and the instruments were installed in a neighbouring room unaffected by the temperature variations.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 10,386. "Electrical connectors or junction pieces." G. H. COLLINS & H. F. COLLINS. July 24th.
- 10,387. "Interlocking arrangements for electric circuits, chiefly for use with internal combustion engines." H. R. WRIGHT. July 24th.
- 10,412. "Supports for accumulators." C. G. BENNETT & H. GARDE. July 24th.
- 10,428. "Electrical and automatic firing of anti-aircraft guns." M. A. V. S. JONES. July 24th.
- 10,438. "Electric lamp shades, reflectors, etc." A. REYNOLDS & F. A. REYNOLDS. July 25th.
- 10,491. "Electrical driving for motor-vehicles, etc." H. CROCHAT. July 25th. (France, May 9th.)
- 10,519. "Electric motors and dynamos." A. LYON AND WRENCH & J. C. TODMAN. July 26th.
- 10,535. "Electric resistances for compensating, etc." J. E. POLLAK (Soc. Anon. des. Etablissements L. Bleriot). July 26th.
- 10,554. "Electric cable joint boxes." C. VERNIER. July 26th.
- 10,558. "System of electric signalling." L. COHEN & G. O. SQUIER. July 26th.
- 10,561. "Circuit controllers." IGRANIC ELECTRIC CO. (Cutler-Hammer Manufacturing Co.). July 26th.
- 10,563. "Galleries for gas and electric fittings." T. CRACKNELL. July 26th.
- 10,573. "Rotatable contact-breakers for magnets, etc." E. J. PHILLIPS. July 26th.
- 10,576. "Wireless telegraphy and telephony." J. BETHENOD & E. GIRARDEAU. July 26th. (France, August 10th, 1915.)
- 10,588. "A line-up of ammeters and voltmeters to supports." V. DELEBECQUE & WALSALL ELECTRICAL CO. July 27th.
- 10,589. "Ammeters and voltmeters." V. DELEBECQUE & WALSALL ELECTRICAL CO. July 27th.
- 10,611. "Automatic telephone call distributing systems." WESTERN ELECTRIC CO. July 27th. (United States, December 19th, 1914.)
- 10,627. "Electrical transmitting apparatus." H. K. HARRIS. July 27th.
- 10,638. "Controllers for electric motor circuits." IGRANIC ELECTRIC CO. (Cutler-Hammer Manufacturing Co.). July 27th.
- 10,677. "Controllers for electric motors, etc." ELECTRIC CONTROL, LTD., & O. EISEN. July 28th.
- 10,705. "Magneto-ignition devices." G. R. SALT. July 28th.
- 10,713. "Valves for receiving or producing wireless current." E. R. CLARK, EMISON AND SWAN UNITED ELECTRIC LIGHT CO., & S. R. MULLARD. July 28th.
- 10,720. "Combined starter and lighting dynamos." A. H. MIDDLEY & C. A. VANDERVELL. July 28th.
- 10,721. "Magnets, etc." W. O. KENNINGTON. July 28th.
- 10,722. "Method for producing high-frequency oscillations." I. CHORTIK. July 28th.
- 10,734. "Field magnets for electric dynamos and motors." LYON & WRENCH AND L. MURPHY. July 28th.
- 10,745. "Anodes for electro-plating." G. JONES. July 29th.
- 10,750. "Time meter for alternating current." ALLGEMEINE ELEKTRICITÄTS-GES. July 29th. (Germany, April 26th, 1915.)

PUBLISHED SPECIFICATIONS.

1913.

- 26,934. TRANSFORMATION OF THE FREQUENCY OF HIGH-FREQUENCY ALTERNATING CURRENTS FOR WIRELESS TELEGRAPHY AND TELEPHONE BY MEANS OF DYNAMO-ELECTRIC MACHINES. Soc. Marius Latour et Cie. November 22nd. (November 22nd, 1912.)

1915.

- 9,852. IMPULSE TRANSMITTERS FOR TELEPHONE SYSTEMS AND THE LIKE. Relay Automatic Telephone Co., and L. C. Bygrave. July 6th.
- 9,921. ELECTRICAL TRANSFORMERS. G. Harlow. July 7th.
- 9,934. SMALL OR POCKET ELECTRIC FLASH LAMPS. F. O. Trautmann. July 8th. (Cognate application 12,377/15.)
- 9,964. ELECTRIC JOINT. G. H. Scholes. July 8th.
- 9,981. ELECTRIC CLOCK. F. O. Read. July 8th.
- 10,067. ELECTRIC TIME SWITCHES. E. H. Horstmann and Horstmann Gear Co. July 10th.
- 10,121. INCANDESCENT ELECTRIC LAMPS AND HOLDERS THEREFOR. T. P. Casotti. July 12th.
- 10,242. SHAFT PACKINGS. British Thomson-Houston Co. (General Electric Co.). July 14th.
- 10,453. ELECTRICAL DRIVING OF SPINDLES FOR SPINNING, TWISTING AND LIKE MACHINES. Siemens-Schuckertwerke Ges. July 19th. (July 20th, 1914.)
- 10,454. X-RAY TUBES. British Thomson-Houston Co. (General Electric Co.). July 19th.
- 10,938. ELECTRICAL SWITCH CONTROLLING DEVICES. A. W. House. July 28th.
- 11,201. MOUNTING OF SWITCHES AND OTHER ELECTRICAL APPARATUS IN WALL BOXES. C. B. Burt. August 3rd.
- 11,322. CORD GRIPS FOR ELECTRICAL PURPOSES. R. G. Stripp. August 5th.
- 11,776. TELEGRAPHIC TRANSMITTING APPARATUS. F. B. Dahl. August 14th.
- 11,831. TRANSMITTERS FOR WIRELESS TELEPHONY. Marconi's Wireless Telegraph Co. and S. O. E. T. Tosti. August 16th.
- 12,376. ATTACHMENT OF INSULATOR-CARRYING ARMS TO TELEGRAPH AND LIKE POLES. Bullers, Ltd., and H. C. R. Dagnall. August 26th.
- 13,807. MINERS' ELECTRIC LAMPS. G. A. Bellamy. September 28th.
- 13,943. METHOD OF MANUFACTURING THE CAPS FOR ELECTRIC INCANDESCENT LAMPS. C. E. Hunter. October 1st.
- 14,382. CONTACT BREAKERS OF INDUCTION COILS. M. A. Codd. October 11th.
- 14,496. FILLING WITH INSULATING COMPOUND OF ELECTRIC CABLE JUNCTION BOXES. W. T. Henley's Telegraph Works Co. and F. Harris. October 13th.
- 14,769. ELECTRIC STOVES. J. D. Cray. October 19th.
- 15,450. ELECTRIC LAMP HOLDERS. General Accessories Co. (L. Rosenthal and C. Seymour, Transvaal.) November 2nd.
- 16,747. CASINGS FOR PORTABLE ELECTRIC FLASHLIGHTS. E. C. R. Marks (Interstate Electric Novelty Co.). November 29th.
- 17,328. ANODES FOR ELECTRO-PLATING. G. Jones. December 10th.
- 18,222. METHOD FOR CONNECTING TOGETHER CARBON ELECTRODES USED IN ELECTRO-CHEMICAL AND ELECTRO-METALLURGICAL PROCESSES. R. Haddon (Soc. Française des Electrodes). December 31st.

THE ELECTRICAL REVIEW.

VOL. LXXIX.

AUGUST 18, 1916.

No. 2,021.

ELECTRICAL REVIEW.

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GERMAN FINANCIAL INTERESTS IN ELECTRICAL UNDERTAKINGS ABROAD.

It is somewhat difficult to realise that for so long a period as twenty years the tentacles of the German trading octopus have been extending throughout all parts of the world. Yet during at least the greater part of that period we have been keeping our readers informed as the movement has developed. In almost every seaport town or city of importance in every neutral country having a foreign population, it has only required the presence of a few Germans for the elaboration of schemes for the establishment of agencies which have either developed into branch houses of firms in the Fatherland, or which, in the course of time, have expanded into large importing houses on their own account; and which have been quite willing to accept the representation of such foreign manufacturers and non-manufacturing companies, until the time arrived for the entire substitution of Teutonic for British articles, whilst the non-manufacturing representation was continued for so long as it was available, or for so long as it suited the purposes of the German agents concerned. In fact, nearly every German has served as an active agent for German propaganda in some form or other, and Teutonic banks have co-operated, commendably from the German point of view, but frequently reprehensibly and immorally from the loftier points of view of international commerce, in assisting in the work of propaganda.

The great extent of the Teutonic banking connections in overseas countries is shown by the existence of the Deutsch Ueberseeische Bank, which was formed in 1893 by the Deutsche Bank, and which has branches under the title of the Banco Aleman Transatlantico in various cities in Argentina, Bolivia, Chile, Peru, and Uruguay, as well as in Spain; and branches in Brazil under the name of the Banco Allemao Transatlantico. In addition, there are the Braziliensche Bank fur Deutschland and the Bank fur Chile und Deutschland, which were constituted by the Disconto Gesellschaft and the Norddeutsche Bank, of Hamburg; the Deutsch-Sudamerikanische Bank, the Deutsch-Asiatische Bank of Shanghai, the Deutsch-Orient Bank for Turkey and the Balkans, and certain banks for Palestine, East Africa, West Africa, and Africa in general. These great promoters of German interests, assisted by the parent banking institutions in the Fatherland, have actively furthered Teutonic aims and trading affairs in the parts of the world

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where they have been established, and they have greatly facilitated the expansion overseas of the German electrical manufacturing industry, which, in turn, has been helped by the cable companies and their associated interests, the former comprising the Deutsch-Atlantische Telegrafien Gesellschaft, and the Deutsch-Süd-Amerikanische Telegrafien Gesellschaft. Indeed, every German undertaking abroad has been an actual or potential promoter of Teutonic business.

The greatest German oversea undertaking is represented by the Deutsch-Ueberseeische Elektrizitäts Gesellschaft, of Berlin, whose combined share and loan capital amounts to the formidable total of £11,800,000. The chief centre of this supply company's activity is located at Buenos Aires, where the company has endeavoured to secure a monopoly. Some years ago the company succeeded in inducing the shareholders in the Primitiva Gas and Electric Lighting Co., Ltd., to dispose of their electricity works in Buenos Aires, but a fresh competitor has recently arisen in that great city in the form of the Italo-Argentina Electricity Co., and thus the monopolistic policy of the German octopus has been checked. The company has also failed to obtain control of the Buenos Aires Tramways Co., in which, although an English undertaking, a Belgian tramway company holds very considerable financial interests. Yet the book value of the company's undertakings in Buenos Aires at the end of 1915 amounted to £10,600,000, apart from ordinary and preference shares in the Compañía Argentina de Electricidad, of Buenos Aires. In addition, the value of the company's electricity works at Santiago (Chile) was entered at £771,000; the investments in the Valparaíso (Chile) Electric Tramway Co. comprised £250,000; those in the Transatlántica Co., of Montevideo (Uruguay) were 1,600,000 dollars in ordinary shares; and those in the Empresa de Luz y Fuerza, of Mendoza (Argentina) were 835,000 dollars in shares and 138,000 dollars in 6 per cent. bonds. An important point in this connection is that the Ueberseeische Co. is actually returned as also holding £650,000 in ordinary shares and £404,000 in preference shares of the Chilean Electric Tramway and Light Co., Ltd., and the total amount of the advances made by the former to the five companies in question is given at £3,669,000 on December 31st, 1915. Although the total of these figures may not agree with the total capital of the Berlin company, it has to be borne in mind, as previously mentioned, that the figures refer to the estimated market value as entered in the company's books at the end of last year.

The enormous German shareholding in the Chilean Electric Tramway and Light Co., apart from the financial advances made to the latter, has not been unknown to those who have annually perused the reports of the Berlin company. In this connection, we observe from the report for 1915 that the Chilean company, in accordance with the instructions given by the English Government, abstained from paying any dividend on the preference shares for 1914, although the net profits of £48,500 would have permitted of a distribution of 6 per cent. being made on the preference shares. But if the prohibition of the Government has prevented any allocation of profits to the preference shares, of which the German company holds the entire issue, it has not hampered the continuance of business relations between the two companies. The annual

report for 1915 of the Berlin company, for example, states that the hydro-electric works at Santiago were practically completed in 1915, and handed over to the Chilean Electric Tramway and Light Co., which is operating the works for its own account and has to pay to the Ueberseeische Co. the amount of the rental, which was fixed by contract. Apart from these interests, other German electrical investments or undertakings exist in certain other parts of South America, including the holding of the German South American Telegraph Co. in the Compañía Telegrafico-Telefónica del Plata, of Buenos Aires, and the interest of the Berlin Gesellschaft für Elektrische Unternehmungen in the Société d'Electricité de Rosario (Argentina), which was formed by the Belgian Société Financière des Transports, of Brussels.

We have drawn attention to the existence of the German element in the hope that means may be adopted whereby it may be totally eliminated. The above facts should be brought to the notice of the Committee which is sitting upon the question of British Finance in its relation to After-the-War Trade, and the Electrical Trades Committee might also with advantage take due cognisance of them.

Our allies in Russia and France have removed, or placed under Government control, undertakings of Teutonic formation; in Italy the extinction of German interests is proceeding on private account; whilst at home the Board of Trade is continuing the practice of winding up enemy companies, and important "black lists" of German concerns and individuals abroad are being issued. There is an old saying that "trade follows the flag." As the result of the war sentiments of most of the world and the nauseous odour left by German immoralities and monstrous barbarities, perhaps that saying will be true again for a time. But a more modern saying, as was exemplified several years ago in the case of the Victoria Falls & Transvaal Power Co., is that trade follows finance; and the question now arises as to whether this has or has not been the case with the Chilean company in question. Some valuable light is thrown upon the experiences of the Victoria Falls Power Co. in its dealings with German finance and plant manufacturing in remarks made recently before a South African Engineering Society by Mr. Bernard Price, who is in a position to know the history of that company's operations. Mr. Price's comments were published in our "War Items" last week; they form very profitable reading just now, not only for us at home, but for electrical buyers in other parts of the world where the failings of German plants at Shanghai electricity works have already been made known.

It was with great astonishment "Penny Wise," that we read in the *Times* Trade Supplement for July that, in the interests of economy, the Government had resolved not to publish further reports by British Consuls during the remainder of the war. When the Retrenchment Committee was looking out for directions in which to save money, we strongly advised against any hasty reforms being introduced in connection with the Board of Trade trade efforts. At such a time as this, when our export trade must not be neglected any more than is really imperatively necessary, and when other manufacturing nations are at liberty to gain a hold in our accustomed markets, it seems to us to be false economy to shut off altogether the supply of information that our imperfect Consular service is able to give us. As we have said before, that service has, in our opinion, not been appreciated at its proper worth by British traders; much of the criticism has been amply justified, but there has been a tendency among the critics to describe as useless or worth-

less an improving service which they appeared to have given up using. Maybe some of that want of appreciation had led to Consular reports being regarded as a suitable thing to do without, or as a direction in which the great British nation might save a few hundred pounds per annum. Speaking for ourselves, we regret their temporary stoppage, and the more so because there is certainly no drop in efficiency in the American system of Commerce and Consular Reports. It was stated in our pages last week that the Foreign Office was organising a British commercial tour in Spain. An excellent idea! Would it be out of order to suggest that each member of the party make a study in advance of the valuable report of 40 pages just prepared by American Consul-General Carl Bailey Hurst on the commerce and industries of the Barcelona district? We print certain parts of it on another page this week. It was published last month with appendices prepared by other American consular agencies in Bilbao, Corunna, Palamos, Mallorca, Tarragona, and Vigo. Mr. Hurst enters very fully into such matters as banking activities, local industries, the relative importance of different classes of industries, metallurgical industries, and the conference of Spanish metallurgical interests, chemical and paper manufactures, hydro-electric developments, and Spanish measures for commercial expansion, and he makes a variety of suggestions intended for American exporters, showing, among other things, the place which American skill and products (especially engineering in character) may fill. It is the best report on Spanish trade and the Spanish market that we have seen for a long time. Let us hope that the Foreign Office tour will bring benefit to British trade in due course, but *right here* the American already has 40 pages of material and advice, while we, in the interests of national economy, are compelled for the present to forego the luxury of a report prepared for us by a British authority. German influence in the Spanish market has been strong in the past, and Teutonic resolves are made respecting the future in that country. Assuredly somebody here is "penny wise and pound foolish."

Rubber. WHILE the course of the crude rubber market has continued mostly disappointing for some time past, prices having fluctuated persistently downward since February last, it is only natural that values have lately displayed more resistance after touching 2s. 2d. per lb. for plantation No. 1 latex. It may be pointed out that this figure shows precisely a depreciation of 100 per cent. from the topmost level recorded in the earlier part of January. The fact is worth noting, too, that prices now stand pretty well where they were at about this time last year prior to the steady upward movement which reached its culminating point at 4s. 4d. It thus remains to be seen whether history will repeat itself within the next four or five months. This comparison, at any rate, is rather interesting, and the chances are that the worst of the recent depression has spent itself, and that when preparations are made in earnest in connection with autumn requirements, prices will be once more on the up-grade. Of course, conditions are most abnormal, but it is considered that the current price is intrinsically low, and that, given a more active and sustained American demand, the market will soon feel the effect of this. There is no doubt that periods of low prices tend to stimulate the use of rubber in various new branches of industry where the product was years ago not utilised at all, so that the persistent growth of the plantation output does not contain, after all, that element of danger which has been surmised by some people within the last few years. America will probably continue by far the biggest world's consumer of

rubber, although her takings for some months past disclosed an important falling off as compared with the early months of this year.

At the current relatively low prices, all the rubber being produced appears to be absorbed in spite of temporary accumulations of stocks and the inevitable recurrence of trade slackness incidental to the dead season. The development of the plantation output in recent years has been truly phenomenal. Back in 1905, the world's output of native rubber of the Para grade was a little over 60,000 tons. In 1914 the world's output of this grade was rather under that amount. Within the same period, the cultivated or plantation rubber industry had its birth and development, with its output reaching 64,000 tons in 1914, thus for the first time eclipsing that of Para grades. In recent years, the production of wild rubber has been steadily declining; and the Brazilian output this season may not exceed 35,000 tons, whereas it is estimated that the production of plantation rubber may in the course of next year run into not far short of 150,000 tons. American manufacturers seem very hopeful that the use of rubber for new purposes will be further considerably increased as time goes on. It is suggested that rubber will be utilised in increasing quantities for the making of shoes and belting, while the output of leather is declining. The London market has developed a somewhat better tone over the last week-end, and prices for plantation grades show a fair rally from the recent lowest point recorded, and the freer arrivals have been conducive to a more active demand. Fine hard Para has improved in sympathy, and still commands a good premium owing to the limited supply available.

The German Element in Italy.

THE enormous ramifications of German financial interests in Italy prior to the war are shown by the fact that out of 600 companies, no fewer than 327 have been found to have been fed by Teutonic capital. Indeed, the iron and steel industries, the electrical industry, and the mechanical engineering industry are declared to have been dominated by a financial group who acted through the intermediary of a well-known Italian bank, which formerly had large German interests and several German directors, apart from a large Teutonic staff. According to the statements of an Italian publicist, the native electrical industry represented a nervous system whose brain was to be found at Berlin, through the indirect path of Switzerland. Now, however, a beginning has been made in the direction of the elimination of the German element by the formation of an investment company with the initial share capital of £400,000, and under the title of the Società Nazionale per Imprese Elettriche, of Milan, for the acquisition of Teutonic holdings in Italian electrical companies. The first transactions aim at the absorption of all the interests of the Continental Company for Electrical Undertakings, of Nuremberg, which include the Società Toscana per Imprese Elettriche, of Florence, the Palermo (Sicily) Tramway, the Società Industriale Elettro-Chimica di Pont St. Martin, of Milan, and the Società Torinese di Tramways e Ferrovie, of Turin. It is said that these and other undertakings have passed under the control of Swiss banks since the commencement of the war. In order, however, not to enrich the Germans by simple purchases, an Italian newspaper suggests that the Government should intervene in order to authorise an Italian group to manage German undertakings in Italy until the end of the war, according to the precedent set by Austria in transferring the Austrian rights of a Milan company to a group of Hungarian financiers, and to that of Germany, which has empowered German banks to treat Italians as citizens of an enemy State.

30,000-KW. STEAM TURBO-GENERATOR TESTS.

WE referred, in our issue of June 11th, 1915, to the reconstruction of the generating plant of the Interborough Rapid Transit Co., of New York, where three of the new 30,000-KW. turbine sets are now in operation. These sets occupy the same space as the three 7,500-KW. engine sets which they replaced, and are operated from the same boilers, in which, however, the pressure has been raised from 175 lb. to 205 lb. per sq. in., while superheaters to give 200° superheat, and underfeed stokers have been added, so that three times the rated output is being obtained.

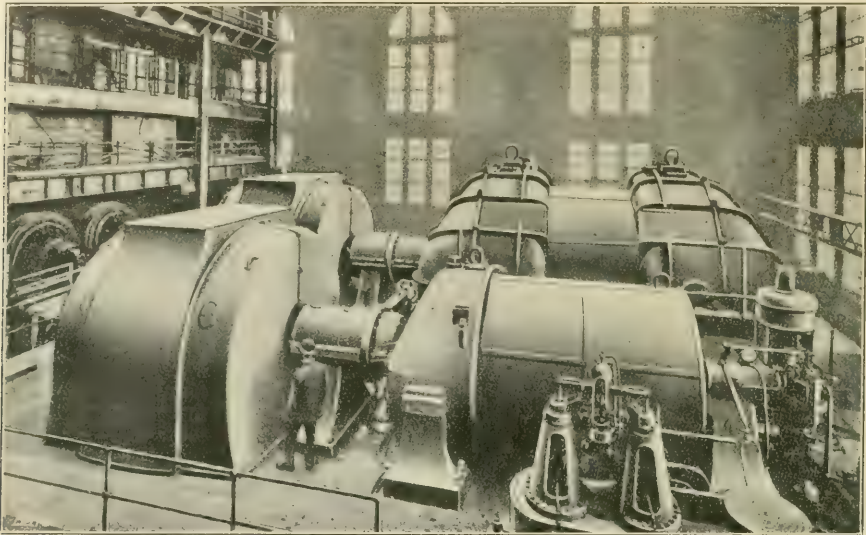


FIG. 1. ONE OF THREE 30,000-KW. TURBINE SETS AT THE INTERBOROUGH CO.'S GENERATING STATION, NEW YORK.

The original engines, generators and condensers represented an expenditure of \$40 per kW., while the new plant, has cost only \$9 per kW. It may be remembered that each of the new sets—one of which we illustrate—consists of a high-pressure and a low-pressure turbine, each coupled to its own generator; the former is of the single-cylinder reaction type, running at 1,500 R.P.M., and the latter, a double-flow turbine, with a speed of 750 R.P.M.

The surface condenser consists of two cylindrical shells, each of 25,000 sq. ft. surface, connected directly to the turbine outlets, with turbine-driven circulating pumps, and hot well and rotary dry vacuum pumps.

The results of a series of tests on these turbines have now been published, showing that at the most efficient load of 26,740 kW., 11.25 lb. of steam per kW.-hour are required.

The performance curves shown in fig. 2 summarise the results of 25 tests under certain standard conditions, and it is noted that they are unusually flat and conducive to high plant efficiency. The peculiar dip in the curve between 22,000 kW. and 26,000 kW. was checked by repeated tests; to investigate its cause, special tests were made of the relative action of the receiver between the two cylinders as a separator, and the velocities of the steam passing through it, with the idea that this might have some direct bearing on the dip, but no definite result was obtained.

In regard to the turning up of the efficiency curve between 30,000 kW. and 32,000 kW., the designer points out that this turbine was designed for high hydraulic efficiency, thus approaching the crest of the efficiency curve; the overload capacity is small—the amount the turbine is by-passed when the secondary valve

opens is small, and the velocity ratio, therefore, is very little lower when full steam pressure is applied to the secondary inlet than when such pressure is applied to the primary inlet. Further, the hydraulic efficiency is nearly the same, so that the Rankine cycle at 32,000 kW. should not be more than 1 per cent. lower than at the point of best efficiency, namely, 26,000 kW. The efficiency at the intermediate overload, say, 30,000 kW., is somewhat worse than this, for while the blading and hydraulic efficiencies remain as high, there is a loss due to a certain portion of the steam expanding through the secondary valve to a lower pressure without doing work.

Tests were also made on the condensers and auxiliaries, with the turbine carrying practically the required load; operating conditions approximated to those guaranteed, with the exception of high air leakage. This leakage has since

been eliminated, and a permanent gasometer installed, in connection with each unit, in order to observe air leakage at regular intervals. We gather that the performance of both turbine and condenser has shown higher efficiencies than

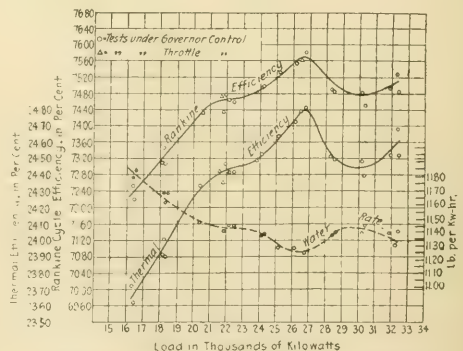


FIG. 2. EFFICIENCY AND WATER RATE CURVES.

were guaranteed, and that the installation has proved thoroughly satisfactory in every particular.

We are indebted to the *Electrical World* for our figures; full details of the tests were recently presented to the American Society of Mechanical Engineers by Messrs. H. G. Stott and W. S. Finley.

ELECTRIC VEHICLE NOTES.

IN our last issue we referred briefly to the action taken by the Electric Vehicle Committee in view of the possible restriction of the importation of electric vehicles following the Proclamation of June 27th.

The letter which Mr. Frank Ayton, the hon. secretary of the E.V.C., forwarded to the Board of Trade is such a concise and able statement of the case for the more extended use of the electric vehicle that it deserves the widest publicity at the present time, and is reprinted below:—

My Committee ask that electric-battery vehicle chassis intended for commercial uses shall be most favourably treated under the licensing arrangements which have come into force, following the Proclamation of June 27th. The grounds upon which we make this application are as follows:—

1. Before the war the adoption of the electric-battery vehicle for commercial purposes was beginning to make good headway by reason of the economy, reliability, and simplicity of this system of motor transport. Since the war, however, the scarcity of horses, the high price of fodder, the continuously increasing cost of petrol, and the dearth of supplies of the latter have all tended greatly to enhance the advantages of the electric vehicle, and have led to its increased use. Thus it is that at the present time some of the leading business houses in this country are adopting, or have already adopted, the electric van for town and suburban delivery work in preference to other types of motor vehicles, and the supply of electric vehicles is not equal to the demand. The reason for this is the more readily appreciated when it is stated that the usual cost of power for operating such vehicles compares with the cost of petrol for a petrol-driven vehicle only when that commodity is priced at, approximately, 6d. per gallon.

2. Since the electric vehicle depends for its power upon electricity supplied (in almost every instance) from the public electric supply undertakings of the country, and, therefore, is produced from coal, its extended use is distinctly assisting in resolving one of the difficulties the Government are at present having to contend with, i.e., the conservation of petrol supplies in order to provide adequately for the requirements in this particular direction of the transport services for the Forces.

3. As the electric energy required for replenishing the batteries of electric vehicles is in practically every instance taken during night hours, when the demands of other electrical consumers are either very small or non-existent, the production of such electric energy employs plant that would otherwise be idle, and takes steam from boilers that, in the absence of such demand, would be standing with banked fires, radiation losses continuing the while. Thus it is that the production of such supply needs but a comparatively infinitesimal quantity of coal for its generation, and necessitates no additional capital outlay in extending the plant. That these factors are of no chimerical character is evidenced by the very low price for electric energy included in the Standard Tariff for Charging Electric Vehicles recommended by this Committee. This tariff has now been adopted by the majority of the public electric supply undertakings of the country.

4. Another feature connected with the use of the electric vehicle, which comes distinctly into line with the aim of the Government in the matter of freeing men of military age for service in the Forces, is the ease and simplicity of operation, making it possible for a woman or an elderly man, possessing no previous experience, to become proficient in driving after but a few hours' tuition.

5. One of the items in regard to which the electric vehicle shows a marked reduction in operating cost is that which is connected with repairs. Its simplicity and sturdy construction make repairs but a small item in the whole expense of running. At the present time, when every mechanic is urgently required for munitions work, distinct encouragement should be given to the use of a vehicle that by comparison so seldom needs his services.

6. Were it possible to obtain electric vehicles of British manufacture at the present time, there would be, of course, no justification in putting forward this application. In point of fact, however, the majority of the vehicles now in use, or on order, are of American manufacture. There is at the present time but one British firm making the heavy type of commercial electric vehicle in this country, and it is understood that they are quite unable to cope with all the orders that flow to them, as they have but recently taken up this line of manufacture, and are heavily involved in the production of munitions of war.

7. In the opinion of my Committee, the indirect effect in the all-round cheapening of electric supply for power purposes that will result from the general use of electric vehicles should not be lost sight of. The employment of plant in our power stations for the production of electricity in charging such vehicles, at times when otherwise it would be idle, is bound very appreciably to improve the load factor of the plant, as it has already done in the great power stations of Chicago and New York. Load factor and coal cost may be

said to be the deciding factors in the framing of power-supply tariffs; improvement in one or other will benefit all consumers, assisting our manufacturers in the direction of more economical production, enhancing the amenities of town and city life by the gradual elimination of factory chimneys and the domestic grate by the increasing use, in years to come, of electricity for power and heat; and lastly, but by no means the least important feature, assisting our electrical manufacturers to regain the position of world pre-eminence which they once held, by reason of the increased home demand for electrical machinery that must inevitably follow from cheap electricity.

8. The free importation at the present time of American-built commercial electric vehicle chassis will assist in the direction named, and will create such an increased demand for this type that there will be some incentive and a great opportunity, after the war, for British manufacturers to establish the building of such vehicles as one of the staple industries of the country.

Should you desire further information upon this matter, we hold ourselves willingly at your service, and should be pleased to attend an interview if that were thought necessary. You will note the representative constitution of this Committee from the names appearing on the heading of this letter, but I may mention that recently representatives from the Society of Motor Manufacturers and Traders, Ltd., and the Royal Automobile Club have been added.

The letter, the educational value of which we hope has not been wasted in official quarters, brought a sympathetic reply; the tenor of which seems to indicate that commercial electric chassis will be allowed to enter this country; as we have said, it deserves the widest publicity, for in these days of petrol scarcity, and shortage of male labour, it ought to be thoroughly impressed upon the vehicle-using public that *the cost of electricity for operating the electric vehicle is, roughly, equivalent to the use of petrol costing only 6d. per gallon*; moreover, its simplicity is such that a woman can safely be allowed to drive the "electric."

It is astonishing in how many cases the London business man's knowledge of the electric vehicle is limited to a faint recollection of some financially unsound electric cab or electric 'bus venture which came to grief in years gone by—this despite the fact that London is the stronghold of electric vehicle business, and, indeed, offers greater scope for its development than probably any other business centre, especially at the present time. It is evident that an early effort must be made to remedy this state of affairs—we require a system of intensive publicity which will aim at nothing less than every commercial motor user in the London area; the business portion of the city is honeycombed with storage cellars, mostly dependent on manual labour for the transfer of merchandise into vehicles in the street, and this is an additional argument for the use of the electric truck, which can so easily be equipped with an electrical haulage winch, and, furthermore, can provide electric light on the spot when required. Manual labour is a luxury at the present day, if it can be profitably replaced by power driven appliances, as in the case in point.

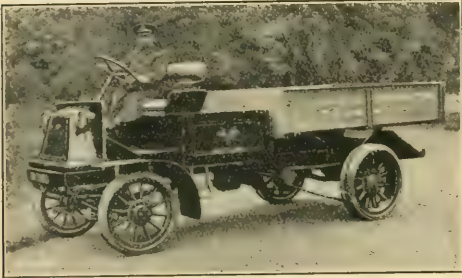
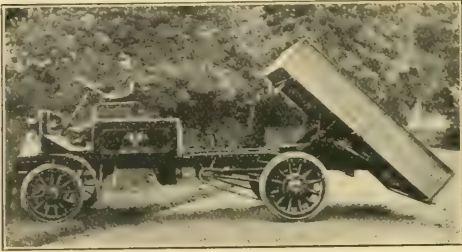
It is a sign of the times that even our "ultra-petrol" contemporary, *The Motor*, has a few words to say on behalf of the electric vehicle. Although we cannot altogether agree with its interpretation of the electrical position, it is satisfactory to find that it is being driven to seriously recognise the fact that there is a field for the employment of a vehicle which is not, and has never pretended to be, a "joy riding" machine. Our contemporary says:—

Now that we are face to face with a calamity, with a hope but no definite assurance that it may be only temporary, we have no alternative prime mover that we can turn to. Steam has been offered, but turned down in favour of an engine that uses a fuel which is, and always must be, a failing quantity when the long view is taken. Electric power is undeveloped, so far as this country is concerned, and even, if we could turn to America to supply us in this direction in any other circumstances, in those which face us it does not help us at all, since imports are prohibited. The war conditions, as they exist at present, and as they must be expected to continue for some time, prevent any development here in the way of electric power as applied to motor vehicles; yet, it seems to us, it is in this direction that the efforts of

constructors must turn in the near future. All the eggs must never again be placed in one internal-combustion basket. We are as confident as ever we were, and we have more than once expressed the opinion in our columns that the electrically-propelled vehicle must eventually receive that consideration which is its due. It is obvious that if serious efforts had been made in this country to develop the electric road vehicle as an alternative to the internal-combustion engine car, our position to-day would have been much less serious than it is, dependent as we are upon a vehicle that relies upon a fuel the use of which is now being so seriously restricted.

Curiously enough, our contemporary appears to have discovered the "obvious" at the eleventh hour.

The growing use of the electric vehicle for municipal purposes has often been referred to in our



VIEWS OF EDISON TIPPING WAGON AT SOUTHAMPTON.

pages; we illustrate this week a two-ton Edison tipping wagon used by the Southampton Corporation tramways department for permanent-way and general carting work.



ELECTRICALLY CONVERTED AMERICAN FIRE ENGINE, SHOWING ACTION OF SWIVELLING MECHANISM.

Mr. W. T. Robson, the manager, has on previous occasions shown his partiality for the all-electric vehicle, and we understand that the wagon illus-

trated and the electric tower wagon, which is also in use, have replaced five horses, with an appreciable saving in cost to the department.

In this connection, with lighting, tramways, and sanitary departments, as well as municipal fire brigades, and ambulances, seriously considering, and in many cases using, electric vehicles, the question of introducing a "transport" department as a feature of municipal organisation should be worth consideration.

The electric vehicle lends itself to maximum efficiency if used with discrimination, and there is no doubt that were a properly qualified official made responsible for supplying the transport requirements of all departments from one electric vehicle depot, and suitable interchangeable bodies, batteries, &c., provided, that less spare vehicles would be required, and more efficient operation would result—the municipal electrical undertakings benefiting at the same time. It may be argued that the idea is equally applicable to any type of self-propelled vehicle, but experience shows that any other type would involve more spare vehicles and more depot labour, and therefore be more expensive in the long run.

MODERNISING AN ELECTRIC SUPPLY UNDERTAKING.

In a paper read before the Liverpool Engineering Society, Mr. E. M. HOLLINGSWORTH, manager of the St. Helens (Lancs.) Corporation electricity undertaking, recently described the modernisation of his undertaking, which, in common with many others, was faced with the necessity of meeting the demands of industry for energy at comparatively low prices. We reproduce his remarks in abstract, as follows:—

Seven years ago, owing to the increasing demand for energy, it was found necessary to carry out considerable extensions to the plant and feeders, and the opportunity was taken of installing plant of a more efficient type. There was room for extensions on the present site, with good railway accommodation, and facilities for dealing with the ashes.

Before the alterations were carried out, the plant consisted of four Lancashire boilers, two small water-tube boilers and seven engine-driven continuous-current generators at 460-550 volts, aggregating 1,700 kw., the capital cost including buildings, but not land, being £40 per kw. At that time, 2,750,000 units were sold per annum, and the load factor was 26.5 per cent.

The capacity of the station is now 7,200 kw., of which 6,000 kw. (.8 power factor) is modern plant, installed at a cost per kw. as follows:—

	£	s.	d.
Extensions to buildings	0	11	0
Boiler plant (rated at 4,500 kw.), including elevators and conveyors, water-softener, foundations, and steam pipes	2	10	0
Generating plant, including turbo-alternators, condensers, and foundations	3	10	0
Cooling towers for 3,000 kw.	1	0	0
Switchgear for generators and for four E.H.T. feeders	0	6	6
	7	17	6
Converting plant with switchgear, rated at 2,000 k.w.	3	0	0

Total cost per kw., including converting plant ... £10 17 6

At the present time, 6,250,000 units are sold per annum, and the load factor is 28 per cent.

The present boiler plant consists of four Lancashire boilers and economisers in No. 1 house, and four water-tube boilers in No. 2 house, generating steam at a pressure of 170 lb. per sq. in., superheated to 535 deg. F.

A single main steam pipe connects the two boiler houses, and all the branch pipes are of wrought steel, including the expansion pieces; all the valve bodies, tee pieces, and water pockets are of cast steel.

Fuel is received on a siding and distributed by elevator and conveying plant to the bunkers. The fuel used is mostly Lancashire fine slack, having an average heating value of 11,000 B.T.H.U. as fired, with 16 per cent. ash and 6 per cent. moisture.

The Lancashire boilers are now used for stand-by purposes only, and will be replaced in the near future with others of the water-tube type.

Four water-tube boilers, two of 18,000 lb. and two of 25,000 lb. steam rating, with superheaters and "E" type under-feed stokers have been installed.

At the normal rating of the boilers, the stokers burn 80 lb.

of fuel per sq. ft. of grate area, and for short periods the rate can be increased to 40 lb. At this high rate of combustion the heat is too intense for brick arches, and they have been dispensed with. The side walls of the furnaces are not subjected to the extreme heat, and therefore the brickwork requires little attention.

Forced draught is used, and there are three motor-driven direct coupled fans connected to the main air duct. The intake of the fans is connected to the engine room, and warm air is thus supplied to the boilers.

The author has had eight years' experience with this combination of boiler and stoker, and considers the results satisfactory. From a number of tests, the combined efficiency of boiler and superheater averages 76 per cent. With the 1,250 and 2,500 k.v.a. turbo-alternators, later referred to, and using fuel of the quality above specified, the lowest monthly average is 2.56 lb. of fuel per unit generated. This figure cannot be maintained, however, owing to the necessity of still having to use one or other of the engine-driven generators, but with the 3,750 k.v.a. turbo-alternator in commission, it is anticipated that the average figure for the twelve months will not exceed 2.5 lb.

The whole of the water used is taken from the town supply, and has a hardness of 14 degrees, but as all the "make up" is supplied to the cooling towers, the admixture with the water returned from the condensers (jet type) gives a combined hardness of 10 degrees. The water for boiler feed pur-

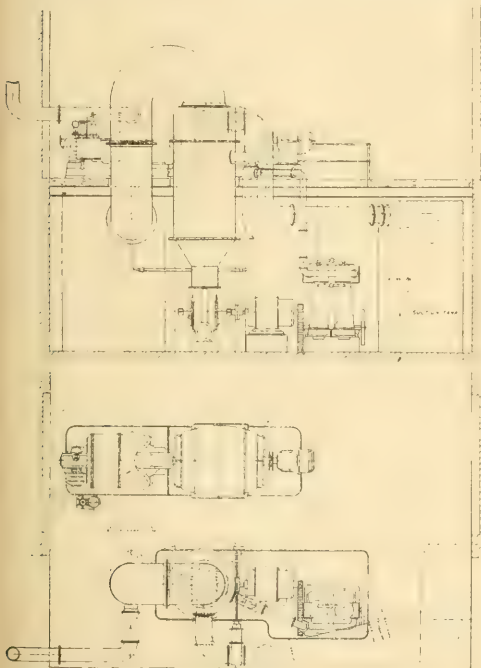


FIG. 1. JET CONDENSING PLANT, ST. HELENS ELECTRICITY WORKS

poses is further reduced to 5 degrees by treatment in a lime soda softening plant. The inclusive cost of treating the water is 1.1d. per 1,000 gallons.

As water of a still lower degree of hardness is desirable for the sealing glands of the turbines, the author has under consideration the question of using a small "Permutit" filter in conjunction with the lime soda plant for this purpose.

The feed pumps, of the direct acting type, exhaust into a feed-water heater to which are also connected the exhaust pipes of the underfeed stokers.

Adjacent to the power station, there is a large disused clay-pit of about 100,000 cu. yd. capacity, to which the ashes are being carted, at an inclusive cost for handling, carting, and tipping of 1s. 4d. per ton.

When first it was necessary to increase the capacity of the station, the merits of gas engines and producer plant were considered, but it was finally decided to continue with steam. The present generating plant includes three of the old engine-driven generators, one rated at 500 kw. and two each at 350 kw., with surface condensers.

The modern generators comprise three high-pressure turbines of the impulse type, with velocity wheel, operating with steam at 170 lb. pressure, superheated to 520 deg. F., and 23 in. vacuum, and coupled to alternators generating 6,000 volt three-phase current at 50 periods, with a speed of 3,000 R.P.M.

No. 1 combined set, installed in 1910, has a rated output of 1,250 k.v.a., with a steam consumption of 15.6 lb. per unit at full load, and 18.5 lb. at half load.

No. 2 combined set, installed in 1912, has a rated output of 2,500 k.v.a., with a steam consumption of 15.2 lb. at full load, and 17.2 lb. at half load.

No. 3 combined set (just being completed) has a rated output of 3,750 k.v.a., with a guaranteed steam consumption of 13.9 lb. at its most economical output, i.e., 75 per cent. of the rated output of the generator.

Each generator has an exciter mounted on the shaft, and the voltage is controlled by an automatic pressure regulator, that of the large set being also arranged to control each of the other generators, and all three when operating in parallel. The generators are protected only by time limit, reverse relays, and the author has under consideration the advisability of fitting each generator with protective apparatus to automatically trip the main switch, and open the field circuit switch in the event of a failure occurring between phases or between any phase and earth. The system is operated with unearthing neutral, but with the adoption of protective apparatus it will be advisable to earth the neutral through a limiting resistance.

Two of the turbo-generators are of the self ventilating type; the other has an external fan and cloth air filter, but a rotary wet filter is being installed. The turbine condensers are of the low level jet type, the discharge being pumped over natural draught chimney cooling towers. The condenser arrangement is shown in fig. 1; the pumps are electrically driven by a single motor, the extraction pump being direct coupled and the air pumps gear driven. Direct-current motors are employed, which in case of an emergency shut-down would be supplied from a battery, with the lighting. The extraction pump is designed to work against a vacuum resistance and discharge against a total head of 52 ft.

The primary reason for adopting the jet plant was the trouble experienced with the tubes of the surface condensers installed with the engine-driven generators. The capital cost of surface plant for the 3,750 k.v.a. set would be 75 per cent. greater, not including for the extra cooling plant which would be required to deal with approximately 40 per cent. more water. As a set-off to this, however, the power taken by the pumps would be 20 per cent. less; the condensate would not require to be treated, and the condenser could be connected to the turbine without intermediate pipes, thus increasing the vacuum by 25 in., and reducing the space occupied.

The whole of the continuous current supply is at present transmitted from the power station, and for this purpose there are three converter equipments of 550 kw., 700 kw., and 800 kw., each with a three-phase oil insulated, self-cooling transformer.

The 550-kw. rotary has an exciter and booster in addition to the starting motor, and can therefore be used for power factor correction, and also for running inverted. It ran in this way for some months under very severe conditions, the load including a rolling mill and colliery haulage plant.

The 800 and 700-kw. equipments are of more recent design, the latter being of the self synchronising type. These machines are fitted with a starting motor only, and are therefore not reversible, and have not the ability to improve the power factor to the same extent as when fitted with a booster.

The overall efficiency of the 700-kw. equipment, the last to be installed, when working level compounded, is as follows:—

Full load.	Three-quarter load.	Half load.	Quarter load.
93.5	92.5	90.25	84.5

At one time, flash-over troubles were experienced when the rotaries were on traction supply, but by re-arranging some of the short feeders, these troubles have been eliminated.

The continuous current switchboard is placed on a gallery at the old end of the station, and the E.H.T. control panels on the floor level of the new portion of the building, opposite the turbo-alternators.

The E.H.T. switchgear is of the mechanically remote controlled type, with the oil break switches and other E.H.T. details, enclosed in brick cubicles, built in chambers directly under the control panels.

Most of the energy supplied for lighting and power is transmitted to switch chambers placed at three points of the distribution system, and these chambers have interconnecting feeders.

Three-phase current at 6,000 volts, 50 periods, is transmitted to static sub-stations in one district, where it is transformed to 400 volts for power, and 230 volts for lighting purposes. All the transformers are wound "delta" on the primary side, and "star" on the secondary, with the neutral point of the "star" winding earthed.

There are ten sub-stations with outputs ranging from 125 to 1,000 k.v.a., with the switchgear placed in brick cubicles. The switchgear is of the same type as that installed in the power station, and the transformers are of the oil-insulated, self-cooling type.

When the power load of a consumer exceeds 100 kw., a supply at 6,000 volts is given to a sub-station on the premises. In several cases, owing to the close proximity of Post Office wires, it was not permissible to use bare wires for extra high-pressure transmission. The consent of the Board of Trade was therefore obtained to suspend insulated cables from the existing poles. The cables are three-core, .05 sq. in., paper insulated, covered with lead containing 2 per cent. tin, taped

and supported. They are suspended by means of steel suspenders and wrought-iron clamps from catenary wire connected to short wrought-iron brackets fixed to the poles. The lead sheathing of the cables is connected to the catenary wire at each end, and at every 400 yards, and the catenary wire is earthed at intervals of 200 yards; there are two miles of such cables in use.

THE ECONOMICAL PRODUCTION OF POWER FROM COKE-OVEN GAS.

(Abstract of paper by G. DEARLE, read and discussed before the Yorkshire Local Section of the Institution of Electrical Engineers.)

IN the case of the regenerative type of coke-oven the volume of gas available for the production of power is much greater than in the waste-heat pattern of waste-heat oven, and it is partly for this reason that the majority of new coke-oven installations during the past few years have been of the regenerative type.

The advantage of regenerative ovens is that the whole of the surplus heat in the coal is produced in the form of a combustible gas, instead of merely as a waste-heat product. This combustible gas can be used to much greater advantage than the waste-heat product, for by utilising it in gas engines it is possible to develop three to four times the power that can be obtained from the use of waste heat under boilers. There is also an advantage in being able to convey the gas any distance without deterioration, which is not possible in the case of the waste heat where the boilers must be installed quite close to the coke ovens.

The principal objections raised by opponents of gas-driven power plant are:

1. The unsteady turning moment.
2. The difficulty of starting the engine.
3. The general absence of reliability in operation.
4. High cost of maintenance.

In this paper the author hopes to show, from his personal experience, that such objections are without foundation.

The installation consists of three 500 B.H.P. vertical tandem gas engines direct-coupled to three-phase alternators, generating current at a pressure of 440 volts, and a frequency of 50 cycles per second.

The gas engines are of the single-acting type, operating on the 4-cycle principle, the cylinders being arranged in tandem. On the up-stroke the inertia of the moving parts is absorbed by the compression of either the top or the bottom cylinder, and part of the inertia is absorbed on the downward stroke by a buffer cylinder formed under the upper piston.

In the case of the four-crank, eight-cylinder engines under consideration, running at 300 R.P.M., with cranks at 90°, the shaft receives four impulses per revolution or 1,200 impulses per minute, so that with a comparatively light fly-wheel the cyclic variation is less than one-third of 1 per cent., which is sufficiently even for the paralleling of the alternators without the slightest difficulty.

The upper cylinders are 1 in. larger diameter than the lower ones, so that the whole line of pistons may be removed together. By this arrangement the dismantling of the engine for cleaning purposes becomes very simple, and the time usually taken for the removal of a line of pistons and the cleaning and replacement of these is from six to ten hours, but if the engine is urgently needed, this work can be carried out in three to four hours. A considerable saving of time is effected by having a spare line of pistons.

The lubrication of the engine is effected by means of plunger pumps working from an eccentric on the crank-shaft, these pumps drawing the oil from the well of the crank-case through strainers. The oil passes from the pumps through coolers, and so to the various bearings of the engine; the whole of the circulating water for the engine first passes through these coolers. The normal oil temperature at the inlet of the cooler is 74° C. and the temperature at the return to the crank-case is 45° C. The oil is pumped to the main bearings of the crank-shaft, and then through passages drilled in the crank-shaft to the crank-pins. From the crank-pin the oil is again led up to the gudgeon pin. The bearings of the cam-shaft are under forced lubrication, and the valve tappets, rollers, and pins are also fed from the same system. The top cylinders and piston rods are lubricated by means of a separate sight-feed lubricator mounted on the crank-case and driven from the cam-shaft. A separate pump to each point renders this lubrication absolutely certain.

The ignition is obtained by means of a magneto and transformer coil. The sparking plugs are of a very heavy design and mica insulated. A stand-by ignition is provided in the shape of an accumulator which is switched on to the coil by means of a change-over switch, but this is only used for testing the ignition, as no trouble has been found in starting direct from the magneto.

The engine is started by means of compressed air, which is stored at a pressure of 300 lb. per sq. in. in six storage tanks, each capable of giving five starts. The air is compressed by means of two-stage compressors, and these are arranged in duplicate, one being driven by a motor and the second by a small gas engine drawing its supply of gas from the same main which feeds the larger engines.

The cooling water from the engine is pumped over a double-drip natural-draught cooling tower by a Rees Roturbo pump deliver-

ing 12,000 gallons per hour against a head of 52 ft. This pump is driven by a 15 H.P. squirrel-cage motor. Stand-by sets are provided in the form of a separate 3-in. pump to each engine, each pump being driven by an 8 H.P. squirrel-cage motor running at 1,400 R.P.M.

It is, of course, essential that the water used should be reasonably free from impurities, and not exceed, say, 15 per cent. of hardness, and it is also important that the tank of the cooling tower be kept free from grease and oil.

A certain amount of coal dust is always present in the circulating water of a colliery power station, but the application of a powerful hose to the hand holds of the jackets about every three months is sufficient to keep down this trouble, provided that the jackets are designed, as they should be, to facilitate flushing.

The ventilation of the crank-cases of the engines is effected by means of 3-in. pipes coupled to the top of each crank-case, and carried outside the engine-house terminating at the top of the exhaust pipe above the silencers. By placing the outlet of this ventilation pipe concentric with the outlet of the exhaust, an ejector action takes place, which effectually scavenges the crank-cases and prevents any accumulation of gas or oil vapour such as would be likely to cause an explosion in the crank-case.

The ventilation of the engine-house is effected by a 30-in. motor-driven fan, and though this somewhat aggravates the coal-dust nuisance, it is of great service in keeping down the sulphur fumes, and thus protecting the exciter, commutators, &c.

The gas supply is obtained from a battery of 110 Otto ovens: 60 of these are waste-heat ovens, and 50 are of the regenerative type. From the former about 15 per cent. of the total gas is available, and from the latter about 40 per cent.

After all the by-products are removed—that is, after the gas has passed the benzole scrubbers—the gas is drawn to the engines by means of a steam-driven exhauster of 60,000 cu. ft. per hour capacity. This exhauster is governed by a diaphragm governor controlled by the pressure of the gas in the main at the engine stop-valves. An electrically-driven exhauster is installed as a stand-by, and this is controlled from the power-house switchboard, and is capable of dealing with 30,000 cu. ft. per hour. This exhauster is driven from a 10-H.P. motor by means of a silent chain-drive. A further steam-driven exhauster is, however, to be installed, as the electric exhauster is found to be scarcely large enough for the work during peak loads.

The quantity of gas passing to the engines is measured by means of a rotary meter, and the gas pressure at the stop-valve is registered on an illuminated-dial pressure-gauge in the power house. The average gas pressure is approximately 10 in.

When the gas leaves the benzole scrubbers it contains about 900 grains of sulphuretted hydrogen in every 100 cu. ft. If this sulphur were allowed to go through the engines, it would form sulphurous acid, which would, of course, attack the inside of the cylinders and the exhaust valves.

A further effect is that the presence of sulphur appears to cause a certain amount of pre-ignition, or spontaneous ignition, of the charge during the compression stroke. A possible reason for this is that the presence of a small portion of the sulphuretted hydrogen acts as an igniter, this sulphuretted hydrogen being more liable than the rest of the gas to spontaneous combustion under compression.

The gas is therefore purified by oxide of iron in a set of four purifiers of the Wilbourn type, each 20 ft. square by 5 ft. deep. The boxes hold about 30 tons of oxide in two tiers on ordinary grids. Two classes of oxide—"Lux" and "Bug"—are used. These boxes are worked on what is known as the "backward rotation" principle. Air to the extent of 2½ or 3 per cent. is drawn in at the exhauster, and this air supply plays a very important part in the revivifying of the oxide in the purifiers.

In order to check the amount of air flowing into the exhauster, it is passed through a small rotary meter. The spent oxide after being taken from the boxes is revivified by being spread out and exposed to the air. When this oxide is no longer capable of taking up any further sulphur, a ready market is found for it, the present value of oxide containing 50 per cent. of sulphur being £2 per ton, and the revenue thus obtained pays for the oxide and the cost of labour on the purifiers.

After the gas has passed through the purifiers, it is taken to the engines. Its average composition is:—CO₂, 3½ per cent.; C₂H₄, 2½ per cent.; CO, 7½ per cent.; O, 0½ per cent.; H, 50½ per cent.; CH₄, 30½ per cent.; N, 5½ per cent.

The calorific value of this gas varies between 500 and 550 B.T.U., the average value being 520 B.T.U. The total sulphur contained in the gas after passing the purifiers is less than 50 grains per 100 cu. ft., and a further advantage of the purifiers is that they absolutely eliminate the last traces of any tar which may be left in the gas after passing the benzole scrubbers. This freedom from tar is of considerable benefit to the engine, as trouble from valve sticking is absolutely unknown, and not the slightest trace of tar has ever been found in the engine.

The current from the generators is delivered to a 13-panel switchboard, consisting of one voltage-regulating panel, three generator panels, one summarising panel, and seven outgoing feeder panels. A testing panel is also included in the power-house equipment, and suitable means for testing motors up to full load are provided by means of a "Walker" air-brake dynamometer.

The motors connected to the mains aggregate approximately 1,700 H.P., and operate the whole of the coke-oven machinery, the fans, haulages, belts, shakers, fitting shops, saw-mills, &c. The lighting load connected averages about 70 kW. The daily load on the station reaches peaks of 1,050 kW., and the average load during the 24 hours would approximate 580 kW. The station is running continuously, seven days per week.

During the initial running of the plant, some trouble was experienced due to the difficulty of obtaining satisfactory mixing of the very rich gas and air. The main gas-pipe to each engine was reduced for a distance of about 10 ft. to an internal diameter of 2½ in., and on reaching the engine was led into the mixing chamber for a distance of about 6 in. Entering the mixing chamber at right angles to this pipe, and about 3 in. above its end, was an auxiliary air supply, controlled by a diaphragm governor. The gas admitted to the mixing chamber was then diluted here by a certain quantity of air. A further air supply, controlled by a hand-lever from the driving platform, was led direct into the chamber of the governor valve, where the diluted gas and air met. After passing through the chamber of the governor valve the mixture was given a rotatory motion by means of a set of vanes, and was also very thoroughly mixed by being passed through a set of perforated plates. With this device no overheating or pre-ignition is noticed, and the engines can be run up to and above their rated capacity without trouble.

The exhaust gases are analysed at stated times, or as the need arises, and the percentage of carbon monoxide is noted. The result aimed at in the analysis of the exhaust gases is to obtain an excess of air, consistent with the engine giving its full power.

In conjunction with the chemist, and by regular analysis of the exhaust gases, combined with instructions to the drivers to drive by the pressure gauge, the gas consumption was reduced to 12½ million cb. ft. per month in May, 1914. During the next six months the consumption was again reduced, the load during this time remaining approximately at the same value. This goes to prove the important part which exhaust-gas analysis plays in the successful and economical running of these engines. The average of good working results shows—

Carbon dioxide	...	...	98 per cent.
Oxygen	...	...	2
Carbon monoxide	...	...	Nil.

The present consumption is approximately 39 cb. ft. per kw.-hour.

The wearing quality of the engines is particularly good, and the repairs needed have been very small. The total cost of repairs, including wages and spare parts used, for 12 months, is £937d. per unit generated, which cannot be called excessive.

The most tried part of a gas engine of the type under discussion is the exhaust valve, and the material which has been found to be the best for the work is nickel steel.

With regard to the ignition, the low-tension magneto and coil transformer are most reliable, and no failure whatever of these parts has occurred. Sparking-plugs on the whole appear to give very little trouble, the most frequent cause of failure of a plug being the widening of the gap, due to the burning of the points, and (less frequently) short-circuiting due to fouling by oil.

The engines can be got away on the magneto, from cold, in eight seconds. This has been done many times, and with a good man on the switchboard, a machine can be paralleled in 25 seconds. This assumes that two men are available for the operation. With only one man to do the running-up and paralleling, one minute would very easily suffice. With such results it surely cannot be said that the modern gas engine is difficult to start.

The plant now described has no stand-by for 10½ hours out of the 24, and during that 10½ hours is run up to, or very little below, its full capacity. These conditions have prevailed for the past 12 months without one involuntary stop.

Finally, as to the cost of maintenance: during the 12 months ended June 30th, 1915, 3,378,440 units were generated at an average cost of 0.132d. per unit. The capital cost of the plant was £12,247, and it had been in operation two years at the commencement of July, 1914. The costs include all charges except interest on capital, depreciation, and gas used. The items are as follows:—

Management (portion allocated to power house)...	0.009d.
Drivers' wages	0.031d.
Cleaners' wages	0.023d.
Oil, water, waste, &c.	0.022d.
Sundry stores	0.002d.
Repairs, including labour	0.037d.
Purifiers, including labour and oxide	0.208d.
	0.132d.

The power-house staff consists of nine men: a foreman driver, four drivers, and four cleaners. The shifts are of eight hours duration.

A vital question in the running of this type of plant is lubrication. As far as possible the lightest oil should be selected.

A well-known maker of gas engines recommends one drop per minute per inch of cylinder diameter. The plant under discussion is run at one drop per minute per 3 in. of cylinder diameter. During a continuous run of one week with an average load of 280 kw. the oil consumption for the whole of the engine, including crank-case make-up, was 124 gallons.

A good crank-case oil has been found to remain in good condition for 12 months before requiring removal. The amount of the oil in the crank-case is about 90 gallons, and about 50 per cent. of this is recovered in sufficiently good condition after filtration to use as a make-up oil for the crank-case. It is advisable to make a test of the crank-case oil at least once in six months to determine its condition.

The average compression of the engines is about 105 lb. per sq. in., but they have been run with it as high as 120 lb., though at this compression very skilful driving was necessary to prevent pre-ignition. It is usual to find that the compression increases as the engine runs in. An engine put to work at 100-lb. compression

will, if kept in good order, go up to 195 lb. or 108 lb. at the end of 12 months' running.

In the discussion, Mr. Wm. Selvey stated that the efficiency of the latest type of this engine was exceedingly high, as he had found in a test, from which the following results were obtained:—

Load and R.P.M.	Heat consumption in B.H.U.		Thermal efficiency, per cent.
	B.H.U. referred to power, calorific value of gas, 10,000		
Full load (609.3)	8.130	31.3	
½ load (459.7)	9.225	27.6	
¼ load (305)	10.800	23.5	
Overload (668.5)	8.320	30.6	

In a case in which he had been interested he found that violent pre-ignition was accompanied by very high sulphuretted-hydrogen contents in the gas. He searched contemporary records as regards the explosibility of sulphuretted hydrogen, but could find nothing. It was very curious that the bog or purifiers appeared to remove tar as well as sulphuretted hydrogen. Pre-ignition had often been attributed to "tar fog" causing deposits in the cylinder, but he had found pre-ignition to be violent where, although "tar fog" was undoubtedly present, the deposit in the cylinder was quite wet and oily.

Mr. W. B. WOODHOUSE said that if the surplus heat from coke ovens was to be used for the production of steam, there was no doubt that the waste-heat oven would give the bigger surplus. The advantages of the regenerative oven in other directions were, however, so considerable that the present-day tendency was altogether in favour of their use. The author's claim that by using surplus heat from ovens in gas engines it was possible to develop three to four times the power that could be obtained from the use of waste-heat under boilers, was a serious over-statement of the case. The initial or no-load consumption of a gas engine was some 30 to 40 per cent. of the full-load consumption, whereas that of a steam turbine was from 10 to 20 per cent. This being so, the relative consumption on commercial loads with load factors of between 25 and 50 per cent. was increased over that required at full load, much more in the case of the gas engine than in the case of the steam turbine. The engines that the author dealt with were not large gas engines, and could not be economically used in large power stations. Further objections to gas engines were the high capital cost of the plant and the high initial fuel consumption and relative inefficiency at light loads. There were a number of motors driving auxiliary machinery necessary for the gas-engine plant; the power required for these purposes was internal to the generating plant, and in making a statement of costs should have been deducted from the total output. The addition of capital charges would, of course, considerably increase the figure stated. The author was using a very small proportion of the total gas from the ovens. If his generating station were linked up to a power-supply system such as they had in Yorkshire, the whole of the gas could be utilised for the production of electricity, and benefit would accrue to the colliery owner in finding a market for the surplus, and to the power company in obtaining a source of cheap fuel. The future utilisation of its fuel resources was a matter of vital importance to the country, and one in which the public supply of electricity must take a large and important part.

Mr. W. E. BURNAND said the engines could hardly be called large gas engines, since the use of eight cylinders to produce 500 H.P. represented a power-producing unit of only 62½ H.P. so that many conditions which had occurred with really large sets were avoided in these machines. With large cylinders most troubles were traceable to the piston head and combustion-chamber walls receiving many more heat units per square inch of surface than in the case of a small cylinder. When large cylinders were put to work, it was found that the surfaces received very much more heat than in the smaller sizes, thus showing conclusively that a great deal of the heat which had to be conducted away by the cylinder and combustion-chamber walls was due to radiation from the body of the gas. Two possible ways of dealing with it were to get as near as possible to flameless non-radiant combustion of the gases inside the cylinders, either by perfect mixture of the air and gas before ignition or by a modification of the gas giving a less radiant flame, and by creating inside the cylinder, and preferably adjacent to the wall of the combustion chamber, a sort of fog impervious to the radiant energy, thus preventing this energy reaching the cylinder walls, and confining it mainly to the body of the ignited gases.

Mr. S. SIMPSON said there was still a surplus of 50 per cent. of gas which by co-operation with the electricity supply authorities would have a definite market value, and could be entirely utilised if local conditions permitted. The author said the present gas consumption was 39 cb. ft. per kw.-hour, but the consumption during 1913-14 apparently was 53.5 cb. ft. per kw.-hour. Low consumption figures were dependent entirely upon full-load conditions, which were not realised continuously in actual working.

In the United Kingdom, during 1914, some 12 million tons of coke were produced in coke ovens, and if these were all of the by-product recovery type, the surplus gas available for power production would yield 1,000 million units per annum, or a steady output of 115,000 kw. Further, considering blast furnaces, 892 million tons of pig-iron were produced during the year, and the surplus gas available for power production would yield 1,785 million units per annum, or a steady output of 200,000 kw. These two economies would supply at least 50 per cent. of the total colliery power requirements of the country, and in view of the fact that 6 to 8 per cent. of the coal tonnage output was used by collieries for their own requirements, some 9 to 10 million tons of coal per annum would thus be saved, and set free for other

industrial requirements. With regard to the working costs, he submitted the following amendments to the statement of the total generation costs:

3,750 H.P. units generated and say 3,210,000 units to the colliery circuits.

Item.	Pence per unit generated.	Pence per unit sent, i.e. to the colliery.
Management, wages, oil, waste, water, stores, repairs and purifiers	0.132	0.139
Interest at 5 per cent. and depreciation at 7½ per cent. on £12,247	0.109	0.115
Gas, 165 million cu. ft. at 3d. per 1,000 cu. ft.	0.147	0.155
Total, with no spare plant ...	0.388	0.409
Interest and depreciation for fourth set (spare), say, 12½ per cent. of £4,000	0.035	0.037
Total costs	0.423	0.446

The above results were undoubtedly very good, but he was sure that the author would find many supply authorities who would only have been too glad, if they were within reach of him, to take on this colliery load at, say, 110 per cent. of his cost per unit. Were this possible, it would certainly have paid the colliery company, and saved them a capital outlay of £12,000 on what was (so far as they were concerned) unproductive plant. This would have paid for 12 additional regenerative coke ovens, with the result that a corresponding increase in the profits would be obtained from the coking and by-products, owing to the improved efficiency of working and increased yields from the larger installation. At the same time, the supply authority would have been a most likely customer for all the surplus gas. The most economical means for the production of electrical power from coke-oven gas must depend upon the party with whom the choice lay. If with the colliery company, then for a relatively small installation, where sets not exceeding 300 kW. each could be conveniently used, gas engines would show probably 20 per cent. better economy over the year's working, though capital and repair charges would be higher. There was no question that for 1,500-kW. capacity and over, the gas-fired boiler, in conjunction with a steam turbo-generator installation, was the soundest commercial practice, and as regards economy of operation, it was now possible, with the improved efficiency of gas-fired boilers and turbine plants, to obtain consumption efficiencies under working conditions practically equal to the gas-engine performance. The difference was certainly not worth the extra capital and repair charges.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Novel Cooking Device.

THE RUVOIO ELECTRIC CO., of 50, Broad Street, New York, U.S.A., has recently developed a heating device principally for egg cooking, warming small quantities of food, &c. The food is cooked or warmed by steam generated by the passing of current through a small quantity of water, between two carbon electrodes. It is claimed that the amount of water may be adjusted, so that it will be entirely converted to steam at the end of a definite period, thus automatically shutting off the current and preventing over-

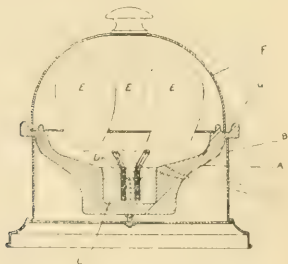


FIG. 1.—ELECTRICAL EGG-COOKER.

cooking. The device consists of a base B, in which rests a porcelain dish A, with a cover F; a small well C contains the water. The groove G, in which the cover rests is of sufficient capacity to hold as much water as the well, and catches the condensation from the cover thus limiting the time of operation of the device. The eggs are carried on a perforated plate. The carbon electrodes are impregnated with salts which the water absorbs thus lowering its resistance; it is claimed that one and a-half teaspoonfuls of water will cook four eggs.

It will be noted that the device is an electrolytic one, and no doubt is designed to avoid the possible formation of an explosive mixture of gases.

"Fluvent" Fuses.

Notable improvements have been made in the construction of the "Fluvent" fuses developed by MESSRS. PARAMETER, HOPE AND SUTTON, LTD., of Hulme Electrical Works, Manchester, and they are now supplied combined with switches, and in many other forms; large feeder switchboards of the totally-enclosed ironclad type, built up on the firm's patent unit system and equipped with Fluvent fuses, are being made, and large numbers of them have been supplied to the Government in connection with new factories. The Fluvent fuse as now standardised is of the handle type, with

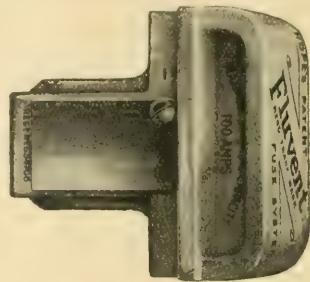


FIG. 2.—"FLUVENT" FUSE.

the fuse wire placed diagonally across a tube in the handle; the contacts are at the sides instead of the ends of the tube and the wire passes from the contacts into the interior through small holes in the porcelain, which prevent any tendency to arc from contact to contact. Moreover, the oblique position of the fuse wire in the tube tends to blow the arc away from the contacts instead

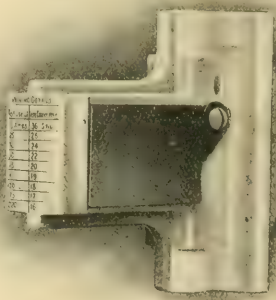


FIG. 3.—UNDER SIDE OF "FLUVENT" FUSE.

of towards them. Hence it is possible to have a fuse with a very short break, reducing the watts lost and the mass of metal involved to the minimum. As the customary tables of fusing currents obviously do not apply under these conditions, a suitable table for



FIG. 4.—ROW OF BASES AND COVER PLATES FROM THE REAR.

copper wire is printed on the bottom of the fuse plug. The holes through which the wire is threaded prevent the insertion of wires much too large for the capacity of the fuse. An incidental advantage of the arrangement is that while in air copper fuse wire reaches dull red heat at about 75 per cent. of its blowing current, in the Fluvent fuse this takes place only at 89 per cent.; thus the principal drawback to the use of copper wire is practically

eliminated, and numbers of these fuses, grouped together can be run sufficiently near their blowing currents to satisfy almost any requirement. In withdrawing a live fuse carrier, the china base below the contacts wipes the contacts and chills the arc, blotting it out suddenly and without danger; and the arrangement of the side contacts and the fuse wire enables full advantage to be taken of the magnetic field due to the contacts to blow out the arc when the fuse is blown. Every part of the device is made accurately to gauge, and any of the fuse bridges will always fit any Fluvent base.

The system has been subjected to very severe tests by the testing department of the Manchester Corporation electricity works, some of which we have recorded. A D.C., 150-KW. 440-volt motor-generator has been repeatedly short-circuited through a couple of the fuses in series, similar experiments have been made with the current gradually raised to the fusing value, with inductance in circuit, and more recently a single Fluvent fuse of standard type has been short-circuited across a 400-volt motor-generator—in every case without damage to the fuse and base.

The firm has recently opened an office in Westminster, where sample fuses can be seen.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Employment of Disabled Sailors and Soldiers.

I have read your excellent account in the REVIEW, of August 4th, of the training at the Northampton Institute. I think electrical engineers would be interested to know that there is also a school in connection with the Queen Mary's Auxiliary Hospital, at Roehampton, which gives preliminary training during the time the men are waiting to be fitted with artificial limbs. Those who show ability in the electrical shop, when discharged, can have further instruction at the Polytechnic, Regent Street, and a large number of men have obtained suitable employment, and firms wanting men to look after private installations, motors, &c., should apply to Mr. Dudley B. Myers, Hon. Secretary of the Employment Bureau, Roehampton House, S.W., who tells me that the training scheme has proved a great success, and that the applications from the public have exceeded the number of men available. Instruction is also given in motor driving and other trades.

The question of deduction of pension, which you rightly term "an incentive to idleness," should be settled at once, as the disabled men will probably in some cases lose their jobs when the large number of mechanics now in the Army return to work, and it would be more consistent to put aside the amount deducted from the pension, while the man is at work, and let him have it later, if through no fault of his own he is unemployed.

Killingworth Hedges.

Member of the Committee of the I.E.E. for the Employment of Disabled Sailors and Soldiers.

August 10th, 1916.

Dry Battery Manufacture.

We notice an advertisement in your current issue inquiring for Swiss and Dutch dry batteries.

If possible we should very much like to know if the advertiser has no faith in British manufactures, or is it merely a case of buying in the cheapest market?

British Battery Manufacturer.

Tar as Fuel.

Will you kindly favour me with some information, through the medium of your valuable paper, relating to the use of "tar" as a liquid fuel for Babcock & Wilcox boilers?

H. C. C.

Pernambuco, Brazil. July 10th, 1916.

Whither Are We Drifting?

As each strenuous week draws to a close, it is usually one's recreation to turn to the weekly papers for light mental refreshment, and your issue this week is of more than ordinary interest.

Your leader on the Paris Conference concludes with the hope that Protection may be the outcome, with security to our industry and progress in our business; if Protection comes, will the result be in every way satisfactory, or shall we fall asleep behind the sheltering Tariff Wall? An equally able article in this week's *Truth* (p. 220) gives the other side.

The most interesting item is contained on page 143 of your issue, and deals with the electrical undertakings in Berlin. Notwithstanding the war, famine in food and metals, financial stress, and all the other disadvantages that we all hope are existing there, here is clear evidence of brains working and achievements accomplished by the German people.

Compare the results achieved in Berlin with those of London in the matter of electrical supply. In London, Committees have sat

for years, evidence has been collected, and things remain as they were, except that a few of the smaller undertakings are considering linking up.

Near Berlin, within 12 months of the outbreak of war, a station of 180,000 kW. was erected and working for the production of nitrates—a station equal in capacity to that of the combined stations in London!

In the article on the Victoria Falls Co. (page 151) the strong power of German finance stands out: when shall we be in a position to command financial aid in like manner? In the article, a powerful weapon against German electrical trade lies to hand unused. In a few lines Mr. Price draws attention to the defects of German plant: why are these defects not set out in detail? A few of them are known to me from first-hand evidence, and even they form a record of disasters which cannot be equalled in any British station fitted with British plant. That this is not an isolated case the experience at Shanghai bears out. The facts should be set out in detail as a warning to the cheap buyer of narrow views (there are still plenty left), and as a guide to our own designers. The article on German Preparations for Peace (page 153), is worthy of careful consideration: again there is evidence of brains, energy and action.

Well, what are we doing? Notices of various Committees are seen in the Press, but the names of prominent business men with weight and financial power are not in evidence. What will be the result of the labours of all the Committees—useful and strong action or only the preparation of masterly minutes?

With a knowledge of nearly every large electrical engineering factory in Europe, I know the need for action is great on the part of the British electrical industry. Is education necessary? See the salaries offered to attract teachers—in many cases they do not exceed those earned by an industrious tradesman with no education at all! The municipality of Portsmouth is now advertising for "The head of mechanical and civil engineering department" of the technical school at £225 per annum.

After this war we should possess everything that makes a great nation. Reputation for honesty, credit, and power. What shall we make of it?

When our businesses were small, individual and personal attention made them successful: now the world's businesses are large we appear to lack the means of conducting them. If we are to remain a great nation, even of shopkeepers, let us get behind the counter without delay and put the shop in order.

J. Shepherd.

Leeds August 14th 1916.

WAR ITEMS.

South American Black List.—Lord R. Cecil, replying to a question in Parliament the other day, said that there were 443 names on the statutory lists of enemy traders in South America, the majority being German firms or persons.

Export Prohibitions.—A number of headings previously included in the list of exportation prohibitions are now to be removed, according to a notice appearing in the *London Gazette* for August 15th. A number of new headings are added.

Picnic for Dependents.—Bolton Corporation tramway employes, on August 10th, provided a picnic for the wives and children of their comrades now with the Forces. Cars were lent by the Tramways Committee, and toys and prizes were given by members of the Corporation.

Liebknecht and A.E.G. Employes.—The Rotterdam correspondent of the *Daily Chronicle* quotes a German paper as saying that "after the conviction of Liebknecht, disorders were the order of the day. The people were furious over his conviction. Amongst others, all the workmen of the General Electricity Co. (? A.E.G.) struck work. The following morning 2,000 of them were sent to the Front."

Patents in War-time.—In the House of Commons, last week, Mr. Peto asked the President of the Board of Trade whether he intended to introduce a Bill to amend the Patent Law so as to give further period for working patents the operation of which had been interfered with by the war; and, if so, whether such legislation would be introduced before the adjournment of the House. In reply, it was stated that the President of the Board of Trade would not be in a position to introduce legislation amending the Patents and Designs Act before the adjournment.

Italy and Enemy Traders.—Reuter's Rome correspondent says that a Government Decree has been published prohibiting Italian citizens, including those residing abroad, and all persons living in Italy or her Colonies, from trading, first, with persons, institutions, or companies established in enemy territory, or territory occupied by the enemies of Italy, or the allies of enemy States; second, with subjects of the above-mentioned States, wherever they may reside; third, with persons, commercial firms, or companies whose names appear on a special list.

Another Decree places under the control of the Government for their eventual liquidation all commercial enterprises existing in the kingdom whose managers or chief shareholders are subjects of States enemies of Italy, or allies of enemy States.—*Daily Telegraph*.

Australian Zinc and Spelter.—According to an announcement made by Mr. Hughes, the Prime Minister of Australia, at Melbourne last week, the Imperial Government has agreed to take a large proportion of the output of Australian zinc and spelter, about the sum of 100,000 tons yearly for ten years after the war. The Imperial Government has also agreed to advance £500,000 on War Loan terms for the erection of plants in Australia and to take 45,000 tons per annum of Australian spelter. Negotiations are proceeding with France and Belgium to take the remainder of the concentrates produced in the Commonwealth.

Canada and Germany.—Mr. J. W. Woods, president of the Canadian Trade Commission now on a visit to this country, said the other day that he did not think that Canada would want to have anything to do with Germany after the war. "We are going to cut them out entirely," Mr. Faithfull Begg, speaking at the same function, said that he had made up his mind to have nothing to do with anything that was German. He would not shut the door upon Germany for all time, but until she had the opportunity of demonstrating that her present attitude of mind had passed, and that she had ceased to be literally a criminal lunatic in politics and diplomacy.

The Commissioners are this week making a tour of the manufacturing centres of the United Kingdom.

Japan and the Economic Conference.—According to a Reuter dispatch in the *Financier*, a joint meeting of the Chambers of Commerce of Japan, attended by the presidents of the Chambers of Commerce of every city in the country, was held there last week. A resolution was passed unanimously agreeing to support the decisions of the Allies' Economic Conference in Paris as regards measures to be adopted both during and after the war. Mr. Nakano, president of the Tokio Chamber of Commerce, addressed the meeting, dwelling on the advantages of the Russo-Japanese agreement.

German Preparations Abroad.—The "Times" special correspondent at Amsterdam quotes the following note from "Die Post," Berlin:—

"German merchants, principals and employés, unable to return home from overseas, have settled in American ports, where they are making themselves as useful as possible. China, the United States, and South America are the principal fields of their new commercial activities. They have succeeded with remarkable skill in adapting themselves to their new conditions. German firms in South America, after the cessation of the arrival of German goods, are working for native firms or for account of neutral firms. England's attempts to prevent this have been mostly ineffective. The organisation of German trade overseas stands as firmly as ever, and the German business world abroad looks with all confidence to the period after the war."

The *Daily Telegraph* New York correspondent quotes the *Wall Street Journal* as claiming to have good authority for the statement that Germany and Austria are endeavouring to effect record-breaking purchases of copper in the States. Negotiations, it is asserted, are under way for buying 250,000,000 to 500,000,000 lb. of the metal, or all the copper available for export in 1917. The metal is to be stored until after the war, but then shipped to Germany, Austria, and Turkey. "The efforts of the *Daily Telegraph's* correspondent to obtain confirmation of this seemingly rather wild statement were unsuccessful up to the time of writing."

It will be remembered that somewhat similar reports gained currency at a much earlier stage of the war.

To be Wound Up.—Further lists of companies ordered by the Board of Trade to be wound up under the Trading with the Enemy Amendment Act, 1916, include the following:—

Bohler Bros. & Co., Sheffield, steel manufacturers. Controller: G. C. Webster, 6, Orchard Street, Sheffield.

S. Reich & Co., 15, Clerkenwell Road, E.C., glass manufacturers. Controller: W. A. Slade, 9, Old Jewry Chambers, E.C. Simon Menzel, 15, Seething Lane, London, E.C., iron merchant. Controller: G. Bostock, 21, Ironmonger Lane, E.C. Levy & Soicher, 15, Seething Lane, E.C., iron merchants. Controller: G. Bostock, as above.

Duron Co., Ltd., 1, Manchester Road, Bradford, manufacturers and dealers in oils, fats, and chemicals. Controller: W. E. Harding, Central Bank Chambers, Leeds.

C. P. Goerz Optical Works, Ltd., 4/5, Holborn Circus, E.C., opticians. Controller: C. Field, Broad Street Avenue, E.C.

Grimme Natalis & Co., Ltd., 46, Cannon Street, E.C., agents for the sale of calculating machines. Controller: L. L. Samuels, 7, Norfolk Street, Manchester.

International Metal Co., Ltd., 1 & 2, Bucklersbury, London, E.C., metal merchants. Controller: W. H. King, 13, Basinghall Street, E.C.

Westinghouse War Fund.—We have received a copy of the balance sheet of the British Westinghouse Employers' War Relief Fund for the period ended June 30th, 1916. A meeting of the delegates is to be held to-day, Mr. J. H. Tearle presiding. The number of employes who have joined the Forces is 2,100. The total receipts from August, 1914, to June, 1916, have amounted to £27,966, of which £18,942 has been contributed by employes and £8,791 by the company. The payments to dependents have been £15,648; Christmas gifts required £885, donations to local and national funds have been

£780, there has been transferred to Disablement and Dependents' Fund £6,000, and a balance of £1,230 is in hand. The last two of these sums, amounting together to £10,480, are invested as to £8,783 in Treasury Bills and £1,697 is at the bank. The statement is signed by Mr. W. C. Mann as hon. secretary to the fund, and by Messrs. W. Bryden and J. Longden, the hon. auditors.

Report on Disabled Soldiers as Drivers.—We read in the *Times* that the Committee appointed by the Home Secretary last January to consider how far disabled soldiers could be employed in the driving of motor-cabs, motor-omnibuses or tramcars has issued an adverse, but definite and unanimous, report. Having regard to the normal conditions of traffic in the Metropolis, it holds that the logical outcome of lowering the physical standard would be to increase the street casualities. It is recommended that men who have lost an eye, a hand, an arm, a foot, or a leg, should not be granted licences. The case of men suffering from minor disabilities do not, they think, require any hard-and-fast rule, but each should be considered on its merits, and a specialist called in to advise if necessary.

The Committee points out that even under the present strict régime "there is no margin of safety to spare," and this consideration plainly underlies all the recommendations. More than once it is stated that "the safety of the public is the first consideration." It is mentioned that over 7,000 drivers of tram-cars, omnibuses, and cabs in London have joined His Majesty's Forces. Assuming that the great majority of these are serving with the Mechanical Transport, where casualties are comparatively light, most of these men may be expected to return to their former employment. The inference to be drawn is probably that it would be hard for these drivers to find their places filled by incapacitated men to whom licences had been granted by misplaced sympathy in defiance of the requirements of public safety.

U.S. Tariff Policy for After the War.—In June last, before the National Gas Engine Association, at Chicago, Dr. F. R. Rutter, Assistant Chief of the U.S. Bureau of Foreign and Domestic Commerce, urged the necessity for a settled American tariff policy. He said that if the country was to hold its own in the bitter competition for trade that would follow the war, the Government must be given the opportunity to make favourable commercial treaties with foreign countries. It must be borne in mind that concessions could not be obtained in the tariffs of other countries if they were not willing to make concessions themselves. "A fixed commercial policy is particularly necessary at the present time. With rumours of trade agreements that will give preferential rates of duty between the allies, and with rumours of a Customs union to cover Germany and Austria-Hungary, we must be in a position to know definitely the effect on our industries of any proposed foreign action." Dr. Rutter regarded the proposed tariff commission as a step in the right direction, as it was authorised to study commercial conditions and to advise regarding commercial policies and commercial treaties, and in this way would be of the greatest possible assistance in establishing a settled tariff policy.

Exemption Applications.—Surrey Appeal Court has refused exemption to Mr. A. E. Chatworthy (39), electrician, who pleaded conscientious principles.

Before the Warwickshire Tribunal, the Stratford-on-Avon Electric Light Co., Ltd., applied for exemption until August 8th in favour of Mr. A. L. Smith (38), electrician, to be extended. It was stated that he was the only competent man left, and a substitute could not be found. Exemption was allowed until October 31st.

St. Albans Rural Tribunal granted a certificate of conditional exemption to Mr. D. T. Webb (39), electrician at the Herts County Asylum, Hill End.

At the Buxton Tribunal, conditional exemption was appealed for on behalf of a foreman fitter, 38 years of age, employed by a firm of electrical engineers, by his employer. The latter stated that the man was employed entirely on skilled work other than driving, and including the working repairs to 10 commercial cars. He also had the supervision of a shell-making department. The Gas Works and Electricity Works relied on this man in all cases of emergency. He also did electrical work in connection with several of the local hospitals. He was married, with a wife and two children, and came from a munition works to witness, and had been with him since some two or three months after war was declared. He had not done a stroke of work on pleasure cars for months. He was fairly represented as a mechanic retained for repairs of plant, machinery, and tools. Temporary exemption granted for six months, until January 28th, 1917.

A final month's exemption has been granted by the Merthyr Tydfil Tribunal to Albert John Davies (31), electrician at the Oddfellows' Hall at Dowlais.

Temporary exemption until October 1st has been granted to J. E. Bearpark, electrician at the Queen's Theatre, Castleford (Yorks.).

At Castleford (Yorks.), on August 8th, Mr. C. J. Cox (32), electrical engineer, appealed for himself and his assistant, F. A. Aldridge (23), financial reasons being urged, together with the plea that the work done was of an indispensable character. Mr. Cox said that out of 19 men, two only were left; one had to go, and the other was Aldridge. He had contracts to keep in order the electrical plant at works of national importance, and the appeals were supported by letters

from local firms. Mr. Cox was given conditional exemption, but the appeal for Aldridge was refused.

Before the Manx Appeal Tribunal, J. E. Gregun, electric mechanic, engaged with the Manx Electric Railway Co., appealed against exemption until the end of July. The exemption was extended until September 12th to carry him over the season.

An Eastbourne electrician, who said that he would join up forthwith if he had anyone to carry on the business for him, has been given 12 weeks' exemption.

At Maidstone, the Corporation Electricity Committee appealed for six coal loaders, and, on the ground of public utility, they were conditionally exempted.

Before the Hants Appeal Court, on August 8th, the Aldershot District Traction Co. appealed for two fitters, who were claimed to be indispensable owing to the depletion of the staff. It was suggested that the men were in certified occupations, but this was not accepted by the Tribunal. The appeals were dismissed.

At Aldershot, on August 8th, Messrs. Burch & Vertue appealed to the Hants Tribunal against refusal of exemption to J. F. White (32), electric fitter and wireman, who assists to keep in repair 60 motors used for industrial purposes, and the contracts for the maintenance of fire alarms, military electric bells, and lighting installations. As all the other men appealed for by the firm had been exempted, the appeal was dismissed.

At Hastings, Messrs. Adams & Jarrett asked for extended exemption for their wireman, C. J. Perks (30). It was stated that Perks was the only man on the staff who could do their electrical work, and, in addition, they were keeping going the business of Mr. Skinner, electrician, while he was engaged in Government service at Woolwich Arsenal. All efforts to fill the place through the Labour Exchange and Electrical Association had failed. The Military opposed any further period, but the Tribunal gave unlimited conditional exemption.

Bath Tribunal has refused an appeal for exemption for A. B. Wills (33), on the clerical staff of the Bath Electric Tramways, Ltd.

An appeal by E. G. Reynolds (28), electrician, engaged at the Redhill Kinema Royal, was dismissed by the Reigate Tribunal, but he was given until September 1st.

At Reigate, an appeal was made by Mr. H. G. Francis, electrical engineer, of Redhill, to the Surrey Tribunal, against refusal by the local tribunal of his claim as a conscientious objector. The facts have already been given in the ELECTRICAL REVIEW, and he was now supported by counsel, who also urged that Mr. Francis was indispensable in the business with which he was connected. The Chairman said that Mr. Francis must make some sacrifice, and he was given time to find work of national importance.

At Maldon (Essex) Tribunal, exemption was refused to G. Vesty, electric wireman and fitter, engaged with Mr. H. P. Girling.

A firm of electrical engineers at Eastbourne appealed to the East Sussex Tribunal for the retention of an apprentice, who has two years to serve under his indentures. The appeal was dismissed, but leave was given to take the case to the Central Tribunal.

Before the West Ham Tribunal, Mr. Haynes, electrician, appealed, and stated that besides other duties he had to supervise 60 lights and 25 motors. His appeal was dismissed, and he was advised to go before the Army Medical Board and be examined as to deafness.

Appeals were made at Barnes by Mr. T. H. Hellyer, electrical engineer, and Mr. G. Harwood, electrical fitter. The former said that he was solely responsible for the business, which must close down if he had to serve. Mr. Harwood had been in the business for six and a half years, and acted as foreman. Mr. Hellyer, on joining the Volunteer Training Corps, was allowed three months, and Mr. Harwood until August 14th.

On the appeal of Mr. J. H. Benyon, of Englefield (Berks), exemption until the end of the year has been granted to G. Slyfield (33), his electrician.

At Rochdale, last week, conditional exemption was allowed to J. A. Shepherd, 36 years of age, a motor-man appealed for by the Corporation tramways department.

At Accrington, last Friday, the Military Representative sought the cancellation of an exemption certificate granted to an assistant to the Borough Treasurer (27 years of age, and single). Mr. Beckett (borough treasurer) said this man was in charge of the electricity department finance, and it was absolutely necessary that revenue should be collected to keep the establishment going. There were 1,500 consumers, and it was necessary that the services of a thoroughly competent man should be retained to have charge of the collection of revenue. They must have finance as well as engineering; in fact, there would be no engineering but for finance, added Mr. Beckett. He was of opinion that no man was indispensable, but this man was essential to the management of the treasurer's department. The Mayor (Coun. Barlow) said the Tribunal had decided that there should be no exemption in this case.

At Blackpool, on August 10th, appeals lodged by Mr. C. Furness (borough electrical engineer) on behalf of certain workpeople were heard. One man was a semi-skilled fitter mechanic; another was the chief fitter engaged on the repair and maintenance of plant on the tramway system; a third

was the attendant at the transformer chambers and electric lighting sub-stations; and a fourth was the only blacksmith at the electricity works, engaged on general repairs and plant. Mr. Furness said he appealed with reluctance for two of the men who had not attested, but force of circumstances compelled him to do so. The men were in certified occupations, and if they left the Corporation they could go to their own work elsewhere. Two men were temporarily exempted until the end of September, and the other two were granted conditional exemption. Mr. Furness was granted leave to appeal for a further month's exemption for the foreman of the tramway track repairers, whose services were desired until the department got over the heavy loads of the summer.

At Hyde, the Slack Mill Co. appealed for an electrical wireman, who was granted conditional exemption.

The Denton Tribunal has granted exemption till the end of September to Alfred Armitage, an accounting clerk employed by the Manchester Corporation tramways department.

Appealing for a depot foreman, aged 23, the manager of the railless traction system at Ramsbottom said the man was in a reserved occupation. He was single. It was pointed out that he was not in a reserved trade on account of his age and the fact that he was single. The manager said the man was the only skilled workman at the depot, and had to do both the mechanical and the electrical work. The cars would have to stop if the man went away. In granting temporary exemption until October 1st, it was strongly urged that a man ineligible for Army service should be engaged.

Littleborough Tribunal last Friday refused an appeal by William Fletcher, of the National Rug Works, on behalf of Herbert Thomason (36), electrician.

At Bexhill-on-Sea, Messrs. J. L. French & Co., electrical engineers, appealed for F. C. Damm (29), electrical wireman, and H. E. Mullinger (40), works manager and electrical engineer, and responsible for the estimates for electrical work. Mr. French said that six out of the ten members of the electrical staff had been called up, and the other four were indispensable if the branch was to be carried on. Mullinger was given three months' exemption, and Damm a fortnight.

Grays Tribunal has given exemption until the New Year to two stokers at the U.D.C. electricity works.

BUSINESS NOTES.

Colombia.—An American Consul quotes *El Nuevo Diario*, of Caracas, to the effect that certain Venezuelan capitalists, in cooperation with a Colombian firm, are seeking a concession from a city in Colombia for the erection of a factory for ginning, spinning, weaving, and knitting cotton. The proposed contract provides that modern machinery shall be used for all purposes.

Russian Waterways.—The *Journal* of the Russian-American Chamber of Commerce at Moscow states that the Russian Government has decided to reconstruct the Duke of Wurttemberg waterway system, connecting Archangel with Petrograd, so that it will accommodate vessels of large size. An effort will be made to complete the work by the first half of the navigation season of 1917.

American Consular Activity and European Economic Policy.—The National Foreign Trade Council, which maintains headquarters at New York, has prepared a report to be submitted to Congress, on the needs of the Diplomatic and Consular Service of the United States. It urges the passage of H.R. 13,383, with all appropriations, recommended by the State Department, including the appropriations of \$355,000 for the purchase of buildings for the United States Consulate and other Government offices at Shanghai, China; \$100,000 for a legation building at Panama; and \$100,000 for post allowances to offset the abnormal increased cost of living at certain posts due to the European war. In explanation of its position the Council says in part:—

"Whether the elaborate economic policies now advocated by many publicists in Europe are actually erected or are modified under pressure of the commercial interdependence of the warring powers, the interests of American foreign trade demand that our diplomatic and Consular representatives throughout the world should be provided with greater facilities for anticipation and analysis of the new commercial policies of the Great Powers and their colonies. Not only intelligence and experience are required in this duty, but all the support that national prestige can give our diplomats and Consuls in intercourse with the important foreign officials and business leaders. An American minister discharging his function from poorly located rented quarters is not an impressive unit in world diplomacy. The most diligent Consul is naturally discouraged if unprovided with sufficient clerical assistance. Many Consuls are now chained to clerical drudgery who should have the time to cultivate important sources of information."

Some time ago the Council submitted a report to Congress stating the needs of the Bureau of Foreign and Domestic Commerce, and recommending adequate appropriations for the maintenance of its trade-promotion work.—*U.S. Commerce Reports*.

Swiss Export Prohibitions.—The Swiss Government has just prohibited the exportation of carbons prepared for electric lighting, and also electric clocks which are mounted on cast

The Consett Iron Electrical Installation.—At a meeting of the Consett Iron Co. Ltd. at Newcastle-on-Tyne on 12th inst. Mr. Mack Farwell said that their profit (£625,000) was the largest but one they had earned. Referring to the past years' work, he said he regretted they had had to postpone certain contemporary electrical developments on account of the war, because it looked as though some of the wage increases, and other advances in cost, had come to stay, and the proposed developments would have made for economy. He mentioned that they had now one of the largest electrical installations in the country, which had enabled them to use coal-cutters and conveyors to work seams which it would otherwise have cost too much to work and generally to reduce costs, thus contributing to the financial stability of the company.

Markets for Electric Fans.—Recent U.S. Consular and Trade Reports draw attention to the Danish West Indies and Porto Rico as promising markets for electric fans. In the case of Porto Rico it is stated that the electric fan is used to only a slight extent on the island at present. The field appears to be an attractive one, however, and it is believed that an active selling campaign would produce good results. "There is plenty of current available, but it is rather high in price, as compared with the prevailing cost in the United States. It is at present very hot here, and the humidity is great, and there appears to be no reason why a demand for electric fans could not be readily created."

In regard to the Danish West Indies, it is remarked that the recent completion of the work of installing an electric lighting system in St. Thomas has opened up a new market for American electrical supplies. "There should be an especially attractive field here for good, but moderately-priced, electric fans, which are almost unknown on the island. St. Thomas lies in the Tropics, and because of the location of its principal town (Charlotte Amalie) on the southern slope of a high ridge of mountains, where refreshing breezes are lacking most of the time, the employment of electric fans would be appreciated everywhere and for all the year round. At the cinema shows, which are given two or three times each week, a number of large hand-made fans are suspended from the ceiling, and are operated by cords pulled back and forth by small boys stationed back of the screens. In the hotels, business offices, and private houses, though, there are no such appliances, and it is believed that immediately after the first electric fan has been introduced it will become generally popular."

"The possibility of introducing electric fans was called to the attention of one of the leading commercial men of St. Thomas, who displayed a lively interest in the matter, and requested the Consulate to put him in touch with American manufacturers of electric fans and other similar articles. Correspondence with St. Thomas business people should be in the English language."

Spanish Electrical Trade.—The French Vice-Consul at Alicante, forwards a report on Austro-German imports into that city, from which it appears that the two latter countries furnish the greater part of the electrical imports. France, which is also a contributor, supplying principally telegraph material. The Spanish industry is a producer of a certain quota of electrical goods, to wit: Transformers, dynamos, motors, and measuring and protective instruments and apparatus for low power machines. Other classes are imported. As electric installations, flour mills, and water-raising installations are being frequently established, both in Alicante and throughout the province, the visits of German travellers are numerous. The Austro-German imports embracing electric cable and wire, lamps, carbons, dynamos, electro-motors and telegraph apparatus. The lamps may be of any origin, as a Spanish company which manufactures them is ready to affix any name asked for by the purchaser. As a result, the lamps on sale bear a variety of names, each having only a limited sale in the region of the person giving the order. Exporters may, therefore, freely export a number of articles, making sure, however, to supply low-priced goods of pleasing appearance to catch the eye. With regard to articles difficult of importation, no hindrances exist preventing the establishment of local manufacturing branches in Spain, for which the war creates a favourable situation.

The Norwegian Electrical Market.—According to U.S. Consul-General E. Haldeman Dennison, Christiania, owing to the large increase in the price of coal, which formerly cost \$7.50 per ton and now sells for \$23.50, an increasing number of households in Norway are turning to electricity for domestic purposes, and the sales of electrical appliances for heating stoves, ranges, washing machines, irons, rings, &c., have never been so heavy as at present. "The demand for these articles is unprecedented and American manufacturers, while deriving much benefit from the changing conditions, could, with little effort, improve their position in this market. It is generally supposed that electric current in Norway is cheaper than in any other part of the world. It is also thought that coal will be expensive for a long time to come, and perhaps never return to its former price, for Norway depends entirely upon outside sources for its supplies. In any event the sale of electrical appliances is bound to continue to expand, and when once they are installed and their many advantages recognised, few will care to return to the use of coal."

This Consular office has recently been requested by one of the largest electrical dealers in Norway to furnish a list of American manufacturers of electrical appliances, and invites such firms to send catalogues, price lists, and full particulars as to goods, terms of credit, &c.

Italy. Among the new companies recently formed in Milan are the Società Nazionali di Imprese Elettriche, with a capital of £40,000, to develop electrical undertakings in Italy and abroad; and the Consorzio per Electro-trazione, capital £60,000, the object in this case being to encourage and take an interest in electric traction undertakings.

The Westinghouse Supply Department at Manchester.

The Supply Department of the British Westinghouse Electric and Manufacturing Co. Ltd., has only been established in its present home for some three years, but it is already becoming generally well known, and is likely to become a "landmark" by reason of the large public clock which has recently been erected over the entrance to the premises. This clock is of handsome appearance, and consists of a copper housing supported on wrought-iron supports, with the name Westinghouse sawpierced over the top of the dial at each side, the dial and backing to the saw-pierings being of white opal; the whole will, of course, be illuminated as soon as the lighting restrictions are removed, and will be seen from both ends of Long Millgate. This clock is one of four which are synchronised with, and receive half-minute impulses from, a master or controller clock situated in the showroom. This master clock, in its turn, will shortly receive the P.M.A. time-signal direct by wire



WESTINGHOUSE SUPPLY DEPARTMENT, MANCHESTER.

from Greenwich Observatory. The system has been supplied and fixed by Messrs. Synchronome, Ltd., of London.

The illustration shows another feature of the shop window at Long Millgate, namely, a skeleton advertisement cut out from a "Cat" fan poster, and stuck on the inside of the glass. The window is set out with Westinghouse fans of different types and sizes, and incidentally with a novelty list and window card combined, making a good window display. The latter is a special catalogue designed and devised by the department, and takes the form of a Westinghouse fan, stamped out to correct shape, and printed in three colours to represent a fan; by means of a strut attached to the bottom of the front cover, and fitting into a slot in the back cover, this will stand on its own base as illustrated. This forms a novel advertisement for electrical contractors, to whom it has been distributed.

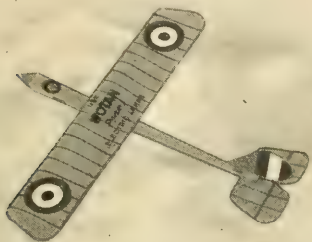
Electrical Stores for Transvaal Mines.—American Consul E. N. Gunsaulus, in a report on the store purchases of Transvaal mines during the year 1915, gives very detailed particulars, from which we extract the following:—

	Gold and other mines.	Coal, diamond and other mines.	Total.
Electrical machinery	£202,742	47,656	£210,398
" " spares	49,424	4,565	53,989
Electric power and light (purchased)	1,049,106	194	1,049,300
Coal-cutting machines	—	3,598	3,598
" " spares	—	4,955	4,955
Transformer oils	2,498	35	2,533
Machinery and tools	272,995	55,366	328,361
Rock drills	54,485	472	54,957
" " spares	195,189	866	196,055
Machinery spares	231,531	13,492	245,023

The total for electrical machinery given above (£210,398) is spread over the following articles:—

	Gold and other mines.	Coal, diamond and other mines.	Total.
Electric generators and engines, driving same if directly driven	£2,401	£2,250	£4,651
Electric hoists (including motors)	25,763	947	26,710
Electric locomotives	1,474	—	1,474
Electric motors driving pumps, including pumps if directly driven	27,865	457	28,352
Electric motors not included above	25,627	922	26,549
Power lines, transformers, &c.	55,533	1,125	56,658
Electric bells, telephones, and other fixtures	21,069	372	21,381
Miscellaneous machinery	43,069	1,553	44,602

A Wotan Monoplane.—Messrs. Siemens Brothers Dynamo Works, Ltd., of 38-39, Upper Thames Street, E.C., are now issuing for trade distribution an ingenious advertising device. This is known as the Wotan monoplane model, and the accompanying illustration is an actual photograph of the made-up model in flight. It is accurately balanced, and when launched in the manner of an ordinary glider, is capable of performing many of the evolutions of a power-driven aeroplane. By adjustment of the tail elevators it is possible to make the model loop the loop, or complete a spiral descent. The instructions give the various adjustments required for the different manoeuvres. The component parts of the model



are printed in colours on a sheet of paper of special quality. These have to be cut out as directed, and when bent and stuck together, can be easily assembled. The size of the completed model is 10½ in. across the wing tip, and the length from nose to tail is a little over 9 in.

Members of the trade who are interested in the sale of Wotan lamps should communicate early with Messrs. Siemens, as above, asking for a supply of these sheets for distribution amongst their lamp-purchasing customers. We understand that a number of complete made-up models are available for trade display, so that the actual model can be exhibited in a contractor's window. These advertisements are supplied free, and, of course, must therefore not be sold.

Private Arrangements.—ANGLO-COLONIAL ENGINEERING Co., LTD., electrical engineers and contractors, 13, City Road, London, E.C.—In pursuance of the provisions of the Companies (Consolidation) Act, a meeting of the creditors of the above was held on Monday last, at the offices of Messrs. Corfield & Cripwell, accountants and auditors, Balfour House, Finsbury Pavement, E.C. The chair was occupied by Mr. G. E. Corfield, who said that the shareholders of the company had passed resolutions in favour of voluntary liquidation, and he was asked to accept the post of liquidator. He had prepared a statement of affairs, which showed liabilities to the trade of £4,247, while £810 was owing in respect of directors' fees and salaries, and in addition £106 was due for preferential claims. The assets were only estimated to realise £38. The creditors passed a resolution confirming the voluntary liquidation of the company, with Mr. Corfield as liquidator. The following are creditors:—

Brush Electrical Engineering Co.	£181	London Commercial Electrical Stores	£247
Belford, J. F.	63	London Telephone Service	14
British and Northern Shipping Co.	10	Mya Foerenade Elektriska (Sweden)	210
Booker Bros.	15	Payne, Blithe & Huxtable	40
General Seating Co., Ltd.	621	Siemens Bros. Dynamo Works, Ltd.	58
Kremensky & Co. (Austria)	2,752	Stokvis, W. J. (Holland)	107

Liquidations.—ASBESTOS MANUFACTURES, LTD.—This company is winding up voluntarily, with Mr. W. C. Tyler, 107, Caxton House, S.W., as liquidator.

The liquidator of the four Bachelet companies, referred to on page 159 of our last issue, has called meetings of creditors of all these companies for August 16th, at 11, Ironmonger Lane, E.C.

MECHANICAL TRANSPORT, LTD.—This company is winding up voluntarily, with Messrs. W. H. Trewartha-James, G. W. Askew, H. W. Philpott and F. M. Sala, of Finsbury House, Blomfield Street, E.C., as liquidators. A meeting of creditors is called for August 23rd.

Book Notices.—"The Principles of Electrical Design: D.C. and A.C. Generators." By A. Still. London: Hill Publishing Co. Price 12s. 6d. net.

"Gas, Oil, and Petrol Engines." By A. Garrard. London: Whitaker & Co. Price 5s. net.

"Scientific Papers of the Bureau of Standards." No. 282.—"Sensitivity and Magnetic Shielding Tests of a Thomson Galvanometer for Use in Radiometry." Washington: Department of Commerce.

"Annales des Postes, Télégraphes et Téléphones." Vol. V, No. 2, June, 1916. Paris: A. Dumas. Price 12 fr.

"Canada: The Country of the Twentieth Century."—A review of the natural resources of Canada and its industrial and commercial development. By Watson Griffin. Department of Trade and Commerce: Ottawa.

"Ferodo" Fabrics.—Ferodo fabrics, which were originally designed and supplied by the HERBERT FROOD Co., LTD., of Chapel-en-le-Frith, for lining clutches and brakes, are adaptable for other purposes. For example, a large firm which is at present engaged on munitions, is using Ferodo fibre in a circular vice for holding the shells whilst screwing in the noses. Good results have attended this application, as the work is not marked, and a remarkable gripping power is exerted.

Catalogues and Lists.—MESSRS. R. A. LISTER & Co., LTD., 47, Victoria Street, Westminster, S.W.—Illustrated list describing the S.O.S. type "Lister-Burston" automatic auxiliary plant, which is claimed to be the only system fully complying with the requirements of the Merchants' Shipping Act, 1914, Article 35. The equipment may be seen in operation at the above address.

MESSRS. T. W. BROADBENT, LTD., Victoria Electrical Works, Huddersfield.—Eight-page list (Catalogue No. 5, Leaflet No. 3), giving full specification, prices, shipping weights, &c., of "M" type continuous-current motors. Copies will be forwarded on application.

MESSRS. BELLING & Co., Derby Road, Edmonton, N.—Illustrated leaflet giving particulars and prices of a rapid boiling-ring and a rapid griller-toaster.

Fire.—Damage, estimated at £1,000, was caused on Monday night by a fire which broke out at the premises of MESSRS. F. J. JONES & SON, electrical engineers, Love Street, Chester.

Ozonair Advances.—Owing to the rise in the cost of everything, MESSRS. OZONAIR, LTD., announce an increase of 15 per cent. in all list prices and net estimate prices, as from August 20th.

Millwall Battery Works Closed.—THE PRITCHETT AND GOLD AND ELECTRICAL POWER STORAGE Co., LTD., announce that owing to the completion of the extensions to their works at Dagenham Dock, they have now closed the works at Millwall (formerly the works of the Electrical Power Storage Co., Ltd., with which company they amalgamated last year). All communications previously addressed to Millwall should now be addressed to the company at Dagenham Dock, Romford, Essex. The surplus plant and stock at Millwall is to be sold on September 5th next. Particulars appear amongst our advertisements to-day. Messrs. Fuller, Horsey, Sons & Cassell will conduct the sale. It is interesting to recall that the Millwall Works were opened by the E.P.S. Co. in 1881, and they have been continuously occupied in the manufacture of storage batteries during the last 35 years.

Plant for Sale.—Bradford Corporation Electricity Committee is advertising a Willans-Phoenix 300-kw. set, also a battery of 260 Hart cells, for sale. See our advertisement pages for particulars.

Trade Announcements.—MRS. C. TETT, electrician, announces that she is giving up the retail portion of her business at 7, Queen Street, Weymouth.

The late business of Chas. A. Muller, electrical accessories merchant, Bradford, which has been wound up by order of the Board of Trade, as already announced, has been taken over by Mr. L. W. Douthwaite, who has been in the employ of the firm for 15 years—for the last eight years as manager. The business is now entirely free from alien capital, influence and staff, and will be carried on as L. W. DOUTHWAITE & Co., at the same address, 10, Arcade, Westgate, Bradford.

LIGHTING AND POWER NOTES.

Ashton-under-Lyne.—Having received a communication from the B. of T. as to economy in the consumption of coal, the Electricity Committee has deputed the chairman and engineer to consult the Ministry of Munitions as to whether an application for additional plant would be considered.

Australia.—The Strathballyn (South Australia) Council has decided to install electric light, and is endeavouring to make financial arrangements for carrying the scheme into effect.

The Southport (Queensland) Council has been approached by a company for authority to provide an electric supply, and proposes to discuss the matter at a special meeting.—*Tenders.*

Arrangements are being made by the Sydney City Council for the erection of new workshops at Pyrmont, for the electric supply department.

The Mittagong (N.S.W.) Municipal Council has decided to proceed with an electric lighting scheme for the town, at a cost of £3,500.

Barnes.—PRICE INCREASE.—The electrical engineer reported that Messrs. Watney, Coombe, Reid & Co. has consented to the addition of 10 per cent. to the contract price on the understanding that all rights under the contract are reserved, and that the increased price is only to be charged until notice is given by the company that it desires to revert to the original price.

Beckenham, Linking-Up.—The engineer has reported to the Electric Supply Committee that, in connection with adjoining areas, was a consideration in the present time owing to the expenditure involved. The engineer is to report further on the matter.

Burton-on-Trent, Cable Extension.—Mains are to be laid at an estimated cost of £1,000 to supply energy for power and lighting purposes to the Humber-Rother G.P. & Telegraph Works Co.'s new factory at Horninglow.

Callington, Proposed E.L. Scheme.—The Urban Council has been considering the purchase of Freewall Mills for a power station in connection with the installation of electric light in the town. A meeting of the ratepayers has been called to discuss the question.

Continental, Norway.—The A.S. Teeklandfos, Christiania, is extending its power plant, so as to supply 5,000 H.P. to a new carbide factory. The company produces mechanical wood pulp to the extent of about 15,000 to 16,000 tons per annum.

Dewsbury, Year's Working.—The report of Mr. Campion, the borough electrical engineer, on the working of the electricity undertaking for the year ended March, 1916, shows that the revenue amounted to £16,588, as compared with £14,950 in 1914-15; the gross profit was £7,286, as against £6,364, and after meeting debt charges, the net profit amounted to £2,900 (constituting a record), as against £1,863 in the previous year. It is satisfactory to know that the greater part of the surplus has been placed to the depreciation fund, which amounts to £4,066. During the year, 2,352,258 units were sold as against 1,949,026 units in 1914-15; the increased output was due wholly to power users, and of the total 1,212,253 units were sold for power. During the year 4,225 tons of coal were used at 12s. 8d. per ton, or 4'20 lb. per unit sold, as against 3,933 tons at 9s. 2d., or 4'52 lb. per unit sold for the previous year; the coal cost per unit sold increased from '22d. to '29d., and the total cost from '91d. to '92d. per unit sold. As against this the price of electricity was increased during the year and brought an additional revenue of £1,136. The Ravensthorpe supply, which is purchased in bulk from the Yorkshire Power Co., resulted in a loss of £25; the agreement shortly expires and increased charges are suggested.

Dundee, Daylight Saving.—It is reported that a decreased consumption of electricity for lighting, amounting to 11 per cent., has occurred as a result of the Daylight Saving Act. This is, however, partly counterbalanced by the increased output for power.

Ealing, The Chairman of the Electric Supply Committee, in calling attention to the electricity estimate for the ensuing year, at the Council meeting, said it showed what appeared on paper to be a deficit of nearly £5,000. The engineer's estimate, showing what would have been the income and expenditure on a pre-war basis, showed a profit of £3,799.

Greenock, Year's Working.—The financial result of the past year's working of the Corporation electricity department, was a total income of £58,650, an increase of £22,915 on the year before. Expenditure amounted to £52,612, leaving a gross profit of £33,037, and after meeting debt charges, the net profit was £6,998. The reserve fund now stands at £23,389, which, with the above surplus, is only £4,323 below the maximum required on the authorised borrowings. The units generated were 23,000,000, as compared with 17,000,000 in the year before.

Hong-Kong.—The rapid development of Kowloon and the demands for power and light have caused the China Light and Power Co. to carry out a scheme of extension of its plant. The new generating plant consists of two high-pressure three-phase 60-cycle B.T.H. turbo-alternators, each capable of maintaining an output of 1,170 K.V.A. for two hours, three Babcock & Wilcox boilers with chain-grate stokers, economisers, and condensing plant of the surface type, with rotary-type motor-driven pumps capable of delivering water from the sea to the condensers at the rate of 1,200 gallons per minute through a double set of 14 in. suction mains, each 1,100 ft. long. The distribution mains cover about 16,000 yd., and an extension to Old Kowloon City is contemplated. The Hong-Kong Electric Co., in Hong-Kong proper, is constructing a new plant at North Point, which will contain two 1,500-kw. B.T.H. turbo-alternators and three Babcock & Wilcox boilers. The frequency of the new plant will be 50 cycles instead of 75, as in the present plant. The new station is not expected to be completed for a year or 18 months. —*U.S. Commerce Reports.*

Hove, Year's Working.—The report of Mr. C. B. Smith, the engineer and manager of the Council's electricity undertaking, for the year ended March last, shows that the revenue amounted to £22,326; the working costs to £11,505; and the gross profit to £10,821. After payment of interest, sinking fund, and other charges amounting to £11,053, less £371 income-tax refunded, there was a net profit of £139, as compared with £3,024 in the previous year. The output sold was 1,024,031 units, as against 1,115,168 units in 1914-15. During the December and March quarters, the increased charge of 20 per cent. was operative and resulted in a slightly increased revenue, on a decreased output. The Electricity Committee's recommendation that a minimum charge of 10s. per quarter be made in respect of each individual consumer was withdrawn, with a view to consideration by the General Purposes Committee.

On the Aldington undertaking there was a deficit of £252; 31,700 units were purchased from the Brighton Corporation, and 84,000 units sold.

Iceland. According to a report in the *Technische Uebersicht*, the municipal authorities of Reykjavik had entrusted the Norwegian De Forenede Ingeniorkontorer, of Christiania, with the task of drawing up plans for a complete electric installation for the capital of Iceland. The work comprises not only the search for the site for, and establishment of, a water-power station, but also the erection of the distribution mains, &c.

Kearsley. At a meeting of the D.C. held on August 10th, the question of the supply of electricity in the district was under discussion, and the clerk was instructed to inquire from the Lancashire Electric Power Co., as to its arrangements for complying with the provisions of the Electric Lighting Act.

London, Fuel Supply.—Speaking at the half-yearly meeting of the South Metropolitan Gas Co., on Wednesday last week, the chairman expressed the opinion that there was little doubt that the gas undertakings would be the fuel suppliers of the future—not only gaseous but solid. After extracting the valuable residuals the solid fuel would be passed on to the steam raiser. He could not believe that the Government would allow the present system of burning large quantities of raw coal to go on unchecked. It might well be considered whether the policy adopted by Parliament of putting the suppliers of gaseous and electric energy into competition had not had its day. He could not imagine that they would put up a power station to produce electrical energy and another to produce gaseous energy; he asked why these steps should be taken separately, and whether the work should not be joined up.

BIRMINGHAM, Bulk Supply.—The Electricity Committee has had under consideration the necessity of increasing its plant or taking a bulk supply, in connection with which it has been in communication with the Southwark B.C., the County of London Electric Supply Co. and the London Electric Supply Corporation.

The Council has now agreed to accept the offer of the latter company to lay duplicate mains and erect switchgear free of charge, the Council to provide transforming apparatus, for a three years' contract, based on a minimum consumption of 1½ million units a year at £3 15s. per kw. of maximum demand plus '3d. per unit consumed, with a coal clause. It was decided that nothing further could be done at present in regard to linking-up with Southwark.

Malvern, Year's Working.—There was a profit of £698 on the electricity works during the year ended March 31st last.

Newcastle-on-Tyne, Fire.—On Thursday, last week, a fire occurred at the electric power station off City Road, which apparently damaged the roof.

Newcastle-under-Lyme, Year's Working.—In his annual report on the electricity undertaking for the year ended March 31st last, Mr. A. J. C. de Renzi, the borough electrical engineer, mentions that the units sold increased from 200,064 in 1914-15 to 257,216 last year, the increase being due entirely to power supplies, which now exceed lighting requirements. The total revenue amounted to £3,475, and the gross profit to £1,553, and after meeting the usual financial charges, a deficit of £116 remained, which is attributed to restricted lighting. It should, however, be mentioned that no advance has been made in the price of electricity since the commencement of the war; and, further, that £300 extra loan charges, and £80 revenue expenditure on switchgear, has been met during the year. The maximum load reached 210 kw., and the fuel cost was '33d. per unit.

Mr. de Renzi proposes to meet the increasing cost of fuel by adapting the Diesel engines for the use of tar oil; we congratulate him on having been able to "carry on" with only one skilled engineer assistant.

New Zealand.—The Hampstead Town Board, Ashburton, has been granted a licence to erect and maintain within the town limits overhead wires for electric lighting, power, and heating purposes. —*Board of Trade Journal.*

The details of the year's working of the Auckland City Council electricity undertaking for the year ended March 31st last show that 6,203,478 units were sold, as against 5,457,372 in the previous year; the income was £55,582, as compared with £51,120; working expenses were £21,711, as against £22,315; and gross profit £33,871, as against £28,804. The number of consumers was 2,123, as against 1,818 in the previous year.

Philippine Islands.—According to the U.S. Commerce Reports, nothing is at present being done to develop any of the hydro-electric projects and water-power sites in the Philippine Islands; several concessions have been made, but apparently more favourable conditions are awaited.

Queenstown, Street Lighting.—The Urban Council having applied to the electric lighting company for a rebate in public lighting charges owing to savings under the Daylight Savings Act, the company has refused, on the ground that any saving made was completely swamped by the increased price paid for coal.

Sheffield, Year's Working.—The operation of the Corporation electricity undertaking for the last financial year shows that the income from electric supply amounted to £277,580, and from installation and motors to £36,857, a total of £314,437; works charges amounted to £181,027, leaving a gross profit of £133,409, and after deducting interest, sinking fund, and other charges, amounting to £100,114, there was a net surplus

£33,295, which, with £6,982 brought forward from 1915, made a total surplus of £40,277. It is proposed that £39,777 shall be placed to the renewals and special expenditure fund and £500 to the motors-for-hire fund. The sinking fund now stands at £383,885. The number of units sold—roughly 78 millions—was greater by 32,994,685, or 73 per cent., than the number sold during 1914-15, and the net revenue increased from £184,668 to £277,580, an increase of 50 per cent. The whole of the increased output being for power and traction purposes at low rates, the increase in revenue was not in the same proportion, the total average price per unit having fallen from '9d. to '85d. The percentage of working expenses to total revenue was 53, as compared with 43 for the previous year, the increase being due to the higher cost of coal, all other items of generation and distribution costs showing a reduction. The average price obtained during the last five years was as follows:

	1916.	1915.	1914.	1913.	1912.
Light and heat ...	2.17d.	2.34d.	2.54d.	2.76d.	2.96d.
Power ...	.71d.	.72d.	.73d.	.76d.	.78d.
Total average price	.85d.	.97d.	1.13d.	1.21d.	1.30d.

The annual consumption of coal during the past five years is shown below:

1912	...	...	...	33,912 tons
1913	...	...	...	37,913 "
1914	...	...	...	44,187 "
1915	...	...	...	70,740 "
1916	...	...	...	131,123 "

Large extensions to the buildings and machinery and plant at Neepsend have been put in hand during the year, and 28,000 kw. of additional generating plant is now under construction or completed. The total number of consumers is 7,318, an increase of 409 during the year, and the total connections amount to 83,834 kw., an increase of 17,691 kw., or 26½ per cent. Applications in hand now awaiting connection amount to 18,000 kw. The turnover of the installation and motor department during the year amounted to £36,837, 1,048 H.P. of motors having been installed, as compared with 3,339 H.P. in the previous year. The number of females employed on the staff and in the generating stations totals 49, and 105 employees are on active service. War allowances during the year amounted to £2,246. The capital expenditure on the undertaking to date is £1,513,000.

The City Council, after considerable discussion, has agreed to an increase in the price of electricity by 10 per cent. where the present price is more than 2d. per unit, and by 20 per cent. where it is 2d. per unit or less; the increase in price will apply to the tramways undertaking. At present the tramways are supplied under agreement at '8d. per unit, and it was stated that the cost of production for the year ended March last at the Kelham Island tramways power station (now taken over by the electric supply department) had been '85d. per unit. It was also stated that the increased cost of coal, which has more than doubled in price, represents £87,000 extra cost to the electricity undertaking this year.

Mains are to be extended, at a total estimated cost of £1,019, to supply current to new consumers.

Stafford.—PROPOSED LOAN. — The T.C. has decided, owing to the greatly increased demand for current at the north end of the town, to extend the mains, at the cost of £1,000, and to apply, if necessary, to the L.G.B., for sanction to a loan.

Straits Settlements.—The annual report of Mr. O. V. Thomas, the chief engineer, on the working of the George Town (Penang) municipal electrical undertaking during 1915, shows that 1,604,980 units were sold, being an increase of 9 per cent. on 1914. The total revenue amounted to \$304,193, while total costs were \$126,381, representing a decrease of \$2,411 (due to the installation of economiser plant), despite the increased output. The gross balance, \$179,811, represents 18'22 per cent. on capital, and, after meeting financial charges, including \$46,000 to depreciation and renewals, the net balance of \$76,914 represents nearly 8 per cent. on the average capital in use. We note that the gradual elimination of the original vulcanised bitumen sheathed cable has resulted in a satisfactory decrease in the number of cable faults, of which there were 21 in the previous year. In the matter of public lighting, owing to the carbon shortage, 43 arc lamps have been replaced by 1,000 C.P. half-watt lamps, run nine in series on the original arc circuits, with suitable automatic cut-outs and substitution resistances added.

Swansea.—At the annual meeting of Messrs. Weaver and Co., of the Swansea Flour Mills, the chairman stated that owing to the present elevating and discharging plant being out of date, the company was erecting an electrically-driven suction elevating plant, capable of discharging an average of 100 tons of grain per hour.

Tasmania.—The State hydro-electric department has concluded a contract with the Amalgamated Zinc (De Barays), Ltd., and the company has already ordered the plant for the first unit of its works for treatment by electro-metallurgical processes of complex zinciferous ores from Broken Hill. The works are to be started at Risdon, near Hobart; the first unit will involve the use of 4,000 H.P., and under agreement 30,000 H.P. is eventually to be made available for use in metallurgical works and in kindred industries which the company intends to establish.

The Outlands Municipal Council is considering the question of introducing electric light.

Representatives of the Lannceston and Longford Councils have conferred with respect to the increased hydro-electric power, which can be obtained from the waters at the head of the Lake River, or the outlet from Arthurs Lake.—*Tenders.*

Yarmouth.—YEAR'S WORKING.—The year's working of the electricity department shows a gross profit of £2,353, but after payment of interest and sinking fund charges there is an adverse balance of £6,219 to be carried forward. The Electricity Committee recommended that the price of electricity be increased by 1d. per unit for lighting and 10 per cent. for power.

TRAMWAY AND RAILWAY NOTES.

Aldershot.—The U.D.C., on August 9th, deferred for six months the question of an electric traction scheme between the town and Farnborough and Farnham. A Light Railway Order was obtained privately some years back, but it lapsed six years ago.

The clerk reported on the matter, pointing out that the heavy traffic on the roads round Aldershot was against the adoption of any system of traction without permanent way, while tramway construction in the Aldershot area should be inexpensive, because a great portion of it could be of sleeper construction on the road margin, thus avoiding road maintenance. A great amount of pick-up traffic would be available between Aldershot and Farnborough, but the extension to Farnham would be of a different character, and it might be best to defer that till later.

Australia.—SYDNEY CITY RAILWAY.—The Premier stated recently that the preparatory work on the city railway is progressing favourably, and the actual work of construction will be in operation about the end of this month. The work will be started simultaneously at three points: between Eddy Avenue and Goulburn Street; from Macquarie Street towards St. James's Station; and from Harrington Street towards Wynyard Square Station. Half the city railway (14,400 yd.) will be above ground, and the other half (11,200 yd.) below; starting from a station to be erected on the Illawarra platform side of the central station, the city railway will be above ground as far as the Oddfellows' Hall near Goulburn Street, where it will pass below the surface. The total length of the sections to be commenced is 9,600 yd. The total length of tunnelling will be 17,000 yd., the difference between that and the 14,200 yd. mentioned above being due to the eastern suburbs junction, which will be put in hand at the same time. The railway will leave the tunnel at Harrington Street, cross Circular Quay at high level, and re-enter the ground on the western side of Macquarie Street, and continue underground until it emerges at the southern side of Goulburn Street. The eastern suburbs junction will be situated under the Botanic Gardens and Inner Domain, and will also be put in hand, and the tunnelling and excavation on the eastern side of the city from Macquarie Street to Liverpool Street should be well in hand before the end of the year. — *Sydney Daily Telegraph.*

The Doncaster (Victoria) Council has appointed a Committee to inquire into a proposal to extend the electric tramways from Kew to Doncaster, Templestone and Warrandyte.

The Tramway Board which was appointed by the Government to take temporary control of the cable system of the Melbourne Tramways Trust has issued a statement covering its work during five months. It is expected that arbitration proceedings will shortly take place on the assessment of compensation payable to the company for its properties and the appeal of the company against the Board's demand for compensation for non-fulfilment of the covenants of its leases. The Board has paid the outstanding balance of the Melbourne Tramways Trust's indebtedness, viz., £351,200. The Board has recently made a successful trial of a Stone train-pattern lighting set on a car and trailer.

Birmingham.—The total number of passengers carried on the Corporation cars on the first Monday in August was 610,000; the receipts amounted to £3,000, these figures comparing with 474,000 and £2,368 for the corresponding Monday (Bank Holiday) in the previous year.

Liverpool.—The heavy rainfall on Monday morning was the cause of traffic being held up on the Southport to Liverpool electric railway. Arrangements were made for steam locomotives to haul the electric coaches.

London.—ELECTRIC VEHICLES.—According to the *Pall Mall Gazette*, the Trocadero management has arranged for a fleet of private electric broughams to be in attendance in the evenings, after 11 p.m., for the benefit of clients, at charges a little in excess of ordinary taxi fares.

The Metropolitan electric train service was interrupted on Tuesday morning, owing to the breaking of an axle of one of the coaches as it entered Bishop's Road Station.

A small fire occurred on Tuesday morning in connection with electrical plant at the Russell Square station of the Piccadilly and Brompton Tube Railway, and was extinguished by the Fire Brigade.

Manchester.—PLATFORM FARE COLLECTION.—NOTICES have been posted in the cars asking passengers intending to travel on the upper deck to hand the exact amount of the fare to the

ward on the platform, excepting at busy loading stations. This deviation from the heretofore rules is to minimise the labour of the women conductors. A correspondent has written to the local Press expressing the risk of accident to passengers and asking if the Tramways Committee will accept liability in case of accident. Surely, they cannot have been struck over the foot of the stairways or the cars, as the women guards may rest, when opportunity offers.

Rugby. ELECTRIC VEHICLE CHARGING. The Electric Vehicle Committee informs us that the British Thomson-Houston Co. and Messrs. Williams & Robinson have arranged to charge electric vehicle batteries, at 2d. per unit, between Monday 7.30 a.m. and Saturday noon. Week-ends, additional fee 2s. per hour. No arrangements can be made for holiday periods, and notice should be given to the firms in advance.

Salford. CONDUCTORS' SEATS. Experiments are being made with various types of seats for the use of conductors on the tramway cars.

South Lancashire.—In consequence of the increased running expenses, the South Lancashire Tramways Co. has increased the cost of return tickets on certain sections of its system from 3d. to 3½d. The revision came into operation on August 10th.

Straits Settlements.—The working of the George Town (Penang) municipal tramway undertaking during 1915 resulted in a deficit of \$5,672, after allowing roughly \$27,000 for depreciation and renewals in addition to debt charges. The system covers 11½ miles of single track, and 5,177,874 passengers were carried, a decrease of 73 per cent. compared with 1914. The revenue also fell off by 7 per cent., while operating costs increased by \$3,000, leaving a gross surplus of \$46,136, as compared with \$60,397 in the previous year. The report mentions the difficulty of obtaining materials for maintenance, and that axles have been made locally. The ordinary fares average out at a little over ¼d. per mile, and the manager, Mr. Thomas, considers that the finances could be improved by a slight increase in fares, without inflicting any hardship on the public.

TELEGRAPH and TELEPHONE NOTES.

Australasian Time Signals.—According to the Australian papers the Government astronomer has submitted a proposal to the Premier, as acting head of the Education Department, for fixing the longitude of islands in the Pacific by means of astronomical observations combined with wireless time signals. The Premier is reported to have said that Prof. Cook proposed to compare Sydney with either Suva or Apia by means of wireless apparatus at Awanui, in New Zealand, and then to compare Suva with the Lick Observatory through Honolulu. This would be equivalent to a direct cable interchange between Lick and Sydney, and should result in a determination of the greatest accuracy. When this work was complete, Prof. Cook proposed to establish the accurate positions of a number of spots in the Pacific, which would enable a more accurate charting of the Pacific islands to be made, and would establish fundamental guide posts from which the accurate longitude of temporary astronomical stations could be determined. Above all, it would make possible the completion of a chain of wireless time signals round the world for navigators. At present this failed just in that part of the ocean where it was most urgently required. Prof. Cook thought that with more accurate charting and proper standard time signals the chances of wreck among the islands would be minimised. They were now in communication with the authorities at the various places it was necessary to link up by means of the wireless signals, and the work would be put in hand right away.

A Wellington report mentions that the New Zealand Government astronomer has been working on the same lines, and that recently the first direct time signal was experimentally sent to Tahiti from Wellington Observatory, with the co-operation of the Telegraph Department.

Society Islands.—A radio-telegraph tariff has been issued of 12 cents a word (10 cents wireless charge, and 2 cents telegraphic charge from Papeete to the station at Mahina). An additional charge of 24 cents a word is made for relaying, *via* the wireless stations at Apia, Samoa, and Awanui, New Zealand. Tariff rates are also provided between the colony and vessels at sea. All messages must pass through New Zealand to Tahiti, and are subject to war restrictions.

Telegraph (Construction) Bill.—This Bill passed its second reading in the House of Lords on the 10th inst. Viscount Middleton stated that it might be necessary, on the report stage, for him to move an amendment which would prevent telegraph works ruining important amenities or agricultural advantages. The Bill later passed through Committee, with an amendment inserted which specifically mentioned the carrying of lines underground as a stipulation which the tribunal might make.

The Channel Tunnel and Telephonic Communication with the Continent.—With reference to Dr. Fleming's suggestion reproduced in our last issue, Messrs. Sir Douglas Fox & Partners have written to the *Times* as follows:—"Prof. J. A. Fleming, of University College, London, very properly points out that this tunnel could be utilised for telegraphic and telephonic cables. This

matter has already received the attention of the company, and, doubtless, the Postal authorities and public companies would, as, for example, in the case of the Mersey Tunnel between Liverpool and Birkenhead, avail themselves of this excellent means of communication. Obvious advantages would be in the avoidance of damage to cables by ships' anchors and sea corrosion, the greater conductivity of cables, and their accessibility for repairs, and economy in laying."

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—September 6th. Powell-Duffryn Steam Coal Co. Electrical goods. Forms from Stores Manager, Aberaman Offices, near Aberdare.

Australia.—SYDNEY.—September 20th. N.S.W. Government Railways. One 50-ton electrically-operated overhead travelling crane for Zara Street power house, Newcastle. October 11th. One motor-driven air compressor for Zara Street power house. Electrical Engineer, 61, Hunter Street.

P.M.G.'s Department.—Telephone material (Schedule 428). See "Official Notices" to-day.

ADELAIDE.—September 27th. Deputy P.M.G. Telephones, telephone material, instruments and parts. Schedule Nos. 429 to 437. PERTH.—October 4th. Deputy P.M.G. Telegraph and telephone measuring instruments and parts. Schedule 501 W.A.*

MELBOURNE.—November 1st. Victorian Railways. 50,000 flame arc carbons. Chief Storekeeper, Railway Offices, Spencer Street. October 18th. Victorian Government Railways. Electric time releasing mechanisms for automatic signalling. Cont. No. 30,343.*

Dublin.—August 29th. Electricity Committee. S.P. and three-phase meters for a year. See "Official Notices" to-day.

Manchester.—August 22nd. Tramways Committee. Hard-drawn copper trolley wire. Mr. J. M. McElroy, Manager, 55, Piccadilly.

August 22nd. Electricity Committee. Ash hopper at the Bloom Street station. Particulars from Mr. S. L. Pearce, Chief Electrical Engineer, Dickinson Street.

August 25th. Electricity Committee. High and low-pressure steam and feed pipes at Stuart Street Station. Specifications, 21s. (returnable), from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

August 30th. Guardians. Refuse destructor furnace for the Institution, Nell Lane, Didsbury. Specifications from Mr. Jas. Macdonald, Clerk, Union Offices, All Saints, Manchester.

New Zealand.—INVERCARGILL.—September 28th. Borough Council. Steam turbo-alternator, condensing plant, and switchgear. Specifications from the Tramway Office. Contract No. 40.*

Portsmouth.—August 29th. Tramways Committee. Tramway stores, insulating materials, lamps, &c., for six months. See "Official Notices" to-day.

Rochdale.—No date. Electricity Committee. Static transformers for 12 months. Mr. C. C. Atchison, Electricity Works, Dane Street, Rochdale (Contract A 117).

South Africa.—JOHANNESBURG.—September 4th. Municipal Council. 10,000 drawn-wire metallic-filament incandescent lamps; 10 miles of 19/14 "Underwriters' wire" (lightly insulated wire for outdoor use). Contract No. 151.*

September 21st. Municipal Council. Tramcar spares. Contract No. 153.*

Spain.—Municipal authorities of Duenas (Province of Palencia). Concession for the electric lighting of the town during a period of 10 years.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The Sydney Municipal Council has been recommended by the Electricity Committee to accept the following tenders:—

Submarine cable for laying across Darling Harbour.—W. T. Henley's Telegraph Works Co., Ltd., £4,124 (based on copper at £85 per ton and lead at £22 10s. per ton).

20 three-pole disconnecting switches and fuses.—W. G. Watson & Co. Ltd., £420.

12 three-pole, s.t., 10,000-volt, 50-amp. oil switches, 12 expulsion fuses.—Aust. General Electric Co., £560.

Two 1,000-r.v.a., 5,000 to 1,000-volt transformers.—Aust. General Electric Co., £1,680.

Owing to the difficulty in obtaining consumers' meters from the firms under contract, the City Council Electricity Committee recommends that the City Electrical Engineer be authorised to negotiate with the British Westinghouse Co. and the Australian General Electric Co. for the supply in the shortest time of from 3,000 to 3,500 consumers' meters at a cost of from £5,000 to £6,000.—*Tenders.*

The Melbourne City Council has accepted the following tenders: Metal-filament lamps.—Edison & Swan U.E. L. Co., Ltd., £442.
Meters. British Westinghouse Electric & Mfg. Co., Ltd., £305; Benson Mfg. Co., Ltd., £1,272.
Carbons. Beacon Carbons, Ltd., £2,040.

N.S.W. Public Works Department
Installation of electric light at Albany Hospital.—Globe Electrical Co., £295.

W. Aust. Tender Board:
12 miles twisted-pair insulated wire, £281.

—Tenders.

Cape Town.—Tenders for wiring the Camps Bay Pavilion and Tea Rooms, for the Corporation of Cape Town:—

Cunningham & Gearing	
Electric Utility Co.,	242
Edward A. Shaw & Co.,	244
Clyde Engineering Works	290

Tenders for wiring new premises for Mitchell, Cotts & Co., Exchange Place, Cape Town:—

Edward A. Shaw & Co.,	
Electric Utility Co.,	255
H. G. Jack & Son,	279
Woods, Weston & Co.,	319
Kitsen (Cape) Lighting Co.,	336

Leek.—Lighting Committee. Accepted tenders for plant for the electricity works:

Crosley Bros., "G" type gas producer, with motor-driven exhausting fan for starting the producer, £468; "S E 238" engine, with the accessories, £1,997; a Mather dynamo, £778; indicator gear of special type, £16.

NOTES.

Australian Income-tax and British Industry.—The *Morning Post* states that on August 14th a deputation representing the Manufacturers' Section of the London Chamber of Commerce and a number of provincial Chambers of Commerce waited upon the High Commissioner for Australia (Mr. Andrew Fisher) for the purpose of presenting a protest against certain sections of the Commonwealth Income-tax Act, the incidence of which, it was thought, would prejudicially affect trade between the United Kingdom and Australia.

Mr. Fisher, in reply, said that this was a matter of policy upon which he could not express an opinion or make any promise of amendment, but he would undertake to forward the representations of the deputation to the Commonwealth Government and ask them to give the matter their early and serious consideration.

The Board of Scientific Societies.—On the initiative of the Royal Society a Board of Scientific Societies has now been established for the furtherance of the following objects:—

Promoting the co-operation of those interested in pure or applied science; supplying a means by which the scientific opinion of the country may, on matters relating to science, industry and education, find effective expression; taking such action as may be necessary to promote the application of science to our industries and to the service of the nation; and discussing scientific questions in which international co-operation seems advisable.

The Board at present consists of representatives of 27 scientific, including technical, societies. The regulations give power to add to this number and to appoint as members of Sub-Committees individuals who are not necessarily connected with any of the constituent societies.

An Executive Committee has been appointed consisting of the following members:—Sir Joseph Thomson, O.M., P.R.S. (chairman); Dr. Dugald Clerk, F.R.S.; Sir Robert Hadfield, F.R.S.; Mr. A. D. Hall, F.R.S.; Prof. Herbert Jackson (hon. secretary); Sir Alfred Keogh, K.C.B.; Sir Ray Lankester, K.C.B., F.R.S.; Prof. A. Schuster, Sec. R.S.; Sir John Snell; Prof. E. H. Starling, F.R.S.; Lord Sydenham, G.C.S.I., F.R.S.; Mr. R. Threlfall, F.R.S.

The first meeting of the Board was held on July 20th, when important questions relating to scientific, educational and industrial matters were under consideration, with a view to taking effective steps for co-ordinating the work carried out at present by a number of independent bodies, or initiating action in the case of other matters of national importance.

Aeronautics Advisory Committee Report.—The report of this Committee, of which Lord Rayleigh is chairman, for the year 1915-16, contains a lengthy record of work done in connection with flying equipment for war purposes. Amongst other matters, a study of the conditions affecting the aeroplane compass, with a view to its improvement, was undertaken by Dr. Keith Lucas, F.R.S., and a special type of instrument, the R.A.F. Mark II Compass, was ultimately produced and standardised, being now made by contract in large numbers.

The report also states that two wireless telegraph sets, of very light weight, have been designed and tested, and progress has been made in the evolution of optical systems for convenient observation of bomb dropping from aeroplanes. The bulk of the report deals with the investigations carried out with a view to perfecting the aeroplane as a flying machine.

A Manchester Contract.—Last week, according to a Manchester paper, Mr. Joynton Hicks gave notice to ask the Home Secretary whether his attention had been called to the fact that the Electricity Committee of the Manchester City Council had accepted a tender for boiler tubes from a firm whose capital was 90 per cent. German, and would he say why the works had not been taken over by some munition department to prevent business of this kind being retained for German benefit.

Cable and Wire Manufacture in Australia.—According to the *Sydney Daily Telegraph*, Mr. Webster (Postmaster-General) announced last month that he had in hand a scheme for the establishment of a Federal works for the manufacture of cables, steel ropes, and wire of various kinds for use in the various Commonwealth Government departments. "Prior to his departure for England," said Mr. Webster, "the Prime Minister conveyed to me his desire to see that everything which could be made in Australia was made here. But, having in mind the interest which Mr. Hughes had taken in the metal question, I necessarily must await his return to confer with him as to his decision, based upon his ripper judgment arising out of his contact with experts in other parts of the world. In the meantime, however, I am having investigations made by experts, so as to have something tangible ready when the time comes. During 1913," continued the Postmaster-General, "we imported into Australia copper wire to the value of £212,937, cable and insulated wires to the value of £637,426, and iron and steel ropes to the value of £131,063, or a total value of £981,426. It is estimated that, taking the English costs as against Australian production, the Commonwealth can save in the neighbourhood of £90,000 a year. Then, of course, with a factory of this kind, instead of having to scrap cable, as at present, we will be able to treat it as to make it equal to one of new manufacture. What the saving in this connection will be I cannot say, but it will certainly be considerable, as we scrap no small amount of cable each year." Mr. Webster said that he was unable to say just now what the probable cost of the proposed factory would be, but he believed that employment would be given to about 1,000 men.

The Metal Manufacturers, Ltd., a company formed for the purpose of manufacturing copper wire and other goods, has made a start to drain an area of land on the site of the old Australian Smelting Corporation, Ltd., Port Kembla, and upon this it is intended to erect an up-to-date plant.

The new industry may be regarded as a direct result of the war. Formerly the bulk of the copper produced at the Electrolytic R. and S. Co.'s works was forwarded to Germany, where it was manufactured into copper wire, electrical parts, domestic utensils, and munitions of war. Most of this copper now goes to England, but the plant is being added to, and there will be an ample supply to foster the new industry when the plant is ready.—*Sydney Evening News*.

Inspection of Theatre Fittings.—The question of the inspection of alterations to the electrical stage fittings of the theatres in Edinburgh was considered at a meeting of Edinburgh magistrates on July 31st. Hitherto the engineer of the Electric Lighting Committee of the Corporation has undertaken the inspection of such fittings where alterations have been made. No performance is allowed to take place until such an inspection has been carried through. The Committee are now putting forward a claim for payment for this service. The magistrates delayed the matter, in order that a report might be made as to the practice in other towns.— *Scotsman*.

Educational Note.—UNIVERSITY COLLEGE.—The Goldsmid Engineering Entrance Scholarship, of the value of £30 a year, tenable for three years, will be competed for at University College in September. Full particulars of the scholarship examination can be obtained from the Secretary of the College, to whom application should be made before September 1st.

The Slackers.—The Leeds Munitions Tribunal, on Monday, imposed small fines on 18 apprentices engaged in a controlled establishment on winding for electric motors, who had absented themselves from work, some on the August Bank Holiday, and others both then and on Whit Monday. The excuse most commonly offered was that the boy was one of a pair, and as the other party did not intend to work, it was no use him coming. The penalty was 2s. 6d. for one Bank Holiday absence, and 5s. for two.

City and Guilds of London Institute.—On the report of the Delegacy of the City and Guilds (Engineering) College, the Council of the City and Guilds of London Institute have awarded the diploma of "Associate of the Institute" to the following matriculated third-year students who have completed a full course of instruction as prescribed by the Council:—

In Civil and Mechanical Engineering.—Allouy y Péon, A. H.; Augier, E. H. N.; Bateman, H. (Henrici Medal); Caldéron y Flores, A. N. A.; Dyson, F. (Brannwell Medal); Finch, H. E. R.; McCann, G. M.; Marsden, E.; Müller, K. V.; Rajada, M. C.; Ratner, L.; Siennicki, K.; Swann, F. A.; Swayne y Pró, J.; Watson, D.; Winter, A. G. A.

In Electrical Engineering.—Arana y Bongeechea, F. D.; Beer, C. A.; Calheiros e Menezes, A. L. de; Chagalloff, C.; Greenwood, W.; Messer, W. G.; Ramaswami, E. K.; Rogers, A. H. E.; Tapsell, H. J.

Electrolytic Zinc in Australia.—The Mount Lyell Co. directors intend to install electrolytic reduction works upon the site now occupied by the Tasmanian smelting organisation at Zeehan, and to concentrate treatment operations at this point. The system for the electrolytic deposition of the zinc and the recovery of the lead, silver and gold in the ore will be similar to that so successfully operated by the Anaconda and other American companies.—*Melbourne Age*.

Registration of Firms Bill.—In the House of Commons on the 10th inst., Mr. Asquith informed Mr. Rendall (R. Thornbury) that the Government were considering whether any steps could be taken to facilitate the passage of this Bill. It was hoped a decision would be arrived at very soon.

Volunteer Notes.—1ST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place. Orders for August by Lieut.-Col. C. B. Clay, V.D., Commanding.

The Headquarters will be closed during August except on Tuesday evenings. The range will be open on Thursday evenings only. Instruction Classes at Regency Street will be held as usual for Platoons Nos. 9 and 10. The Camp at Otford will be available until August 31st. Members wishing to attend should enter their names at Headquarters.

Sunday Entrenching Parades. Parade in Uniform at Victoria Station (S.E. and C. Railway) Booking Office, 8.45 a.m.

MACLEOD YEARSEY, Adjutant.

3RD BATT. (OLD BOYS) CENTRAL LONDON VOLUNTEER REGIMENT.—Battalion Orders by Capt. W. Ridd (Sub-Commandant) Thursday, August 17th, 1916.

Inspection by Brig-General the Hon. F. C. Bridge-man, at Wembley Park at 3 o'clock Saturday, 19th inst. It is of the utmost importance that all members should attend this Parade.

Work-Easy Principles, Saturday. Owing to the inspection there will be no Entrenching duty, nor will sleeping accommodation be provided at the "Blacksmiths Arms, Thornwood."

Sunday. The Battalion will Parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 9.30 a.m., and proceed by train for Entrenching duties. Members will carry their own lunch, and the Quartermaster will make arrangements for light liquid refreshments. The Battalion will return to town about 6 p.m.

Cheerful Camp. It is proposed to hold a tinewell supper in Camp after Saturday's Parade. Officers and men intending to stay will kindly telephone 207 Wembley, on Friday, as otherwise the Quartermaster will be unable to make the necessary arrangements.

Musket, Holland Cup Competition. All competitors for the above are requested to attend at Wembley Park at 3 o'clock on Saturday next, 19th inst., when the presentation of the Cups will take place.

There will be no shooting at Bisley on Saturday or Sunday next. The Miniature Range at Lords is open on weekdays from 3 to 5 p.m.

Recruits will Parade at Lord's Cricket Ground on Saturday at 3 p.m., and on Sunday at 11 a.m., for Recruit Drill.

G. H. F. DUNCAN, Acting Adjutant.

Appointments Vacant.—Charge engineer, for Cheltenham (35s.); telegraph engineer assistant (£350) for the Government Posts and Telegraphs Department, Gold Coast, electrical engineer (£200) for the Corporation of Heywood Electricity Department; teacher of Electrical Engineering for the Dalziel School Board, Motherwell. See "Official Notices" to-day.

Fatalities.—At an inquest into the death of a boy, aged 11, who was killed by climbing up a stay rod of one of the high-tension cable standards of the Powell-Duffryn Co., and receiving a shock from the wires, the jury returned a verdict of "Death from misadventure." They recommended that in future the Powell-Duffryn Co., should exercise greater precautions in the protection of these supports.

The *Globe* states that Bishop William Perry Ereland, an American Methodist Missionary Bishop for Southern Asia, was killed while fishing near Carlisle, Pennsylvania, his steel fishing-rod coming into contact with a poorly insulated high-tension electric wire, carrying 20,000 volts, which hangs about 8 ft. above the fishing stream. One of the Bishop's hands was scorched, and death was apparently instantaneous.

The *Times* states that 12 miners have been killed by an explosion at Michel, British Columbia. It is supposed that lightning struck the exposed signal wires by which current was conducted into the mine.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—In the annual report of the electricity and tramway departments of the Municipality of George Town, Penang, it is mentioned that Mr. E. S. HASLAM, assistant electrical engineer, who was on leave in England at the outbreak of war, was one of the first to volunteer, and he was in France on active service. Mr. C. C. ROGERS, mains superintendent, has acted as chief assistant engineer in addition to his other duties.

The marriage took place at Kensington, on August 5th, of Mr. JABEZ SMITH, J.P., electrical engineer, of Faversham and Sittingbourne, and Miss Ethel Mary Harden, of Canterbury. At Blackpool, on August 10th, Private J. H. DOWNING, of the A.S.C., formerly employed at the electricity works, was married to Miss H. Caldwell, of Marton.

The Sydney City Council has now, by the casting vote of the Lord Mayor, confirmed the appointment of Mr. S. P. MALING, of Melbourne, as deputy-manager of the electric light department. The opponents favoured Mr. T. P. DAVIES, from Canada.

The Loughborough Corporation has agreed to release Mr. W. H. ALLEN as and from August 31st. During the period that elapses before Mr. E. B. LEACH, the new engineer, takes up the duties, Mr. J. H. DENT, the present chief assistant, will be in full control, and a special honorarium will be paid for the services rendered.

Malvern U.D.C. has increased the salary of Mr. S. TROW SMITH, electrical engineer, by £50 a year.

General.—The wedding recently took place, at Burnley, of Mr. RONALD VICTOR CAWTHORNE, electrical engineering inspector of telephones in the Government engineering department, Burnley, and Miss Lillie McVilly, of Lazonby, Cumberland.

Mr. EDWIN B. ROSCOE, A.M.Inst.E.E., electrical engineer to the Buenos Aires Western Railway, has arrived in London. His address is: c/o Cocoa Tree Club, St. James's, London.

Roll of Honour.—Corporal J. E. RUSSELL, Royal Engineers, formerly employed by the British Westinghouse Co., Trafford Park, Manchester, has been killed in action, aged 35.

Private A. E. OGDEN, of the Manchester "Pals," an employee at Manchester Corporation electricity works, has died of wounds, aged 24 years.

Private ROLAND CLAYTON, formerly employed in Burnley electricity department, has died of wounds.

Flight-Sergeant EDWARD MEYNELL, member of the firm of Messrs. H. Meynell & Co., machinery exporters and engineers, of Accrington, who was an assistant tramway manager in the South of England up to a few years ago, has been awarded the D.C.M. for gallant conduct with the Royal Flying Corps in Egypt.

Private R. F. MORTON, of the Royal Fusiliers (Public Schools' Battalion), killed in action at the age of 26 years, was formerly employed by Messrs. Dick, Kerr & Co., Ltd., London.

Sergeant G. H. RASTALL, Royal Lancaster Regiment, an employee in the Manchester Corporation tramways department, has been killed in action. He had won the D.C.M., and had also been awarded the Russian Order of St. George (Fourth Class).

Private G. W. WHALEN, of the Manchester "Pals," who has been wounded, was employed by Messrs. Connolly Bros., Ltd., Blackley Vale.

Sergeant J. D. NIXON, Canadian Field Ambulance, Mechanical Transport, formerly an electrical engineer at Crewe, has been awarded the Military Medal. When war broke out he was in America, and he made his way to Canada and enlisted.

Private WILLIAM MOSS, of the Border Regiment, killed in action, was employed by the National Electric Supply Co., Preston. He was 20 years of age.

Lance-Corporal THOMAS QUIGLEY, Lancashire Fusiliers, who has been wounded, was formerly employed at the British Westinghouse Works, Trafford Park. Private C. L. DARLOW (22), of the Manchester "Pals," formerly employed at the same works, has been killed in action.

Corporal GEORGE VICTOR PYNE, of the 1st Canadian Battalion Field Force, who belonged to Reading, and was, when he enlisted, engaged at Chatham, Ontario, with the Bell Telephone Co., has been killed in action in France.

Private T. R. ROGERS, of the North Eastern Railway Battalion, Northumberland Fusiliers, who was on the railway company's electrical staff at York when he enlisted, has died of wounds.

Private ARTHUR HIPWELL, of the Leicestershire Regiment, and Corporal RICHARDS, of the Royal Welsh Fusiliers, who have fallen in action in France, were engaged with the British Thomson-Houston Co., Ltd., of Rugby, the former in the turbine department, and the latter was a draughtsman in the drawing office.

Private FRANK HINDE HAYES, of the Signal Department, Royal Warwickshire Regiment, killed in France, was formerly an employee of the British Thomson-Houston Co., Ltd., of Rugby.

Second-Lieutenant BASIL WHITBREAD, of the Royal Warwickshire Regiment, formerly on the staff of the British Thomson-Houston Co., Ltd., of Rugby, is reported missing and believed killed.

Private HARRY STANLEY LANT, of the North Staffs. Regiment, reported wounded and missing, was on the staff of Messrs. Siemens, Ltd., of Stafford.

Private JULIUS GREGORY, electrical engineer, of Romiley (Cheshire), who was in the Royal Fusiliers (Public Schools' Battalion), has fallen in action in France.

Private GEORGE MOONEY, of the Shropshire Light Infantry, a wireman with the Great Western Railway Co. at Shrewsbury, has died of wounds.

The Military Medal, for conspicuous bravery in the field, has been awarded to Sapper D. F. ALLEN, who was, when he joined, engaged as an electrical engineer at Coventry.

Lieutenant DAN HUGHES, of the Gordon Highlanders, who is reported wounded and missing, was an assistant electrical engineer at Llandudno.

Second-Lieutenant G. C. MARTIN, Royal Dublin Fusiliers reported killed, aged 24, had entered the Eastern Telegraph Co.'s Training School for Submarine Telegraphy, which he left to join the Forces.

Lieutenant J. R. HOLDEN, R.E., reported killed, aged 32, had been employed at the Leigh Cable Works, and subsequently at Hornsey electricity works.

Captain CARLTON COLLINGWOOD, South Lancashire Regiment, reported killed, aged 27, served his engineering apprenticeship with Armstrong-Whitworths, at Manchester, and subsequently became assistant manager of the Vulcan Foundry Co., Newton-le-Willows.

Will.—It is announced that the amount of the net personality of LADY KELVIN's will was £204,941.

Several rises have taken place in electrical supply shares. Kensingtons are $\frac{1}{2}$ up at 5 $\frac{1}{2}$, which is a remarkable sequel to the reduction of 1 per cent. in the interim dividend. St. James's are $\frac{1}{2}$ higher, and so are the preference shares of the Charing Cross and the Metropolitan Companies. Manifestly the buyers are looking forward to the end of the war, disregarding the immediate conditions, which, as we have ventured to point out all along, is the sensible thing to do.

THE CENTRALISATION OF ELECTRICITY SUPPLY.

[COMMUNICATED.]

LATELY there has been an epidemic of proposals for the centralisation of electricity supply. Some would nationalise it right off, while others, more cautious, would generate through semi-national authorities controlled by a board of representative men with large legal powers. In his Institution paper, Mr. Williams suggested that the Board should be made up of a president, six electrical engineers, one lawyer, one accountant, one financial member, and one parliamentary member.

When one thinks over the proposal, one cannot but feel that Parliament may be in no mood to take half measures. Even now many influential parliamentarians advocate the immediate nationalisation of railways and other businesses, and if a Centralising Bill were introduced into the House, Socialistically-inclined members would undoubtedly declare that it was a golden opportunity for the nation to take over the monopoly of electricity supply. Let us not forget the fate of the telephone. Many benefits were to accrue when the old company was taken over, but so far we have seen only heavier charges and the flight of the erstwhile liberal profits. For the same fate to befall the electrical industry would be a calamity so far-reaching that one would not wish to contemplate it.

Again, why centralise the control of electricity generation at all? Do those who demand it grasp the fact that their plan means that one set of minds will be set to do the work now carried out by a multitude? *In other words, that it means the sterilisation of the minds of our most capable men?* It is easy to assume that a Controlling Board will be sympathetic towards new ideas. But who ever found a Board that was so? A little thought will show that it is unreasonable even to expect it. Men who rise to places of high authority under Government are men who have proved themselves safe, men who are good talkers, whose personality appeals to the kind of men who become members of Parliament, and, if one may hint it, men who have influence behind them. The pioneer and the inventor do not appeal to committees of selection. Often the inventor is a shy man with a mixture of diffidence and tactlessness that quickly rules him out of court. It was said once that Mr. Marconi spent his holidays putting kings and queens at their ease by his charming manners. If all pioneers were like him, the problem of centralisation would be easier; but, unhappily, Mr. Marconi is the exception.

Mr. Williams's Board of Control would be for all the world like the Council of the I.E.E. The president would be a gentleman of highly dignified appearance with irreproachable manners, and the rest of the Board would be just the kind of men that we see year by year at our annual meetings. Only there would be this difference: the Council of the I.E.E. is open to improvement to some degree, if the members will only take the trouble to vote in new blood, but the Board of Control would be appointed for life. It would, further, be walled in by laws and regulations, and not infrequently would have to spend more time considering its terms of reference than in working out technicalities. The more active members of our industry might fret and fume at the slowness of progress, but the legal member of the Board would continue to draw up memoranda proving that the energetic ones were really ignoramuses who were not aware of the legal points in the said terms of reference, while the accountant would spend much time in preparing a flood of unnecessary forms to be filled up on every conceivable topic, in the manner of the

War Office, so greatly admired (!) by our long-suffering officers. Some people may contend that there would be opportunity for progressive men to join the Board. This hope is a delusion and a snare. All councils and boards of control hang together, whether of institutions, associations, or golf clubs, and once a majority has passed a resolution, etiquette demands that all shall support it. The bigger the business controlled by the Board, the more unprogressive it must be, for the more severe will be the criticisms of failure through haste to take up new ideas. Accidents and mistakes occur in small businesses, but after necessary changes have been made, they pass out of mind. But where there is a Board of Control, every untoward event is the subject of careful inquiry, which, in turn, results in an ever-multiplying variety of regulations which are distributed by headquarters to all departments. This is the origin of the red tape which strangles Government departments and destroys initiative in men, who, under different conditions, would take a high place in commerce. Life means continual adjustment to environment, continual change, and endless variety, and live businesses act accordingly. The best practice of to-day will be obsolete to-morrow, and live engineer-managers make it their business to ensure that they will leave things in a different state from that in which they found them. But the ideal of a Government department is to formulate perfect regulations with which everyone must comply, and it is the insistent aim of governing heads of departments to frame such rules that no servant will ever require initiative. Following this hope, our legislators year after year sit in the House passing laws for the guidance of the country, with the result that the vast majority of the said laws fall into oblivion and are heard of no more in everyday life. Let us be thankful that it is so, for if the truth were known, most of us are infringing some of them every day of our lives.

An industry which is growing at the speed of electricity supply requires freedom from unreasonable restraint, and not a growing accumulation of shackles and chains. It requires foresight and bold initiative, and not an eye riveted on musty precedent; it requires for captain the adventurous spirit who, Columbus-like, will venture out on the great unknown ocean in frail inefficient craft, and not the entirely safe man who won't leave port until someone else has built the large, comfortable liner. Government departments won't fill the bill. They carry out everything in a nagging and obstructive spirit, with the idea of fulfilling to the uttermost all the Acts of Parliament under which they work. The raucous voice of the House of Commons gentleman who wants to know by what authority this or that official did this or that thing, for ever rings in their ears and deadens them to progress. Anyone who is keen for the nationalisation of our industry would do well to read the evidence given before the Air Commission, bearing in mind that the urgency of the war might be expected to do something towards bringing in a spirit of eager endeavour to help our brave flying men, of whom so few can possibly come unscathed through the war. Yet even with the urge of military peril pressing too hard on them, some of the evidence revealed a state of things which filled us with loathing, and the enemy with derision.

A remark of one of the judges throws light on the difference between the methods of a Business Man and those of a Government Official. The judge told a witness that very little of his evidence would have been accepted by a court of law. Now, the interesting point about this is that very little of the evidence on which a business man is in the habit of forming his conclusions would pass in a law court. Where a judge trusts to accumulated evidence, a business man trusts to judgment, experience, and intuition. Had a competent

business man been sent to look into the aeroplane department, he would have held no inquiry in the manner of the law courts. He would himself have gone to France. He would have visited factories. He would have talked privately with many men. Then he would have dismissed some, promoted others, re-arranged things, and, more particularly, he would have encouraged the better men to do their best. There would have been no mass of written questions and answers, and perhaps not even any report to speak of, but everything would have gone better, and output would by now be increasing with leaps and bounds. That is the difference between Government and private control. Of course, private concerns often are badly managed, but these go into the Bankruptcy Court and meet an end more or less painful. Government concerns, when they fail in their duty, hang on to the nation and drag it down as a drowning man drags down his would-be rescuer.

Lest it should be thought that I am exaggerating the deficiencies of Government departments, I would remind readers of incidents which can be paralleled multitudinously by all who have experience in that direction. Take our Patent Department. Only by continual pushing has it been compelled to give our manufacturers licences to use enemy patents. And when our own patentees ask that the duration of patents be extended to compensate them for non-manufacture of patented articles owing to the Government having requisitioned factories for war material, the Board of Trade not only denies that it can do anything, but states that it does not even intend to ask Parliament to do anything. Fancy running a competitive electricity supply business on these lines!

Or may we recall the change made a few years ago by the Parcel Post Department? They used to send parcels by baskets, and breakage was almost negligible. Then someone thought that bags would be cheaper than baskets. So bags were used and, as might have been foreseen, the breakage of parcels was appalling. Anyone who sees the bags being thrown about at railway stations knows how it happens. But the Post Office would not rectify the error, and the breakage goes on year by year, to the great loss of the nation. A personal experience will illustrate what happens to thousands of unfortunate people who send parcels by post. Some time ago I sent a carefully packed felt hat per post, which arrived a complete wreck. The local postmaster inspected the remains, and, with a smile, remarked that sometimes these things got through unbroken, but that there was no responsibility of the Post Office, as cardboard boxes should, according to rule, be protected by a crate. I suggested that the public could not know the rules, and that the Post Office girls should tell senders about them. The postmaster was horrified at this idea, and stated peremptorily that people who sent goods per post should first read the book of the regulations and comply with them! A friend in the Post Office summed the matter up thus:—Said, he: "It's like this. A lady sends a hat, someone else a rabbit, and another a bottle of medicine. When they arrive here, the rabbit is mixed up with the hat and the medicine is running over them both." Again, one cannot but say, fancy running the electricity business like that!

One may recall one other experience, which, doubtless, is familiar to many. Some time ago the Telephone Department issued a batch of instructions to the telephone girls, with this kind of result:—

Telephone User (calling Exchange): "Three, please."

Operator (desperately): "Will you kindly say 'Little Puddleton-on-the-Marshes, three'?"

User: "Why should I? You know quite well what I want."

Operator: "It's the orders, and I cannot attend to you otherwise."

User: "Oh, all right. Here you are. Will you please get me Little Puddleton-on-the-Marshes, three? Will that do?"

Operator: "Number engaged."

This kind of thing went on for weeks in small towns where there was no possible excuse, until the telephone girls were worn out, users were in a perpetual state of bad temper, and the working of the system was upset.

One can only hope that our industry will not be put under the control of Parliament to be subject to this kind of thing. On July 25th, Mr. Ashley entertained (that is how the report in the Press puts it) the House of Commons for nearly an hour by telling them how money was wasted by the War Departments, at a time when every penny counts. The War Office wanted 30,000 packages of tapioca. Of these they bought 10,000 packages direct from a tapioca merchant, 10,000 at a higher price through a grocer, and a second 10,000, also coming from the same firm, and also at a higher price, from an ironmonger. A master tailor in a regiment was paid £25 for keeping non-existent suits of clothes in order. Over £700,000 was spent in converting ten oil-tank vessels into transports, and re-converting them again, quite uselessly, and so on. We also, most of us, know of influential gentlemen who are getting good pay in army departments during the war for doing mighty little. We also know of other cases where pensions are withheld, and where tradesmen are quite unable to get their bills paid. Many of us also know of cases where money could be saved by a little experimenting, if only the top-hatted, frock-coated man would listen to the fitter, but that is not the way in Government departments.

By all means nationalise the liquor industry. We want to reduce the nation's drink bill, and that will do it to admiration. But electricity supply has not yet come to that pitch, and something else is needed.

A word with regard to centralisation without Government control. This is not quite so bad as nationalisation, but it has many of the same vices. The president, who when appointed is full of push and go, settles into staidness and sobriety. One calls to mind the railway manager who would not allow a bogey carriage on his line, because he felt sure it would run off the rails, and they had to wait until he went to heaven before the improvement could be added. But our railways, while not active in making improvements in the way that we understand that word in the electrical industry, have this advantage, that they are not all under one board. When the North-Western, Midland, and other great lines have turned down a new idea, there is always a chance that the inventor may have luck with one of the other companies. One would hardly care to think of what state our railways would have been in to-day if the whole lot of them had been controlled by one board for the past dozen years! Centralised control would be wrong for our railways, at any rate in the present state of development of this nation, and it would be even more wrong for electricity. If one of the provincial stations wanted to use steam at 400 lb. pressure, why should the Board have power to tell them to wait until some other nation had proved that it was satisfactory? And if the staff at some other station feel themselves totally at variance with the policy of the Board of Control, why should they, in the name of etiquette, find themselves compelled to maintain a dire silence, when they feel that outspoken criticism would do a world of good? Boards of Control of all kinds are only too apt to become like Government departments. Everyone treats the members with profound respect, as if, indeed, they were a bench of bishops, because it is the only way to keep in with

them. They, in turn, become portentous in demeanour, and even come to believe that they know more about things than the men whom they control. Then the members spend so much of their time pottering about committee rooms, and that kind of thing, that they lose touch with the technical side of the industry, although, of course, no one dares to tell them so. Also, they acquire large salaries and titles of various kinds, and with these their women folk demand that they shall spend much time in attending social functions suited to their exalted rank. Now, it is the use that a man makes of his spare time that determines his real place in his profession, and no man can continue to do the highest work if he also strives to maintain a place in society. Of course, the private individual may try to do this, but he merely drops behind and takes a lower place. But where such a one holds high position officially, he is only too apt to hold back the whole industry.

One may sum all this up by giving a type of standard letter which we may imagine has been sent to some pushful young fellow who, in his inexperience, desires the Board to give special terms to a new consumer. The said consumer is willing to spend much money on plant to introduce a new electrochemical process, but wishes the electricity supply authority to give him special terms to make it worth his while to run the risk. The pushful manager writes a long letter, pointing out that the station happens to be in a position to do just what is needed, and that he feels sure that it will bring about an outlet for their energy which will speedily bring in fine profits. Well, one knows the reply to this kind of thing. It runs something like this:—

"Sir,—I am directed by the Board of Control to acknowledge receipt of your letter. The Board of Control directs me to point out that, under the rules and regulations which govern the Board's actions, they have no power to depart from the standard tariff.—I am, sir, your obedient servant, —."

The first time a man gets this kind of thing he feels as if he had slipped on a banana skin and sat down in a puddle. After a time he loses interest in progressive work and becomes a true official, and, when grown old, he may even take a delight in jumping on the next generation of men who have come out of college and the workshop crammed full of ideas for helping humanity.

But, it may be asked, what can be done to push the industry on? To reply to this would take up too much space for this article, but I will give a few heads on which there might be action. First of all, we might set up a Board drawn from the then Councils of bodies such as the I.E.E., the I.M.E.A., the Civils, the Railway Companies, and other interested parties. A Board selected thus would keep in living touch with the industry, and not tend to lose touch with new ideas as would be the case with a permanent Board. Funds should be collected by legal levy from the departments concerned, and with these a permanent laboratory should be set up with trained staff. This might well be a branch of our admirable National Physical Laboratory. The laboratory would test materials, including metals, coal, oil, &c. It would undertake the testing of plant of all kinds from the working of 20,000-kw. steam turbines to the performance of voltage regulators. Many of these tests would continue over long periods, and the staff would draw up reports on results obtained in actual working. One has only to think of Diesel engine and steam turbine experience to see how testing of this kind would help progress. Or take the experiments now going on with steam at 400 lb. pressure. We have reports that this is completely successful, and yet many men will continue to put down plant for 200 lb. pressure until the 400 lb. results have become common knowledge. With the resources of an expert staff to test and follow up

results with the higher pressure, many years of waiting would be saved, while the results obtained in the pioneer stations would be at the service of the whole industry.

The laboratory would, further, index and classify faults which occurred in all kinds of plant, which would prevent the repetition of the same defect long after the causes and remedy had been found out. It would advise the Local Government Board on the duration of loans based on the actual life of plant. It would advise Government Committees as to the desirability of linking-up and bulk supply, and would thus help the amalgamation of supply authorities in large areas. The London question alone would occupy much of its time, and we all know the vast possibilities that there are there for the elimination of waste. With the aid of a paid staff, the Board would draw up schemes by which all extensions would go to large efficient stations, while unnecessary stations would be wiped out as cheaply as possible. It would fix standard voltages and periodicities, and advise on ways and means for bringing everyone into line as far as possible.

The Board would, further, grant diplomas to properly educated electrical engineers, thereby raising the status of the profession to that of lawyers and doctors. It would supervise and license wiring contractors and eliminate the nondescript man who goes into wiring because he has failed in everything else. It would, further, test apparatus and materials used in installation work, and grant certificates where the same were satisfactory. This work is now carried out in some other countries, and is really required urgently here if we are to avoid a very unpleasant time in the near future, when much of the present bad wiring begins to yield to the stress of service for which it was never suitable.

Doubtless additional opportunities would arise for useful work, but the above programme would do for a beginning. The proposals here set forth have the great advantage that, while they would make it harder for those engaged in the electrical industry to follow the wrong path, those who are doing good progressive work would be able to continue their efforts without the fear of unreasonable interference.

SPANISH INDUSTRIES AND TRADE.

[INFLUENCES OF THE WAR.]

IN an exhaustive report prepared by U.S. Consul-General Carl Bailey Hurst it is stated that the commerce and industries of the Barcelona district underwent marked changes during 1915, and the resulting situation with its new problems was capably met by local merchants, manufacturers, and others, in spite of extraordinary difficulties. He says it may be conservatively stated that the value of the commerce of the district as compared to that of the whole country is 85 per cent. of the imports and 65 per cent. of the exports. Figures regarding the commerce of Barcelona are small as compared with those of other great mercantile centres of the world, but in reality this trade is of great importance, owing to the situation of the port between the Western Hemisphere and Europe. It is the confluence of the manufacturing activity of Catalonia, and the warehouses and depôts of Barcelona may be regarded as the storehouses of the entire country. The city, with its surrounding Provinces, may be said to have experienced an era of exceptional industrial activity in 1915, and in spite of the many hindrances to commerce from which it suffered, its importance in the world's trade has increased. The imports from the U.S.A. during 1915 would have been far greater had not the lack of vessels and the freight rates interfered with the development of American trade throughout this district. Nevertheless, 1915 was by far the best year American merchandise has ever had in Barcelona; new lines of goods have been put upon this market with success that promises a lasting demand. The war does not seem to have had an altogether harmful influence on the banks of Barcelona and vicinity. The mercantile world and the public generally have adhered to their habits of saving and to conservative business transactions. The tendency that has been noticed for some years toward the absorption of banking negotiations by the Barcelona branch of the Bank of Spain has been accentuated. The personal wealth of the public is not known, and it is accordingly impossible to fix exactly

the proportion of local capital invested in local commerce and industry. The confidence of local investors in home conditions is readily shown by the rapid absorption of new bond issues by the municipality or by the provincial Government. During 1915, 82 new joint stock companies were registered in Catalonia with a total capital of £576,470, nearly 40 per cent. of the capital thus invested in the whole of Spain during the year. A notable peculiarity of these companies is that they represent entirely Spanish capital, no foreign capital having been invested in this way, as has been the case in previous years. Mr. Hurst reviews the exchange situation, and details the railroad construction that has been under taken. He next proceeds to discuss the local industries compared with those of the rest of Spain. In this connection he refers to five classes of tariff for taxation. "The third tariff," he states, "embraces manufacturing industries, including cotton, woollen, and silk textiles, drugs, chemicals, leather goods, metals, machinery, and others, with a total of 57,439 contributors. There were 9,832 of these industries in the Province of Barcelona, followed by Valencia, with 3,703. Other Provinces in the district contained large numbers of contributors under this classification, amounting altogether to 50 per cent. of the whole number of contributors. In this district are centred the manufacturing interests of the country. The woollen industries number 2,087, of which 660 are in the Province of Barcelona, 149 in Burgos, 116 in Gerona, and lesser numbers in other Provinces of this district, making a total of 75 per cent. of the whole woollen industries of Spain. The cotton industries have 1,530 establishments, of which 1,155 are in the Province of Barcelona, 120 in Gerona, 31 in Tarragona, 34 in the Balearic Islands, and smaller numbers in other Provinces of the district, making 95 per cent. of the cotton industries of Spain. The silk industries number 252, of which 50 per cent. are in this district, 101 being in the Province of Barcelona alone. Sixty per cent. of the mixed silk, woollen, linen, and cotton industries are in this consular district, over 50 per cent. being in the Province of Barcelona. Of other textile mills, numbering 1,238, 85 per cent. are in this district, 756 being in the Province of Barcelona. There are 8,821 different kinds of plants making machinery, of which 75 per cent. are in this district, 2,393 being in the Province of Barcelona. Out of 353 paper factories, 67 per cent. are in this district, 147 being in the Province of Barcelona."

Many of the Provinces of Spain have industries more or less peculiar to themselves, and their centralisation in various localities is frequently the result of natural causes. Catalonia is the greatest manufacturing part of Spain, and activity in this line has spread to some adjacent Provinces. The Vizcayan Provinces are the seat of the principal blast furnaces and metallurgical industries, the Asturias are famous for their coal mines, and the Galician Provinces for their fisheries.

The effect of the war on this district, wherein is centred so much of the industrial life of Spain, has been at once favourable and harmful. It has created a demand in new markets for certain manufactured articles and, at the same time, it has encumbered with difficulties the means of securing raw material for their production. Local manufacture depends primarily on coal, which is imported annually in large quantity to supply the industrial plants. The interruption of regular imports threatened for a while to paralyse manufacture hereabouts, but the Government removed both customs duty and transport tax on imported coal in April, 1915, and soon large shipments began to arrive from the United States.

Although this district produces a great deal of iron, manufactured articles of this metal have been imported extensively. Machinery and hardware of various classes were brought before the war from points with which traffic is now stopped, and some local industries have consequently suffered from the lack of machinery and parts while the raw material for their manufacture was at hand. The price of iron in Spain is nearly double that in other countries, while manufactured articles are admitted with a duty of approximately 20 per cent. *ad valorem*, and this has apparently had the tendency to retard the development of local industries in this line. A similar condition is noticed in regard to copper, produced here in large quantity, but almost all exported. The lack of sulphate of copper has been a menace to many industries.

The textile interests of this district have suffered for want of colouring material, heretofore imported almost exclusively from Germany, and there has been a great demand for chemical products, aniline oils, varnishes, and other materials. While the requirements of the moment have been met, it has frequently been at great expense, and, although most of the mills and factories have been running, the net profits to the manufacturer have not been as great as might appear.

Barcelona under normal circumstances ranks after Liverpool, Bremen, and Havre as the fourth cotton port of Europe. There was increased activity of the Barcelona cotton market in the campaign year 1914-15.

The Spanish cotton industry employs over 2,100,000 spindles, of which 2,000,000 are located in Catalonia. The labourer employed in Barcelona and neighbourhood in the cotton industry works about 3,000 hours annually, or 62 hours a week, with 11 to 15 traditional and local holidays, besides the 52 Sundays and 11 fixed holidays. In mountain villages he works 66 day hours and 43 night hours weekly, or a total of

114 hours a week. The average weekly wage in this industry is from 3.60 dols. to 5.40 dols. for men, 2.70 dols. to 3.96 dols. for women, and 1.44 dols. to 2.16 dols. for children. The price of motor power is from 22.50 dols. to 27 dols. annually per h.p. in the river valleys and 0.009 dols. to 0.0144 dols. per kilowatt-hour in the plains for not less than 3,000 hours a year.

The cotton-textile industries of Spain, as classified for the collection of the industrial tax, comprise 365 machines for spinning and twisting yarn, of which 260 are in the Province of Barcelona and 73 in Gerona; and 46,175 looms, of which 33,883 are in Barcelona and 3,799 in Gerona.

The wool industry of this district is most intensive in the cities of Sabadell, Tarrasa, and Barcelona. In the mills of Sabadell there are 66,511 spindles for spinning wool, 64,131 for twisting yarns, and 1,645 looms, employing altogether 9,000 hands and producing annually goods to the value of 7,380,000 dols. In Tarrasa there are 37,800 spindles for spinning, 54,000 for twisting, and 1,300 looms, besides finishing establishments. The wool industry of Tarrasa employs 5,000 hands and turns out finished products with an average annual value of 5,310,000 dols. Other towns in which this industry flourishes are Alcañ, Bejar, Bocalente, and Antequera.

At Tarrasa there are 136 combing machines employing 400 hands, at Sabadell 30 such machines, and at Bejar and Renteria 14, making 180 machines in Spain, served altogether by 530 operatives and consuming about 3,960 metric tons of wool per year. The number of spindles employed in wool spinning are 46,800 at Sabadell, 43,000 at Tarrasa, 18,500 at Barcelona, and 10,400 at Badalona, Renteria, San Juan de las Abadesas, Puigcerdà, and Gerona, making a total of 119,000 spindles. This branch of the industry employs 2,000 hands.

The metallurgical plants at Sestao and Baracaldo, near Bilbao, have modern coke furnaces and rolling mills for making steel rails and sheet iron. They, with another plant called the "Iberia," formed in 1902 a combination known as the "Altos Hornos de Vizcaya," the greatest metallurgical enterprise in Spain, and produce all kinds of iron and steel, machinery, and hardware. There are also important furnaces in the Asturias and the Government maintains a foundry at Trubia, in Asturias, for the production of steel for cannon and projectiles. All of these establishments are fitted out with thoroughly modern appliances for an industry which is constantly assuming greater importance.

The neighbouring Provinces of Leon, Palencia, and Gerona produce between 400,000 and 500,000 tons of coal annually, the Provinces of Barcelona, Teruel, Guipuzcoa, the Balearic Islands, and Zaragoza produce about 275,000 tons of lignite, and at accessible distance from the furnaces much lead and iron are mined. The Province of Vizcaya produces about 3,500,000 tons of iron ore annually and Santander and Teruel contribute as well to the domestic supply of iron. In the Provinces of Santander and Lerida zinc also is mined to considerable extent. From Bilbao alone 3,500,000 tons of iron are exported annually under normal circumstances, and taking into consideration that the "Altos Hornos" handles 200,000 tons a year, it has been stated that if the amount exported could be retained for domestic consumption it would furnish material for 17 more such furnaces, employ 17 more villages of workmen, stimulate coal mining, and generally benefit the metallurgical interests of the whole country. During the year 1915 the exportation of iron, steel, and zinc in pigs and blocks was prohibited. This will have a noticeable effect on statistics of exports from this district.

In November, 1915, an assembly of the metallurgical industrial interests was held at Barcelona. It was the first meeting of the kind in Spain, and the object was to decide on the course to be taken to remedy so far as possible the difficulties arising from a slack domestic market, high prices, and growing scarcity of raw materials. The assembly adopted resolutions concerning Government aid, exportation of crude materials, some of which, although embargoed, found their way out of the country, and suggestions for classifying metal articles on a more technical basis in ensuing reforms of the Spanish Customs tariff. It was stated that the reduced activity affected over 100,000 operatives throughout Spain.

Chemical industries in this district are greatly favoured by the fact that the country furnishes nearly all the necessary raw material, but they have not been sufficiently exploited, and at present a need of finished chemical products is felt. The greater part of the carburetted calcium is produced in Catalonia, and a large plant for its manufacture is being built in Gerona. There are factories producing relatively small quantities of sulphuric acid, carbonic acid, oxygen, &c., and there is a noticeable tendency for such industries to concentrate in Barcelona.

Among the chemical manufacturing companies one is at Cijón, in Asturias, making mineral fertilisers as well as explosives, and another at Besaya. A factory for carbonate of soda recently opened at Torrelavega, near Santander, is easily capable of producing about 30,000 tons of this chemical a year. A company with a capital of 2,160,000 dols. is constructing a plant near Lérida for obtaining nitrates from the air, endeavouring to render Spanish agriculture independent of imported nitrates, and to make, as a secondary product, nitric acid for scientific and industrial use. This plant is in the Pyrenees, where the immense water power that exists has influenced Catalan manufacture in a marked degree. The olive oil of the district has contributed to the establishment

of a number of soap factories, which produce usually the ordinary grades, the finer qualities being largely imported.

The extensive paper industries of Spain are largely centred in Catalonia, where, established for centuries, they have developed, with the discovery of printing and modern methods of paper-making, to their present flourishing condition.

Since the beginning of 1915 hydro-electric development in this district has recovered from the check suffered in 1914, and works of great importance are being continued and completed. Aside from the Scandinavian countries and those in proximity to the Alps, this part of Spain possesses perhaps the best facilities for hydro-electric enterprise on the Continent. The rivers flowing from the Pyrenees and vicinity are capable of supplying power calculated at 1,350,000 H.P. For the exploitation of part of this great force there are three companies now operating. A hydro-electric plant has been constructed at Capadella which utilises the waterfall of Flami-sell, 2,739 ft. in height, yielding 52,000 H.P., said to be one of the greatest forces obtained from water power in Europe. One of these companies, after studying the waterfalls of the Pyrenees, chose three groups which seemed susceptible of profitable exploitation. These are the Essera, in the Province of Huesca, which feeds the Aragon and Catalan Canal; the Noguera-Ribagorzana, forming the boundary between the Provinces of Huesca and Lérida; and the Noguera-Pallaresa, in the Province of Lérida. From these three groups the energy to be obtained amounts to 300,000 H.P. This vast enterprise is being finished in sections. During 1915 the works on the Run in the Essera were practically terminated, yielding 44,000 H.P. and having necessary apparatus so that it can be stepped up to 140,000 volts. The lines transporting this force from the Central de Sierra to Barcelona are 140 miles in length. This line, capable of transmitting 80,000 H.P., traverses, by the bridge of Montoñana and Tremp, the rivers of Noguera-Ribagorzana and Noguera-Pallaresa. All along this line there are numerous terminal stations distributing this force throughout Catalonia.

Besides the three great companies referred to, there are others of lesser importance, and growing out of this development are dependent industries of which at Barcelona alone there are 34 factories for electrical material, machines, and accessories required in the utilisation of this natural force.

The capital employed in hydro-electric enterprises in this district has increased greatly since 1910, the date of the latest official statistics under this head. The three great companies referred to have a total capital of 86,400,000 dol., and if one considers that there are in this region 177 localities with electric light, and some using motor power as well, it is safe to estimate the capital thus employed at 90,000,000 dol.

The report proceeds to review the fishing industry, agriculture, vineyards and wine.

(To be concluded.)

TRADE STATISTICS OF SOUTH AFRICA.

THE following statement, showing the imports of electrical and similar goods into the Union of South Africa during the year 1915, has been taken from the recently-issued official trade statistics. The figures for 1914 are added for purposes of comparison, and notes of any increases or decreases are given.

	1914. £	1915. £	Inc. or dec. £
<i>Asbestos manufactures.</i> —			
From Great Britain ...	3,000	4,000 +	1,000
„ Other countries ...	3,000	2,000*	1,000
Total ...	6,000	6,000	—
	*Holland £1,000.		
<i>Brass manufactures.</i> —			
From Great Britain ...	26,000	19,000	7,000
„ Germany ...	1,000	—	1,000
„ Other countries ...	2,000	2,000*	—
Total ...	29,000	21,000	8,000
	*India £2,000.		
<i>Copper, plate and sheet.</i> —			
From Great Britain ...	3,000	4,000 +	1,000
<i>Copper manufactures.</i> —			
From Great Britain ...	4,000	3,000	1,000
<i>Electrical cable and wire.</i> —			
From Great Britain ...	173,000	102,000	71,000
„ Germany ...	18,000	—	18,000
„ United States ...	3,000	8,000 +	5,000
„ Other countries ...	—	2,000 +	2,000
Total ...	194,000	112,000	82,000
<i>Electrical fittings, including posts.</i> —			
From Great Britain ...	157,000	125,000	32,000
„ Germany ...	40,000	3,000	37,000
„ Holland ...	3,000	11,000 +	8,000
„ United States ...	22,000	37,000 +	15,000
„ Other countries ...	10,000	6,000*	4,000
Total ...	232,000	182,000	50,000
	*Denmark £4,000.		

	1914. £	1915. £	Inc. or dec. £
<i>Lamps and lampware.</i> —			
From Great Britain ...	16,000	15,000	1,000
„ Germany ...	11,000	1,000	10,000
„ United States ...	12,000	12,000	—
„ Other countries ...	2,000	4,000*	2,000
Total ...	41,000	32,000	9,000
	*Sweden £3,000.		
<i>India-rubber manufactures, including tire rubber, but not rubber tires.</i> —			
From Great Britain ...	27,000	32,000	5,000
„ Germany ...	3,000	—	3,000
„ United States ...	3,000	5,000 +	2,000
„ Other countries ...	1,000	2,000*	1,000
Total ...	34,000	39,000	5,000
	*Spain £1,000.		
<i>Machine bands and belting.</i> —			
From Great Britain ...	87,000	108,000	21,000
„ United States ...	34,000	38,000 +	4,000
„ Other countries ...	4,000	—	4,000
Total ...	125,000	146,000	21,000
<i>Electrical machinery.</i> —			
From Great Britain ...	178,000	110,000	68,000
„ Germany ...	168,000	4,000	164,000
„ United States ...	89,000	59,000	24,000
„ Other countries ...	5,000	5,000*	—
Total ...	434,000	178,000	256,000
	*Mainly Sweden.		
<i>Cranes, elevators, and lifts.</i> —			
From Great Britain ...	31,000	18,000	13,000
„ United States ...	3,000	2,000	1,000
„ Other countries ...	1,000	—	1,000
Total ...	35,000	20,000	15,000
<i>Mining machinery.</i> —			
From Great Britain ...	460,000	368,000	92,000
„ Germany ...	60,000	2,000	58,000
„ United States ...	155,000	240,000 +	85,000
„ Other countries ...	28,000	3,000*	25,000
Total ...	703,000	613,000	90,000
	*Sweden £2,000.		
<i>Machinery not specially mentioned (other than agricultural, manufacturing, &c.)</i> —			
From Great Britain ...	328,000	201,000	127,000
„ Germany ...	23,000	5,000	18,000
„ United States ...	28,000	43,000 +	15,000
„ Other countries ...	10,000	6,000*	4,000
Total ...	389,000	255,000	134,000
	*Canada £3,000.		
<i>Telegraph and telephone material.</i> —			
From Great Britain ...	9,000	8,000	1,000
„ Germany ...	1,000	—	1,000
„ Sweden ...	2,000	2,000	—
„ United States ...	1,000	1,000	—
„ Other countries ...	2,000	—	2,000
Total ...	15,000	11,000	4,000
<i>Tramway rails.</i> —			
From Great Britain ...	2,000	5,000	3,000
„ Germany ...	7,000	—	7,000
„ United States ...	4,000	2,000	2,000
„ Other countries ...	1,000	—	1,000
Total ...	14,000	7,000	7,000
<i>Tramway rolling-stock.</i> —			
From Great Britain ...	19,000	21,000	2,000
„ United States ...	2,000	4,000 +	2,000
Total ...	21,000	25,000	4,000
<i>Other tramway materials.</i> —			
From Great Britain ...	12,000	5,000	7,000
„ Germany ...	2,000	—	2,000
„ United States ...	5,000	2,000	3,000
„ Other countries ...	—	1,000 +	1,000
Total ...	19,000	8,000	11,000
In addition to the above the following goods were imported as "Government Stores":—			
<i>Electric fittings.</i> —			
From United Kingdom ...	6,000	14,000	8,000
„ Germany ...	500	—	500
„ Other countries ...	1,000	1,000	—
Total ...	7,500	15,000	7,500

	1911.	1915.	Inc. or dec.	
<i>Brassware.—</i>	£	£	£	
From United Kingdom ...	3,000	1,500	—	1,500
<i>Copper, plate and sheet.—</i>				
From United Kingdom ...	14,000	14,000	—	
<i>Electrical cable and wire.—</i>				
From United Kingdom ...	49,000	18,000	—	31,000
.. United States ...	—	1,000	+	1,000
Total ...	49,000	19,000	—	30,000
<i>India-rubber.—</i>				
From United Kingdom ...	6,000	1,000	—	5,000
<i>Lampware.—</i>				
From United Kingdom ...	4,000	1,000	—	3,000
<i>Cranes and elevators.—</i>				
From United Kingdom ...	14,000	8,000	—	6,000
<i>Electrical machinery.—</i>				
From United Kingdom ...	9,000	3,000	—	6,000
<i>Other machinery.—</i>				
From United Kingdom ...	38,000	20,000	—	18,000
.. Other countries ...	4,000	1,000*	—	3,000
Total ...	42,000	21,000	—	21,000
*United States mainly.				
<i>Telegraph and telephone material.—</i>				
From United Kingdom ...	103,000	30,000	—	73,000
.. Sweden ...	36,000	5,000	—	31,000
.. Other countries ...	1,000	1,000	—	—
Total ...	140,000	36,000	—	104,000

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

EGYPT.—Revised Tariff valuations for use in assessing duties on metals imported into Egypt have been issued with effect from July 1st to August 31st. Duty is leviable on these valuations at the rate of 8 per cent.

JAMAICA.—A new law, dated March 22nd, has been passed, providing for the temporary increase of the import duties on certain articles.

Among the articles which were formerly free of duty, but are now subject to a duty of 16½ per cent. *ad val.*, are: Locomotives, railway rolling stock, and all materials and appliances to be used for construction and equipment of railways and tramways; professional plans, specifications, and drawings.

Motor-cars and motor-car parts and accessories now have to pay an additional tax of 20 per cent. on the former duty of 16½ per cent. *ad val.*, making a total duty of 20 per cent. *ad val.*

RUSSIA.—According to a Customs Circular, dated May 26th/June 8th, it has been decided that temporarily, for the duration of the war, certificates of origin will not be required in respect of samples of various materials and manufactures having neither the form nor the nature of articles of merchandise. Samples from allied or neutral countries entitled to most-favoured-nation treatment will be admitted free of Customs duty in accordance with the provisions of Tariff No. 218.

FRANCE AND ALGERIA.—A Presidential Decree, dated July 18th, prohibits the importation into France and Algeria, except on behalf of the State, of certain metals from foreign countries.

SUDAN-ERYTHRAEA.—The Customs Convention of November 26th, 1901, between the Anglo-Egyptian Sudan and Erythraea was denounced on July 2nd last by the Italian Government, and the Convention will accordingly lapse on January 2nd, 1917.

MOROCCO.—The General Commanding in Chief in the French Zone in Morocco has issued an Order prescribing that all goods destined for Fez and Mequinez, which were not landed at a port in the French Zone, shall on arrival at the two towns mentioned be deposited in special stores, whence they shall not be withdrawn except on production by the consignee of a certificate of origin as required by the regulations.

CHILE.—The Board of Trade have received a copy of the new Tariff Law of Chile—vide the Review of May 12th—and of the general regulations for its application. The Board propose to publish, as soon as possible, a translation of the new Tariff, showing the former rates of duty for purposes of comparison.

A copy of the Tariff, together with an alphabetical index thereto (both in Spanish), may be inspected at the Commercial Intelligence Branch. The Branch will also be prepared,

in response to written applications from British traders, to furnish information as to the rates of duty prescribed by the Tariff Law in respect of any particular class or classes of merchandise.

NICARAGUA.—Telegraphic information has been received at the Foreign Office from H.M. Consul at Managua to the effect that the Customs duties leviable on goods imported into Nicaragua have been increased by 38½ per cent.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 10,767. "Electrical telephones for field telegraphs, &c." G. M. MASTERS. July 31st.
- 10,774. "Apparatus for testing electrical ignition plugs." C. T. GARNER. July 31st.
- 10,783. "Electric switches." M. COMPARE & E. PIZZI. July 31st.
- 10,795. "Magneto electric machines." BRITISH THOMSON-HOUSTON CO. AND A. P. YOUNG. July 31st.
- 10,809. "Sparkign plugs for internal-combustion engines." B. E. STACEY AND F. C. STACEY. July 31st.
- 10,835. "Driving and controlling dynamo-electric generators." J. FIRTH AND W. F. W. RHODES. August 1st.
- 10,850. "Electron discharge apparatus." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). August 1st.
- 10,855. "Electric lighting and heating of railway, &c., vehicles." C. H. VIDAL. August 1st.
- 10,875. "Ammeter for alternating currents and electric oscillations." I. WILLIAMS. August 2nd.
- 10,882. "Dynamo-electric machinery." ELECTROMOTORS, LTD., E. GREENHALGH & B. LONGBOTTOM. August 2nd.
- 10,883. "Life-saving electrical warmer." H. O. GUNEWARDENE. August 2nd.
- 10,905. "Wireless transmitting systems." BRITISH THOMSON-HOUSTON CO. AND R. C. CLINKER. August 2nd.
- 10,906. "Governing mechanism for compressors and exhausters." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). August 2nd.
- 10,923. "Sparkign plugs." R. H. COLLIER & W. J. MALLINSON. August 2nd.
- 10,938. "Switch controls." G. A. FRITSCH. August 2nd.
- 10,939. "Motor-starting switches, controllers, &c." NEWTON BROS. & F. NEWTON. August 2nd.
- 10,950. "Electric switches." G. O. DONOVAN & W. DONOVAN. August 3rd.
- 10,979. "Magneto-electric machines." BRITISH THOMSON-HOUSTON CO. AND A. P. YOUNG. August 3rd.
- 10,985. "Apparatus for transmitting and receiving sound waves through the ground." R. A. FESSENDEN. August 3rd. (U.S.A., October 7th, 1915.)
- 10,999. "Detectors for wireless telegraphy." W. CROSS. (Svenska Aktiebolaget Gasaccumulatör). August 3rd.
- 11,001. "Electrical means for locking railway, &c., carriage doors." P. DAYTON. August 3rd.
- 11,014. "Electrical screening or jamming systems." R. A. MACK, G. H. NASH & WESTERN ELECTRIC CO. August 4th.
- 11,043. "Electric motor control." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). August 4th.
- 11,047. "Cut-out for electric circuits." E. C. R. MARKS (J. Kuntziger) August 4th.
- 11,052. "Electric signalling or indicating apparatus for signalling orders and numerical data." E. A. GRAHAM. August 4th.
- 11,055. "Electric oscillating or wireless systems and apparatus." INDO-EUROPEAN TELEGRAPH CO. & A. H. MORSE. August 4th.
- 11,058. "Electrical conducting cloths, &c." H. H. COOPER. August 4th.
- 11,067. "Contact breakers for magnetos, &c." J. JELLEY & W. V. STOLFOE. August 5th.

PUBLISHED SPECIFICATIONS.

1915.

- 10,752. ELECTRIC MOTOR STARTERS AND CONTROLLERS. E. Schatner, T. G. Travis & J. R. Walter. July 24th. (Cognate application, 661/16.)
- 10,785. RUMBLERS AND THE LINK FOR ELECTROLYTIC PURPOSES. C. J. Lane and D. L. Honeymann. July 26th.
- 11,172. MEANS FOR SUSPENDING AND ADJUSTING ELECTRICITY OVERHEAD CONDUCTORS. British Insulated & Helsby Cables, Ltd., and J. W. Astley. August 3rd.
- 11,263. ELECTRICAL WINDINGS. British Thomson-Houston Co. (General Electric Co., U.S.A.). August 4th.
- 11,723. LAMP HOLDERS FOR ELECTRIC LAMPS. E. F. Guth. August 13th. (January 21st, 1915.)
- 12,666. RECTIFIERS FOR ELECTRIC CURRENTS. British Thomson-Houston Co. (General Electric Co., U.S.A.). September 3rd.
- 13,679. ELECTRO-MAGNETICALLY-OPERATED BRAKE OR OTHER MECHANISMS. R. S. Lewis. September 35th.

1916.

- 298. ELECTRIC LIGHTING MEANS. R. S. Woods. January 7th. Patent No. 100,879.
- 469. ELECTROMAGNETIC THERAPEUTIC APPARATUS. E. Bachelet. January 11th. Patent No. 100,860.
- 1,643. ELECTRIC MOTOR CONTROL SYSTEMS. Igran Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.). February 3rd, 1916. Patent No. 100,872.
- 4,699. SWITCHING APPARATUS FOR INTERCONNECTING TELEPHONE LINES BY ELECTRO-MECHANICALLY-CONTROLLED SWITCHES. F. Aldendorff. January 30th, 1914. (Addition to 28,502/13, and divided application on 2,530/14.) Patent No. 100,839.
- 6,302. POCKET AND OTHER ELECTRIC FLASHLIGHT BATTERIES. J. W. Mander. May 3rd, 1916. (Addition to 7,079/14.) Patent No. 100,863.

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SELF-HELP.

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In all our discussion of trade affairs we have never belittled the importance of electrical exportation nor failed to observe the rate of its progress. Our object has been to show how much bigger it might and should have been, considering the growing service of electricity and the developing state of the world. We have to remember that the by no means discreditable results of the past have been secured in spite of the strength of Teutonic rivalry, fair and unfair—largely the latter. They have been largely the result of initiative by individual manufacturers, and in some measure the fruits of Britain's reputation. To-day, when we have come to what is in many things the parting of the ways, we may be permitted to state that we hold that, whatever happens, the future of our export trade progress will continue to depend partly upon national and industrial reputation, but largely upon individual initiative, though, as we have often indicated, we look also for great things from co-operative or consolidated efforts by groups of manufacturers and traders and by means of Trade Associations. This opinion is subject to the important reservation that any consolidation which means that we go out as a solid body in search of new business contains an element of danger in that we may relax our personal specialised attention by putting our trust in organisations. By isolated action we may scatter our forces most wastefully, and, when against strong competition, more or less uselessly; but unitedly we may go to the opposite extreme. Co-operative action may produce economy in the cost of trade expansion efforts; it may enable many an expedition or effort to be made that would not be undertaken by isolated parties; it may bring a united force up against a competing united force from other countries, and the fight may be fiercer than in the past, when a huge German trust was able to come up against a dozen British firms acting separately, competing severely between themselves as well as with the said German trust. But it never can fill the entire needs of the situation. We would rather see many small groups and isolated enterprise on the part of strong manufacturers, even if some of those groups have to confer and agree as to geographical limitations to their activities.

We have argued for national industrial organisation, for organisation of Empire resources, and for the better organisation and utilisation of science and scientific training. All of these we are now in a fair way to secure, and we trust, and believe, that the results will be immensely beneficial. But we own to doubts when it is urged that we should carry our organisation efforts to such an extent that they become an idol or a fetish. After all, boards and councils will be successful in so far as they limit their activities to the matters coming legitimately within their scope, and deal with matters or principles or measures which are common in their application—common to national industry, common to the Empire interests, common to the national well-being. Let them render separate action in their special spheres of service, whether it be within their own ranks, or for the purpose of influencing the Government and the nation; but let them

be reasonably co-ordinated in an ultimate sense. Organised science and industry, with scientifically organised and utilised resources, should produce excellent results. But the question is sometimes asked whether to follow up the efforts in these very essential directions there should not be one other great national organisation of tradesmen, salesmen, and commercial men. Now there may be very excellent reasons for affording traders and commercial managers facilities for conference, discussion, and so forth, but while such facilities may promote a good deal of "talking" enterprise of the Across-the-Water type, they must inevitably be very general, and cannot well become definite organised business-getting schemes for a particular class of trade. They may be very good in a general sense, but the selling of corsets and stockings is one thing, and trading in electrical machinery and apparatus is another and very different thing. Further, even when men tell themselves off into groups, those groups are composed of a number of commercial, perhaps technico-commercial, men, all of whom have by the nature of their calling and experience particular interests and pursuits of their own, and have specialised knowledge of, and connections in, particular markets, which are their own and their employers' property.

We recognise that in the three great movements mentioned there is no room for anything pertaining to small commercial or trade detail, but we believe that all those local matters can be handled in a far better way by specialised trade associations and by individual firms acting in co-operative groups. If the Board of Trade is sooner or later to emerge in a re-organised form it will, no doubt, find considerable advantage from the existence of a number of these specialised trade organisations; but we are disinclined to favourably view the proposal which is elaborated at length by Mr. P. A. Reuss in last week's *Engineer*. Twenty-eight objects he enumerates for a National Commercial Company—a limited company with directors and, of course, directors' fees, with shares and dividends, with substantially-paid officials who would have a permanent career opened for them to exercise their personal abilities in furthering "important patriotic work of this nature." The *raison d'être* of the company or organisation, as it is variously termed, would be to carry out in a practical way, "amongst others," the 28 suggestions so far as they relate to the hardware manufacturing, engineering, and allied industries.

We cannot spare space to reprint all those suggestions, nor is it necessary, for they are far from being novel, nor can it be said that they are being grossly neglected by some of the leading associations that are at work amongst us to-day. The proposals are most certainly ambitious. The writer's idea seems to be to form an association, either of firms or individuals, "to investigate fundamentally, and to remedy, the absence of sale or decline in the sale of manufacturers' products in overseas markets." As we study the suggestions we find some overlapping, and "words, words, words."

The Association will induce "co-operation between manufacturers in the production of different parts of one article"; will undertake a "complete re-organisation of sales methods," whether we require it or not; will solve the "difficulties confronting manufacturers in extending their business overseas," and will prevent "further encroachment by foreign competition." It will "establish," and, after having established, will "nurse a demand for British goods in countries or markets at present in foreign hands." But, most desirable organisation—it will study the "methods of our principal competitors, and particularly the commercial side of German enterprise." So far, we have hinted at but six out of the 28 or more offices that this Company

will fulfil. As we proceed, we come to a lengthy omnibus resolution covering a hundred useful purposes (insurance, freight, packing, "information and subscription," "chartering, import and export, catalogues, correspondence in foreign languages," and goodness knows what else). Later, we find that the said company will buy and sell goods—it must, we suppose, in order to pay directors' fees and dividends—will represent groups of manufacturers abroad, will assist "the smaller manufacturer to extend his business abroad," will bring the overseas purchaser into touch with the most suitable supplier in this country (a member, of course!), will act as purchaser "of articles where contributory manufacture is necessary," will "organise a continuity of business" in certain cases, will organise the holding of stocks abroad, will "obtain early information" of contracts, will negotiate concessions for public works, will "investigate the processes of manufacture adopted by competitors abroad in cases where under-selling is taking place." But we have now only arrived at No. 18. When we get to 19 and 20 and 21, and think of the assistance that is to be offered to certain trades where "under-selling is not warranted by cheaper production," and of the information that is to supplement Consular reports, and of that vast catalogue of industry that is to be compiled, we have to pause to take fresh breath. And when, in 22, we contemplate this great company "assisting manufacturers"—poor helpless creatures—"in the preparation of their own special catalogues," find it engaging competent men abroad in such a way as to save our manufacturers' money, see it setting up a "department for the expert, technical, and scientific study of competitors' patterns, goods and processes of manufacture," and watch it facilitating "the prices of goods delivered," &c., we are humbled to the dust with the terrible extent of our past inefficiencies which have enabled us to build up so fine an export trade, and overwhelmed with the vastness of the organisation, staff, operations, and profits or losses, of the proposed company. But our blood runs cold, and our cover goes bluer than it ever was before, as we follow on to the bitter end and read the contents that it is proposed to publish in that "trade paper" that it is proposed to "regularly" publish in different languages "with a scheme of advertisement for British manufacturers." If we were to say that there was "nothing new under the sun," we should lay ourselves open to the charge of uttering a platitude; or if we referred to the size of a given servant's baby, or to the result of the throes of labour of a certain mountain, it might be wondered what we meant; but when we give the above brief summary of the great organisation of Mr. Percy Reuss, we believe that, like the curate's egg, being good only in parts, it speaks for itself. Wherein it is good, we seem to have heard most of it before, but taking it as a whole it is fearfully and wonderfully made, terribly and unworkably overloaded and, if it is no reflection on the good intentions of the author, it is, on the whole, mere light fantastic.

The moral of all which is that, while up to a certain point trade organisations are most excellent things, they never can adequately do for the individual manufacturer a host of things that he can, and should, do for himself. The individual manufacturer may profitably confer with his competitors and friends in respect of many important matters, but conference of such kinds, and the setting up of companies to do parts of his business for him, never will—particularly in the times that are ahead of us—remove the necessity for him to take his own coat off and do things for himself. He will want an excellent export staff and organisation of his own, and will have to be prepared to spend money. It is useless pretending that the future course of business is going to remove that necessity or lessen it by one iota.

BLUSHING UNSEEN.

THAT we have never failed to appreciate the important place that efficient organisation occupies in connection with industrial affairs is well known to our regular readers. Without desiring to unduly belaud the system of the Teuton, we have made it our business to keep observers informed concerning its manifold aspects and activities, and our volumes upon the readers' shelves contain an abundance of interesting material which, in season and out of season, has been placed on permanent record. To many of our readers, therefore, much that has been appearing in the daily Press in "special" article form, and in the reports of speeches by political and other leaders of thought, has been very familiar indeed. Even during the last few weeks we have observed in important newspapers "features" which have consisted of popular discussions of some electrical and other industrial matters to which the public should have given attention years ago. When legislators in their Parliamentary speeches confess the extent of their pre-war ignorance of German economic, financial, and industrial operations and intentions, and admit their failure to see the trend of German scientific education and development, they are but endorsing the criticisms that they have had their heads too much in the clouds and have given too little thought to common mundane affairs. They have, in other words, been so occupied with what might be called local and domestic matters that they have been blind to momentous international tendencies and movements. Stating the case bluntly, they have been more interested in heavy monthly reviews and the legal journals than in the Trade Press, and if we say that the Trade Press has latterly come into its own to a larger extent than previously in point of reputation and prestige with public men and public departments, let it not be imagined that we are unduly puffed up at having been able in war-time to render national service in a score of ways about which we cannot at present write, but that we appreciate the privilege, and recognise that we have done nothing more than has been our duty and our delight. What we sometimes wonder is whether, when the times of "piping peace" return, those days when matters of industry and trade will inevitably occupy a much larger place in all our national thought, we shall witness a relapse into indifference to the contents and counsel of the great and substantial organs which form the Trade and Technical Press of the United Kingdom. We believe that the revolution that has taken place in much of our thinking during the past two years will render us secure against any such relapse, for, unless we mistake the signs, party politics as we knew them in the past will not return for a long time to come, and the nation will desire to be governed along national lines with a policy which shall involve a closer concern for business and industrial affairs, conserving the interests of the Empire, carefully reconciling the interests of the Empire and the Allies, adequately safeguarding those of neutral countries, meting out justice to enemy trading communities, and securing as decent as possible a standard of employment and remuneration for our own people. All the problems of the past two years, and those which appear to be opening out before us to-day calling for inquiry and solution, seem to us to suggest that public men and public departments will in the future find the Trade Press and Trade Associations of great utility. We gather from a recent speech by the Prime Minister that a scheme for the re-arrangement or re-organisation of the Board of Trade is being elaborated. We have heard of many such schemes before, but they have come to nought—this is one of those pieces of organisation work that the Trade Press has long been anxious to see carried out—and we

hope that the measures now to be taken will soon actually mature, and will be suited to the needs of the case. By the co-operation of a re-organised Board of Trade, large and representative Trade Associations, and a substantial Trade Press, there would be made available for the service of the nation a co-ordination of effort which could render industry invaluable assistance in the important period that lies before us.

Copper.

THERE has certainly been more demand for copper from all consuming centres within the last few weeks, though the great bulk of the business has been on behalf of big American consumers and belligerent countries. The fact is worth noting that, as regards the latter, the buying is more centralised, or organised in such a way as to eliminate competitive inquiries through various channels, which usually tempts sellers to raise prices unduly against buyers. There is, in fact, good reason for believing that there is an understanding between the Allies as to the filling of their requirements for war purposes. Importations by Russia, too, are being made through the medium of the British authorities, as arranged with the Petrograd authorities. At any rate, the orders placed quite recently for Russia, which amounted to about 7,000 tons, went through the British authorities. A very large portion of this copper is being provided by Australian and Japanese producers apart from American. For one thing, these orders have not had any effect on the market. Obviously, the current high prices are found tempting enough, and there is not much doubt that leading American producers will be induced to make some concessions when the further big orders to be placed by Allied countries come on the market.

So far as can be gauged, current output across the Atlantic is so heavy as to leave a considerable surplus over present actual requirements, although it is claimed by American authorities that the progress of operations at the refineries has been in some degree impeded in the last two months through the abnormally hot weather. Advices from that quarter are more optimistic as to future developments since buying has shown signs of reviving, and with supplies well under control, it is probable that attempts will be made to hold prices as long as possible, inasmuch as there is now a more general impression that the European struggle will be prolonged well into next year. This, of course, means the continuation of a phenomenal consumption for copper in connection with munitions. Prices in New York were lately again advanced with reports of large orders being placed, though doubtless these have been exaggerated, as usual. The price of electrolytic on this side has risen again to about £130 c.i.f. for near shipment, but the run of ordinary business is still light, consumers fighting rather shy of the extravagant prices while munition works are being accommodated by Government copper at some pounds a ton below the figures at which business is possible in the open market. Dealings in warrant copper have been a little more active, and prices have been lifted at one period up to £116 for cash delivery in a sensitive market, due to the fact that there are but few sellers, while the stocks of standard copper in home warehouses remain at a dangerously low point, as shown by the last statistics. The European visible supply is now down to about 11,000 tons—a new low record—this comparing with 35,113 tons at the end of July last year, when the price of standard metal stood at £71 5s. a ton. The American refinery production was then somewhere in the neighbourhood of 65,000 tons a month, whereas it is now not much below 90,000 tons a month. There is a fair amount of metal coming from various outside sources, including Australian, Japanese, and even African descriptions, but American control has still to be reckoned with so long as the war lasts.

THE CHICAGO, MILWAUKEE AND ST. PAUL RAILWAY ELECTRIFICATION.*

WHILE many terminal and tunnel installations have been made in the past for the purpose of eliminating smoke, taking care of suburban traffic or other local conditions, the Chicago, Milwaukee and St. Paul electrification is the first project of the kind where electric locomotives were installed to operate over several engine divisions.

Steam engines were first abandoned on the Three Forks-Deer Lodge Division, 115 miles long, and crossing the main Continental Divide, thus giving the electrification its initial tryout under the severest service conditions of the entire system. The first electric locomotives were placed in regular service on December 9th, 1915, and during the month of April, 1916, service was extended to Harlowton, making a total of 220 miles of electrically-operated road. By November 1st, 1916, it is expected that steam engines will be superseded over the entire distance of 440 miles from Harlowton, Montana, to Avery, Idaho.

In crossing the three mountain ranges included in the electric zone, there are several grades of 1 per cent. or more, the most difficult of which is the 21-mile 2 per cent. grade between Piedmont and Donald, and the longest the 49-mile 1 per cent. grade on the west slope of the Belt Mountains.

over a mile and a half in length, through the ridge of the Bitter Root Mountains.

The passenger service consists of two all-steel finely equipped trans-Continental trains in each direction, the "Olympian" and "Columbian," and a local passenger train in each direction daily between Deer Lodge and Harlowton.

Freight traffic through the electric zone comprises from four to six trains daily in each direction. Westbound, the tonnage is made up of manufactured products and merchandise for Pacific Coast points and foreign shipment. Eastbound tonnage includes grain, lumber, products of the mines and some live stock.

As a large part of the traffic is through freight, trains are made up of an assortment of foreign cars, including box and flat cars, coal and ore hoppers, stock cars, refrigerators, &c., varying in weight from 11 to 25 tons empty, to as much as 70 tons loaded. These cars being owned by many different railway systems, are equipped with air brakes adjusted for different conditions of operation, and in

accordance with different standards as to braking power and type of equipment, thus making the problem of holding the long trains on the heavy down grades by air brakes, a most difficult one.

Electrification promises a material reduction in running time. It has been found, for example, that on the 21-mile 2 per cent. grade from Piedmont to Donald, the electric



ELECTRIC FREIGHT LOCOMOTIVE AND 82-CAR TRAIN, WEIGHING 2,680 TONS.



3,000-VOLT DIRECT-CURRENT LOCOMOTIVE AND 10-CAR TRAIN, CHICAGO, MILWAUKEE AND ST. PAUL RAILWAY.

The curvature is necessarily heavy, the maximum being 10°. There are also numerous tunnels in the electric zone, 36 in all, of which the longest is the St. Paul Pass tunnel.

* Previous articles on this subject appeared in our issues of February 3rd and November 5th, 1915.

locomotive can reduce the running time of passenger trains from an hour and five minutes to approximately 40 minutes. On the run from Deer Lodge to Butte, which, under the steam locomotive schedule, required an hour and 20 minutes, a saving of approximately 30 minutes can be made.

In the freight service it has been found that on the first division, where the steam locomotives have required 10 to 12 hours to make 115 miles, electric locomotives can meet a schedule of from seven to eight hours for the same distance. The capabilities of the electric locomotives are in no way impaired by cold weather, or by inability to obtain fuel or water in case of snow blockades. During a series of record-breaking temperatures in December, 1915, Mallet engines were frozen up at different points on the system, and the new electric equipment was rapidly pressed into service to replace them. On several occasions electric locomotives



RAILWAY SUB-STATION SHOWING POWER CO.'S TRANSMISSION LINE.

hauled in disabled steam engines and trains which would otherwise have tied up the line.

During initial operation on the Rocky Mountain Division, the capacity of the new locomotives has been thoroughly tested. Trains of 3,000 tons trailing have been hauled east and 2,800 tons west, using a helper on the heavy grades. From the operating data obtained on the first division, it is evident that much heavier trains can be hauled with the electric locomotives than with



OVERHEAD CONSTRUCTION ON CURVE, CHICAGO, MILWAUKEE AND ST. PAUL ELECTRIFICATION.

steam engines, and all passing tracks are being lengthened to take advantage of longer trains. On some of the runs where the grades are less than 1 per cent., trains of as many as 130 cars and as heavy as 4,000 tons have been hauled with a single locomotive.

The four through passenger trains, "Olympian" and "Columbian," are taken across the two mountain ranges by a single passenger locomotive. These trains at present consist of eight full-vestibuled steel coaches, weighing approximately 650 tons. Instead of changing locomotives

at Three Forks, as has been the practice under steam operation, the same locomotive is run through the 220 miles from Deer Lodge to Harlowton, changing crews midway. Passenger trains will travel over the entire electrified division in approximately 15 hours, including all stops, and the tourist thus will have an opportunity of traversing by daylight some of the most beautiful scenic regions in the United States, and without suffering the annoyance of cinders and smoke incident to the use of steam locomotives. The local passenger train operating in the electric zone between Deer Lodge and Harlowton is handled by a half unit weighing about 150 tons.

Regeneration furnishes a ready solution of the difficult braking problem on the long-sustained grades encountered in crossing the three mountain ranges, where great skill is required to handle either the heavy and varied freight or the high-speed passenger trains with the usual air brakes.

With regenerative braking, the strain on draw bars and couplings is reduced to a minimum, since the entire train is bunched behind the locomotive and held to a uniform speed. The electric-braking mechanism automatically controls the speed by regulating the amount of energy fed back to the line. The smooth and easy descent is in marked contrast to the periodical slowing down and speeding up of a train controlled by air brakes.

The usual speed of the electrically-hauled freight train is 15 miles per hour ascending and 17 miles per hour descending the maximum grade, but half these speeds can easily be maintained with series connections of the motors should conditions require it.

Regenerated power not absorbed by other trains passes through the sub-station machinery into the distribution system connecting all sub-stations. The Power Co.'s lines are so extensive and the load of such a diversified character that any surplus power returned by regenerating locomotives can readily be absorbed by the system; credit is given for all energy returned.



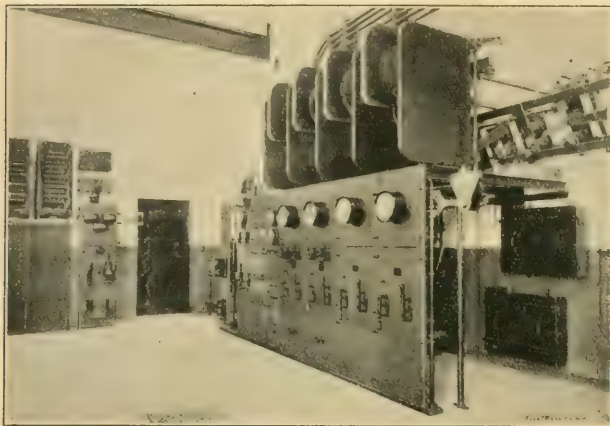
100,000/2,300-VOLT TRANSFORMERS AND OIL SWITCHES. MOREL SUB-STATION.

The advantages of regenerative braking include elimination of brake shoe and wheel wear, with resultant reduction in maintenance; reduced wear on tracks, especially on severe curves; and a probable saving of approximately 15 per cent. in the total power consumption.

The scheme of electrification includes the generation of electricity from the several water-power plants of the Montana Power Co., developing, roughly, 160,000 H.P., transmission at 100,000 volts, three-phase, 60 cycles; conversion in sub-stations to 3,000 volts direct current, and

distribution over catenary overhead construction to electric locomotives.

The main line electric locomotives are constructed in two units permanently coupled together, the halves being duplicates, and each capable of independent operation. The modern Muller steam locomotive, weighing 278 tons with tender, which has been released, has a tractive force of 76,200 lb., while the electric locomotive, weighing 282 tons,



SWITCHBOARD FOR MOTOR-GENERATOR SETS AND OUTGOING FEEDERS.
MOREL SUB-STATION.

has a running tractive force of 85,000 lb., or a starting tractive force of 136,000 lb.

There are 42 of these main line locomotives (30 freight and 12 passenger) and two switching locomotives. The passenger locomotives are equipped with a gear ratio permitting the operation of 800-ton trailing trains at speeds of approximately 60 miles per hour on tangent level track. The average passenger train weighs from 650 to 700 tons, and is hauled over the 2 per cent. grade without a helper. The freight locomotives are designed to haul a 2,500-ton trailing train at approximately 16 miles per hour on all grades up to and including 1 per cent. On 2 per cent. grades the trailing load was limited to 1,250 tons, although this figure has been exceeded in actual operation.

Each locomotive is equipped with eight 1,500-volt motors, insulated for 3,000 volts to ground. The motor has a normal one-hour rating of 430 H.P. and a continuous rating of 375 H.P., so that the locomotive power plant has a normal one-hour rating of 3,440 H.P. and a continuous rating of 3,000 H.P. Each motor is twin-g geared to its driving axle in the same manner as on the Butte, Anaconda and Pacific, the Detroit River Tunnel, and the Baltimore and Ohio locomotives, a pinion being mounted on each end of the armature shaft. Additional flexibility is obtained by the use of a spring gear and a spring nose suspension, which minimise the effect of all shocks, and also reduce gear wear to a minimum. The motor is of the commutating pole type, and is constructed with longitudinal ventilating ducts in the armature for forced ventilation from a blower in the cab.

The control equipment is the well-known Sprague General Electric Type M arranged for multiple unit operation. The main control switches are mounted in steel compartments inside the locomotive cab with convenient aisles for inspection and repairs. A motor-generator set in each half of the locomotive furnishes low-voltage current for the control circuits, headlights, cab lighting and for

charging the storage batteries on the passenger coaches. Under steam operation the charging current for these batteries is furnished by a steam turbo-generator set located on the locomotive. The blower for ventilating the traction motors is also direct connected to one end of this set.

The pantograph collectors, one of which is mounted on each half of the locomotive, are of the double pan type with a working range of from 17 ft. to 25 ft. above the rail.

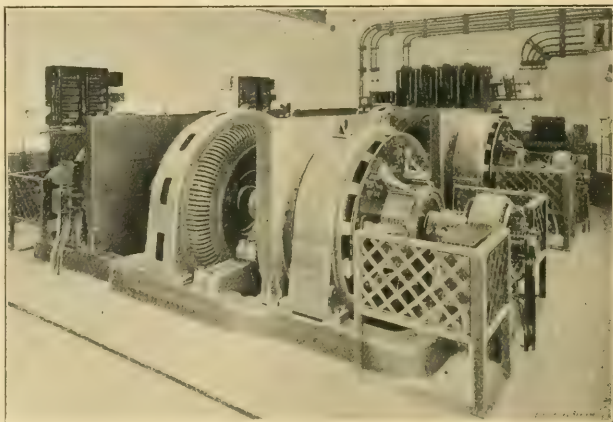
The contact elements are of the same metal as the trolley wire, so that current passes from copper to copper.

The air brake equipment is practically the same as that used on steam locomotives except that motor-driven air compressors are used to furnish compressed air. Aside from the air brakes, compressed air is also used for signals, whistles, bell-ringers, sanders, flange oilers, pantograph trolleys, part of the control equipment, and on the passenger locomotives for the oil-fired steam boilers.

The switching locomotives are of the swivel-truck type, weighing 70 tons each, and equipped with four geared motors; a single pantograph is mounted on the cab. The motors are of the commutating-pole, single-g geared type, designed for 1,500 volts, with an insulation of 3,000 volts to the ground. Many of the switching locomotive parts are interchangeable with those used on the main-line locomotives; for example, the air compressors, small switches, head lights, and cab heaters.

The Montana Power Co.'s transmission lines are carried on steel towers or wooden poles, and tap the railway system at seven different points.

A 500,000 cir. mil. feeder is installed the entire length of the electrification, and a supplementary feeder on heavy grades. The feeder is tapped to the trolley wire at every seventh pole, or approximately every 1,000 ft. On top of the poles is carried a supplementary 4/0 negative feeder, which is tapped to the middle point of every second² reactance bond. These bonds are used for insulating the 60-cycle signal circuits, and are installed at points averaging from



2,000-KW. 2,000-VOLT D.C. 2,300-VOLT A.C. SYNCHRONOUS MOTOR-GENERATORS,
MOREL SUB-STATION.

5,000 to 6,000 ft. apart. With this completely interconnected transmission system, each sub-station may be fed from either direction and also at the tie-in points from a third source of power.

Fourteen sub-stations are distributed at average intervals of 32 miles. Each station contains step-down transformers, motor-generator sets, switchboard and the necessary controlling and switching equipment, the plant aggregating 59,500 kW. in 32 sets. The transformers receive the line

current at 100,000 volts and supply the synchronous motors at 2,300 volts. Each synchronous motor drives two 1,500-volt, direct-current generators connected permanently in series, thus supplying 3,000-volt current for the locomotives. The fields of both the synchronous motors and the direct-current generators are separately excited by small direct-current generators direct connected to each end of the motor-generator shafts.

The overhead construction is of the modified flexible catenary type designed by the General Electric Co. (U.S.A.), comprising two 4/0 copper wires flexibly suspended side by side from the same steel messenger by independent hangers alternately connected to each wire. Bracket construction is used wherever the track alignment will permit, and cross span construction on passing tracks and in the switching yards. All of this work is supported on 40-ft. wooden poles suitably guyed and spaced.

Electric locomotion has been undertaken with the expectation of effecting a sufficient reduction in the cost of operation to return an attractive percentage on the investment required; about \$12,000,000,00 will be expended, and with the work more than half completed there is every reason to believe that the cost of construction will come inside the estimates.

A summary of the advantages which will be derived is as follows:—

Marked reduction in cost of electricity as compared with cost of coal.

Reduction in maintenance cost of locomotives.

Elimination of delays due to coaling, taking water, oil, &c.

Elimination of delays due to natural causes, such as freezing of locomotives, loss of steam in cold weather, bucking snow drifts.

Elimination of non-revenue trains hauling coal and water for steam locomotives.

Increased tonnage per train; increased train speed on grades.

Greater reliability and certainty of maintaining schedules.

Reduction in train crew hours per ton-mile.

Reduction in damage to rolling stock due to rough handling by steam engines.

Greatly increased safety of operation on grades due to regenerative braking. Saving in power and reduction in wheel and track wear by use of regenerative braking.

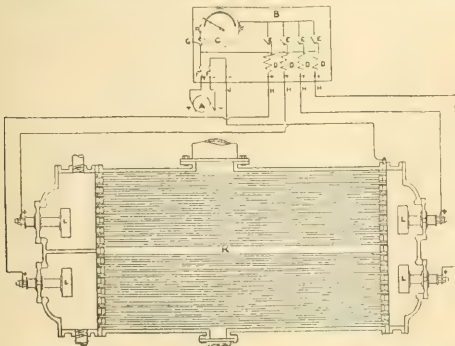
Improvement of tunnel conditions, uniform speed and absence of grinding brake shoes on grades.

In conclusion, we are indebted to the General Electric Co., of New York, and British Thomson-Houston Co. for the particulars and illustrations contained in the above article.

PREVENTION OF CONDENSER CORROSION.

In a paper read by Mr. J. F. PETER, before the Institute of Marine Engineers, the author described the Cumberland electrolytic method of preventing corrosion in condensers, boilers, &c.: an abstract of his remarks is as follows:—

The most widely held present-day theory is that electro-chemical action is the cause of corrosion, and it is not a



A, motor generator; B, switchboard; C, ammeter; D, adjustable resistances; E, two-way switches; F, double pole switches and fuses; G, bus; H, wires from positive pole to electrode; I, wire from negative pole to tube plate; K, surface condenser; L, electrode.

FIG. 1.

matter of surprise to learn that this theory embraces and overlaps many others previously put forth. Galvanic activity is now found to play the primary part in this deterioration of

metallic structures; therefore, the author wishes to confine attention to the preservation of metals in contact with water and other corrosive liquids, and to briefly describe an effective method of eliminating this evil and, incidentally, keeping the protected surfaces free from deposit of any kind.

This action is not only existent in cases of distinctly dissimilar metals, as we generally regard them: iron and steel contain other elements, the presence of which imparts special properties fitting the iron and steel for specific purposes. It is found that these incorporated elements in conjunction with the surrounding fluid, cause corrosive action by forming microscopic galvanic cells.

Galvanic action also occurs between the harder and softer portions of a similar metal comprising the structure. This is met with in parts of boilers which have been flanged, caulked, hammered, or stressed in any way, either during manufacture, or by reason of unequal working strains. The harder or stressed portions are found to be electro-positive to the softer or unstressed portions, and this may account for the grooving and pitting met with in various types of steam

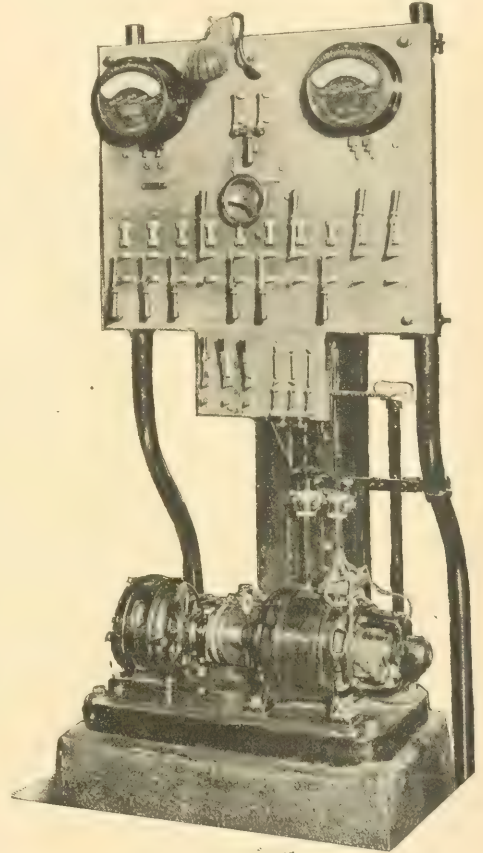


FIG. 2. GENERATOR AND SWITCHGEAR FOR CUMBERLAND PROCESS INSTALLED AT BROOKLYN NAVY YARD, U.S.A.

boilers. It is also noticeable in the case of copper pipes where they form bends, and have been subjected to working and hammering in the course of manufacture, and may show up as pitting over certain areas, or grooving, according to the manner in which the material has been strained.

Thermo-electric couples also exist, due to variations of temperature, and evidence of this is to be found on the water side of the furnaces of marine boilers, along the line of firebars.

Much of the corrosion in hot-water pipes, heating systems, &c., is due to electrolytic action between the hot and cold portions.

The question of perfect non-ferrous alloys has been a subject of much research, and it is found that mechanical mixtures are often produced instead of the desired true alloy, or chemical compound.

The very prevalent corrosive action which causes the failure of condenser tubes manufactured from an alloy of copper and zinc produces minute pinholes extending right through the tubes, and in other instances patches of various dimensions become weakened and ultimately develop cracks and break

...that the zinc has dissolved, leaving the copper unsupported. The latter is a very short one. The principle of the electrolytic theory, let us consider the reason why some methods which are adopted to check corrosion prove futile, while others are effective. The question resolves itself into preventing the corrosion cells from coming into existence. To do this, two conditions are necessary: first, a complete cell, and the presence of an electrolyte; therefore, if we eliminate one of these factors, or overpower it by some means, the action will be prevented.

It will be recognised that all attempts to obtain a perfectly homogeneous metal are doomed to failure in a practical way, when we bear in mind that the dissimilarity which gives rise to the formation of electric couples may be physical or chemical, and that the operations necessary for manufacturing the parts of most structures considerably affect the regular crystalline formation of the metal.

The next method that suggests itself is raising the resistance of the electrolyte. By increasing the specific resistance of this part of the circuit, the current flowing in each cell is lessened, and corrosion proportionately lessened.

So the plate Davy, slabs of pure zinc, placed in contact with the metal to be protected, lessen corrosion, and this method is not resorted to by many engineers. This method is not very effective, the reason being that

with the inserted iron as anode. A similar arrangement is applied to boilers.

The Cumberland process has overcome most obstinate cases of corrosion, and it was also discovered that it had a remarkable effect in decomposing and removing hard scale in boilers. It has been adopted on a large scale by shipping companies; the Union Steamship Co., of New Zealand, has all its boilers equipped, and a number of the White Star vessels have it fitted to their boilers and condensers; it has also received the approval of the Inventions and Research Committee and is being fitted to H.M. ships.

The apparatus as fitted to the average steamship consists of a compact type of rotary converter receiving its electric supply from the ship's mains and giving a continuous current of sufficient amperage at eight to ten volts. The switchboard may be fixed near to this machine, and the current supplied is distributed to the various units by electric cables suitably protected from injury.

The amperemeter, mounted on the switchboard, is of the moving coil type, and so arranged that the amount of current passing to each individual unit can be measured; this amount may be regulated by the adjustable resistances fitted on a frame at the back of the board.

The amount of current found necessary to ensure protection from corrosion varies somewhat. In the case of surface condensers, one ampere for 500 sq. ft. cooling surface is found in practice to afford complete protection. Take the case of a surface condenser containing 6,000 sq. ft. of cooling surface; the amount required will be 12 amp. at 8 volts, equal to 96

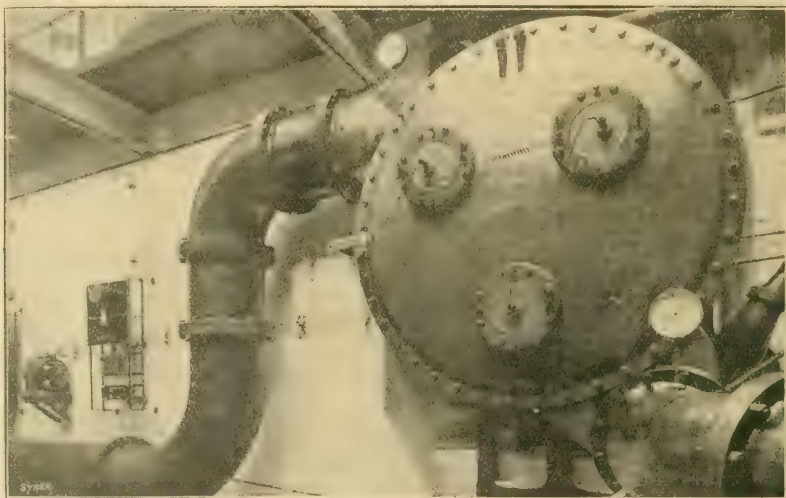
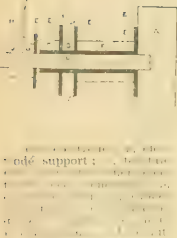


FIG. 1. CUMBERLAND SYSTEM APPLIED TO CONDENSER, BRIGHTON ELECTRICITY WORKS.

the zinc soon becomes coated with the products of corrosion which are electro-negative to the structure. It, therefore, rapidly loses its power to protect, and subsequently reversal of polarity occurs, and if the zincs are not frequently renewed, the result will be accelerated corrosion of the structure, instead of protection.

Mr. Elliott Cumberland has devised and perfected a system whereby an unlimited supply of protective electrical force can be introduced to overcome corrosive action. The apparatus consists of a low-tension dynamo, generating a 6 to 10-volt continuous current, and pieces of metal, preferably iron, suspended in the water contained in the vessel to be protected and suitably insulated from it.

Figs. 1 and 4 show the Cumberland equipment fitted to a surface condenser of the usual type with the circulating water passing through the tubes. It will be noted that the iron electrodes or anodes are supported by the steel stud 'b' (fig. 3), and insulated from the condenser door. These electrodes are connected through the adjustable resistance 'd' and two-way switches 'e' (fig. 1) to the positive terminal of the generator. The body of the condenser is connected as shown to the negative terminal. An amperemeter 'c' is fitted on the switchboard, and the supply of current can be regulated to the anodes with the aid of the resistance coils 'd'.

The common cause of failure of condenser tubes is galvanic action brought about in various ways, such as dissimilar metals in juxtaposition, the presence of carbonaceous matter in contact with the tubes, or difference of electrical potential due to variations of temperature, &c. This action is rendered ineffective by introducing a superior E.M.F. from an external source and ensuring that the flow of current is from the inserted electrode through the liquid on to the surfaces to be preserved—the whole of the condenser surfaces in contact with water becoming the cathode of a strong artificial cell,

watts at 1d. per kw.-hour. This would cost roughly £1 15s. per year running continuously.

The number of anodes fitted to a condenser of these dimensions would be six, each weighing 20 lb. As these would require renewing each year, the amount of iron consumed would be less than 120 lb., at the outside cost of 15s. to cover casting and drilling. Therefore, the total annual expense would work out at £2 10s. for a condenser of these dimensions.

Where only the question of corrosion has to be dealt with in boilers, it is found that considerably less current is required than 1 amp. per 300 sq. ft.

One of H.M. cruisers having 12 Yarrow water-tube boilers, with a total heating surface of 49,500 sq. ft., or 4,125 sq. ft. per boiler, was fitted with the process, and on the above basis it was decided to supply 14 amp. per boiler. The engineers found in actual practice that all corrosion was arrested and heating surfaces kept clear of scale by using about 1 amp. for 800 sq. ft. of heating surface. The anodes in these boilers consisted of two 7-ft. lengths of 3 in. x 3 in. bar iron, fitted in the steam drums of each slightly below the water level, and their life will be considerably more than two years.

[We may add that the process has been adopted by several electricity supply undertakings in connection with condensers, economisers, &c., and is in use on large land boiler installations as well as on the vessels of many well-known shipping concerns.—EDS. ELEC. REV.]

Japan's Electric Lamp Business.—According to the Acting British Consul-General at Odessa, electric lamps (bulbs) and appliances, formerly supplied by Germany to the Russian market, are now being supplied in large quantities by Japan.

CORRESPONDENCE.

Letters received by us after 5 P.M. on TUESDAY will appear in the following issue. Correspondents should transmit their communications at the earliest possible moment. No article can be published unless we have the writer's name and address in our possession.

Cab Whistles and Lamp Calls.

Now that whistling for cabs is at last to be put down, to some extent in London at any rate, perhaps sign-makers, contractors, and others will wake up to the fact that it is quite feasible to arrange over the portico or entrance of a building, a lamp signal which will give a silent call by day or night.

All that is wanted is a neat double-faced sign-case of distinctive shape, with two or three coloured lamps in it, and adequate switching arrangements whereby one, two, or three of the lamps can be turned on from one or more points (with or without a repeating lamp indicator) inside the building. The one, two, or three lamps would correspond with blasts on the whistle; and not so long ago would have signified taxi, hansom and growler. Nowadays possibly two lamps would suffice to signify taxi and private car, or perhaps one lamp only. Whatever the number of lamps, up-to-date methods of switching provide various convenient ways of turning the lights on and off from various points; and the use of indicating lamps prevents confusion. We published various methods some time ago, and a simple one for two lamps may be described briefly as follows:—A lamp indicator in the entrance and another in the office (of the hotel or club, &c.) shows the condition of the sign. As soon as a cab draws up, the man at the entrance switches off the call. Either he or the office can then start another call. Before signalling a call, the office waits till its indicator shows blank.

There are various simpler or more elaborate arrangements; and a little reflection will show that the idea constitutes a notable addition to the numerous convenient minor applications of electricity. Something of the kind is already in limited use we believe.

A. P. Lundberg & Sons.

London, N. August 18th, 1916.

Induction Motors on Circuits of Different Frequencies.

I should like to express my thanks to your correspondent "A. B. J." for his most interesting reply (published in your issue of August 11th) to my previous letter dealing with the above subject.

It is apparent from his remarks that in order to make sure of the behaviour of each machine, running on different frequencies, the only satisfactory method is to place the motor on the test bed, unless records of the individual design are available.

I should also judge that, as a rule, it is better to run a 50-period machine, say, of 200 volts on a 60-period supply, rather than *vice versa*, providing the mechanical design be substantial—and, in fact, that one might safely take a 50-period machine of a reputable make, and have little to fear of the behaviour of same on a 60-period supply of the same voltage, expecting, however, that the power factor might be slightly lowered. Presumably, in any case, machines of, say, 1 H.P. and under, can quite satisfactorily run under conditions specified.

I am told that it has been the practice with Continental manufacturers to import into this country, machines designed for 50-period circuits, and sell for either 40, 50, or 60-period ditto. If this is the case, I presume from "A. B. J.'s" explanation, that under such circumstances it would be evident that special attention must be given to the mechanical design, to allow of use on higher periodicity, with consequent higher speed, also that the saturation point of the iron is not exceeded, and that the ventilation is sufficient, even at the lower frequency.

To sum up, I deduce from "A. B. J.'s" kind explanation that it would be fairly satisfactory to vary the frequency and voltage on single-phase circuits, within reasonable limits, providing the machines were *generously* designed.

Practice.

The Channel Tunnel and Telephone Cables.

In view of the great importance of the subject, I venture to remark that the letter of Sir Douglas Fox and Partners, which you quote from *The Times*, does not indicate a full appreciation of Dr. Fleming's suggestion that *ample provision* should be made for telephonic and telegraphic cables in *any* plans for such a tunnel.

As a conduit for telephone cables the tunnel has always been of interest to telephonists. Some years ago, when the prospects of its construction were by no means brilliant, Mr. F. R. Welles, who has an exceptional knowledge of Continental telephony, wrote me on the subject. If I remember rightly, he argued that the telephonic value of the tunnel might be an important factor in determining upon its construction. Now that there is greater prospect than ever before of its becoming an accomplished fact, it is well to emphasise this importance, and to avoid the possibility of the designs being completed without full inquiry as to the ample provision which Dr. Fleming advocates.

Perhaps it may be permissible for me to quote from my "Telephone and Telephone Exchanges," which you reviewed on April 21st last, the following very brief statement of the principal effects.

Telephonically Great Britain is not separated from Europe by the Channel. Submarine cables as at present constructed limit

the distance of speech; but suppose that a dry-core cable suitable for submergence be evolved, or that the Channel Tunnel be completed, the talking distance will be extended, the cost reduced, and the number of communications increased." (Page 410.)

In quoting Dr. Fleming above, I have italicised the words.

It is probable, however, that some gentleman, hitherto an acquaintance of his communication. Only expert telephone engineers familiar with traffic developments would be able to determine what is ample provision, and to indicate how the plans for the tunnel should be modified to meet the requirements.

In making such estimates, the engineers would take into account the larger area of the Continent which would be brought within speaking distance of Great Britain by reason of the improved transmission that would result from dry-core cables laid in the tunnel, and the probable growth of traffic which would be obtained within the period contemplated before a second tunnel would be built. The results of such estimates would have their influence on the designs of the tunnel, and it would be unfortunate if they were omitted to be made by those who are specially qualified.

The construction of the tunnel must, of course, be primarily determined by its profit-earning capacity as a means of physical transit, but the money value of the facilities afforded for conductors of speech, and messages might eventually be found to be of material importance in estimating the Tunnel Co.'s net revenue.

The estimates should be prepared in advance, and would have their effect upon the designs. It would be unfortunate if the very important question of telephonic communication were regarded as too much of a side issue, and dealt with in a haphazard way.

J. E. Kingsbury.

7, Serjeants' Inn, Temple, London, E.C.

August 24th, 1916.

"Whither are We Drifting?"

After reading many articles and much correspondence in the technical and lay Press concerning the awakening of our national faculties towards scientific education and economic development, I, as a wage-earner, am wondering whether my class, so well verbally flogged for its inefficiency, will receive any encouragement for an increased technical ability and skill when the great awakening shall arrive.

In pre-war days we were flooded with evening school prospectuses, and we were confronted each week with the advertisements of numerous correspondence schools, promising prodigious increases of earning power after their special treatment. Many men spent strenuous hours to improve a poor general education, and in getting a sound knowledge of their business. When this knowledge has shown itself, their superiors, or employers, often much less instructed, have dubbed the manifestations "Perkinisms," and with the usual snobbery of the lower middle classes, have barred the men from opportunities of further experience, the very food of efficiency. Nothing more calculated to make stationary a man's market value, can be practised, and the victims, not disgraced, but merely disappointed, pursue knowledge for its own sake.

These generalisations do not apply to chiefs and leaders whose knowledge and ability is a lustre to their positions and a shining light to the profession. These men invariably encourage latent ability in their staff or workmen, but it is otherwise with those whose value is potential rather than intrinsic.

Much must be done to ensure an open passage for the aspiring worker, and many years will pass before the profession can be cleared of the wretched limpets who, in a well-ordered community, would most probably be pushing a barrow.

Monk.

LEGAL.

MUNITIONS COURT CASES.

At the Monmouthshire Munitions Court, sitting at Newport on August 15th, according to the *South Wales Argus*, Reginald V. Powell summoned the Newport Corporation, his employers, for unreasonably refusing to issue a leaving certificate. His complaint was that he objected to a man being made senior switchman attendant over him while he was put as switchboard assistant, which was a drop in his position. He gave a week's notice in writing. He had been in this employ 18 months and objected to a young man who had only been employed there three weeks being made his senior. If they would put him on the same footing he would remain. In reply to the Chairman, Powell said that he went as a temporary switchboard attendant at 30s. a week, but had recently received an increase. If he had not seen, on the pay-sheet, the other man described as "senior" he would not have complained. He was told that that was a clerical error, but could not get any information. The man he complained of received the same wages as he. The defence was that both men were seniors. The application was refused.

At the same Court, James Tutton was summoned for absenting himself from work on July 22nd and 23rd, and leaving his employment on August 1st. Mr. Frank Quick, National Union of General Workers, defended. Mr. A. Nicholls Moore, borough electrical engineer, Newport, proved that defendant was absent without permission. He was assistant coal plant attendant. He had been employed there since September.

1015. They had a very small staff indeed, and the coal plant was one of the most important. There was no actual shortage in this case, no other man having been obtained. Their allegation was that the reason of his absence was for the purpose of drinking. Their work was important to numerous factories engaged on war work.

According to the report in the *South Wales Argus*, Mr. Quick pleaded guilty, but suggested that there were extenuating circumstances. The man was under the impression that he could leave when he liked, and did so because of certain anomalies in his position as compared with some of the other workmen. He was paid the standard rate of 31s. 6d. a week.

The Chairman said men must realise that all rules as to leave had been suspended. They must realise the importance of the work they were engaged upon. Inasmuch as he had returned, he would only be fined £1, payable in four weekly instalments.

At Newcastle-on-Tyne Munitions Court, on August 18th, Albert E. Pryke, an assistant engineer employed by an electrical company, applied for a leaving certificate. He stated that he was now a qualified electrical engineer, and he would have no difficulty in obtaining a berth at £2 10s. or £3 per week, whereas his present wage was only 30s. He had been told that if he left they would bring him back between two soldiers. At that time, he alleged, the firm was not controlled, and he had therefore been detained by deliberate and wilful misrepresentations and threats.—Mr. Cusworth, the manager of the company, strongly objected to the terms "deliberately and wilfully misled," but admitted having told Pryke that he could not leave. Pryke was the kind of young man who came to pick up all the information he could in order to better his position as an electrical engineer.—The application was refused.

THEFT.

At West Ham, last week, James Benjamin Phillips, Westminster, and Alfred Berry, East Ham, electricians, were charged on remand with stealing a quantity of wire and other electrical fittings, valued at £6 6s., the property of the Midland Railway Co. According to the *Morning Advertiser*, Mr. Swarbrick, who prosecuted, said that Phillips was employed by the company as foreman in charge of the electrical department at Plaistow, and Berry was engaged under him. It appeared that at the beginning of July Phillips entered into a contract with a man, named Byers, to fit up a shop in High Street, Plaistow, and he had been working there, with Berry, during the hours they were employed by the company, and they had been using material which belonged to the company.—Detective-Inspector Childe deposed to stopping Berry in High Street, Plaistow, carrying a roll of wire, and when he was questioned he made a statement which showed that he was taking it to a shop, where he was working under the instructions of Phillips. When the shop was visited it was found that it had been almost completely installed with electrical fittings which belonged to the company.—Berry pleaded that he was innocent of any knowledge of the theft.—Berry was discharged, and Phillips was sentenced to six months' hard labour.

WAR ITEMS.

Iron and Steel Trades and German Dumping.—Mr. John Hodge, M.P., addressing a meeting of iron and steel workers at Newport (Mon.), on Sunday, said that in 1898 he proposed a scheme to prevent the dumping of German and American steel into this country. At present 10 or 15 millions of pounds sterling had been expended on new plant, and after the war no German or American steel should be imported. Whether this result was achieved by means of a prohibitive tariff, subsidy, or bounty, he did not care, but we must keep the whole of the new plant erected going for, if not, the money would be taken from the pockets of the British working men. When he contemplated the barbarities of the enemy he could never shake Germany's blood-stained hand after the war.—*Morning Post*.

Enemy Goods in Australia.—A Reuter dispatch from Melbourne, dated August 19th, reports Mr. Hughes as stating that enemy goods imported before the war were still being sold. The Government had decided that wholesale houses must not sell such goods after September 30th, nor retail houses after November 30th.

The British Mannesman Tube Co.—In reply to a question in the House of Commons last week, it was stated, for Mr. Runciman, that the British Mannesman Tube Co., Ltd., was a controlled establishment under the Munitions of War Act. The right to transfer the shares belonging to enemies had been vested in the Public Trustee, who had now completed negotiations for their sale.

Australian Metals.—Mr. Hughes, Prime Minister of Australia, has announced his intention to issue a regulation as an additional safeguard against the metal industry falling into enemy hands, prohibiting any contract for the sale of mining or metallurgical business to any person other than a British subject.—*Morning Post*.

To be Wound Up.—The latest list of companies ordered to be wound up includes the following:—

F. Turpitz & Co., 150 & 151, Fenchurch Street, London, E.C., iron and steel merchants. Controller: P. Woodthorpe, 1, Leadenhall Street, E.C.

Haberecht & Co., 75, Parade, Birmingham, export hardware merchants and factors. Controller: W. S. Aston, 45, Newhall Street, Birmingham.

Enemy Businesses Wound Up.—In reply to a question in Parliament, Mr. Petyman stated that orders had been made under the Trading with the Enemy Act in respect of 312 businesses belonging to enemy aliens, of which approximately 50 were carrying on manufactures in the United Kingdom.

Export Prohibitions.—A special Supplement to the "Board of Trade Journal" for August 17th contains a detailed list of "Prohibitions of Export in Force in the United Kingdom and in certain Allied and Neutral Countries."

Export Trade Prohibitions.—In the "London Gazette" for August 22nd there appear further lists of persons and bodies in the following countries with whom or which trading is prohibited:—Argentina and other South American States, Denmark, Netherlands, Norway, &c.

Additions to the list of firms, &c., in China to whom exports may be consigned are also published in the same issue.

Manchester War Charities.—The collections on the Manchester Corporation tramcars, which were started soon after the outbreak of war, to assist war charities, have now been suspended for a time. It is announced on the cars this week that the total amount collected for various war funds to date is £24,032.

The Board of Trade.—In reply to a question in Parliament by Sir E. Cornwall, Mr. Asquith said that active steps were being taken with a view to placing the Board of Trade in a position to deal effectively with post-war economic and commercial problems, but he was not now in a position to go into details. In regard to a Minister of Commerce, no good object would be attained by the multiplication of Ministers.

Lighting Restrictions.—When Charles Beckett, a Blackpool Corporation train-driver, was summoned at the local Police Court for a breach of the lighting regulations, it was explained that the conductor had charge of the car lighting regulations, and not the driver. This view was corroborated by the chief inspector, who said the conductor was solely in charge of the car's arrangements. The Magistrates' Clerk held that both were responsible, and he advised the Chief Constable to proceed against both on the next occasion. The driver was fined 20s.

German Ordinance re Contraband.—In the "London Gazette" for August 18th there is printed at length a translation of a new Ordinance signed by the German Emperor declaring various articles contraband of war. These articles include electrical supplies for use in war, submarine sound signalling apparatus, searchlights, lathes, machinery, aluminium, and many other manufactures, metals, &c.

Absentee.—At Newcastle-on-Tyne Police Court, on Friday last, Ernest Raffield Freeman, electrical engineer, was charged under the Military Service Act with being an absentee.—Defendant said he did not know really whether he was an absentee or not, and asked for an adjournment in order that he might instruct a solicitor.—The Bench declined, and imposed a fine of £1, at the same time ordering him to be handed over to a military escort.

Exemption Applications.—Before the Bucks Appeal Court, Gen. Sir G. W. A. Higginson, of Marlow, answered an appeal by the Military against exemption granted to his electrician, Wm. Bridgen. The Military representative said it was a question whether the man was indispensable, but as he was over 40, and was passed only for home service, he left the case to the Tribunal. Ultimately the appeal was withdrawn, with the consent of the Tribunal.

An appeal for the exemption of Mr. O. Wokey (37), assistant foreman at the generating station at the Aberdare U.D.C. electricity works, has been refused by the Local Tribunal.

Before the East Kent Appeal Court, on August 11th, Mr. W. Marshall (25), electrician, of Brookland, Romney Marsh, appealed on the grounds of domestic and financial hardship, but exemption was refused.

Maidstone Tribunal, on August 15th, conceded conditional exemption to Mr. F. E. Graefe (24), secretary to the municipal tramway service.

The Farnham (Surrey) Tribunal, on August 17th, granted a final three months' exemption to Mr. E. Banwell (33), electrical engineer, of Hindhead.

At the East Kent Appeal Court, Mr. W. H. Glendinning (39), electrician in charge of an installation at a private residence at Broadstairs, appealed, and was given until November 30th.

Before the Bucks Appeal Court, Sir J. Bell, of Stoke Poges, High Sheriff for the County, appealed for Frank Lavington (40), who attends to the electric light plant at his house. Exemption was allowed whilst Sir John is High Sheriff.

At Bideford, on August 12th, Messrs. Stevens, Brain & Co. applied for exemption for Robert H. Grant, electrician. It was stated that the man had put his name down for mun-

tion work, but the firm protested, and, as a result, the Munster of Munitions decided not to take him away from his employment. Exemption was refused.

Mr. Arundell, electrical engineer, of Maidenhead, appealed to the Local Tribunal, on August 15th, for Walter Sibley (30), electrician, the only man left capable of dealing with a particular class of work in the erection of electrical machinery, and who will be engaged on work at Aldershot Camp. He was exempted until November 1st.

On the Appeal of the Corporation electricity and tramway departments, Gloucester Tribunal has conditionally exempted a wireman and two tramway inspectors.

The Llanfair Electric Light Committee appealed at Llan-fyllin for exemption for John Fred Arthur, who has been specially trained to look after the electric light system. It was stated that the Committee could not get another man to do the work. The Tribunal decided to put the case back for the Committee, who were not represented, to be personally represented.

Brighton Tribunal has granted six months' exemption to an electrical engineer and contractor (36), all of whose men have been "badged."

At Carshalton, Mr. S. J. Evans asked for the retention of his electrical fitter, aged 32, and said that he had been unable to fill the place of the man, who carried out work of national importance. His staff of five men was reduced to two. A final month was allowed.

Mr. Furness, electrical engineer and tramway manager, Blackpool, asked for conditional exemption until the end of the season for 12 motormen, one track supervisor, and a skilled mechanic in the electricity department. He had the authority of a special resolution of his Committee to appear. Twenty motormen were going from the department within the next 14 days, and if these men for whom he asked were also taken it would mean withdrawing 15 or 18 cars from a service which it was taking the department all their time to maintain. If any motormen over age had been dismissed, it was because of serious irregularity, which could not be condoned. Application allowed.—Application was also made at Blackpool on behalf of a working foreman and electrical engineer. Conditional exemption was allowed to each, with the condition of joining the V.T.C.

At Great Harwood Tribunal, on August 17th, Mr. P. Haworth applied on behalf of a doctor for his chauffeur and electrician, who looked after his electrical plant. He did not think a woman could do the work efficiently. Final exemption to October 30th.

At Oldham, the Empires Theatre Co., Ltd., appealed for the head electrician of their five theatres—a married man of 40—and exemption until October 1st was granted, the firm to try to release him by that date.

At Accrington Tribunal, on August 18th, Mr. Lupton appealed on behalf of an electrician, single, aged 24, who was the only armature winder available. It took several years to make a man competent to do this class of work. October 31st, final.

Mr. Pilling, manager of the Accrington tramway undertaking, appealed for two motormen and an electrician, all married. He said that motormen were necessary, and hoped that the Tribunal would release the men rather than compel him to employ women drivers. Conditional exemption was granted under the public utility instructions.

The *Daily Telegraph* states that two officials of the Institution of Electrical Engineers—the accountant and editorial assistant—have been granted four months' exemption by the Westminster Tribunal.

The Llandudno Tribunal has granted conditional exemption to George Sowter, assistant engineer at the electricity works, the chief engineer having stated that his services were indispensable to the conduct of the undertaking.

At Bermondsey, Benoit Lejeune, Ltd., electric welders, applied for the exemption of an electric welder and factory manager, and for an engineer and workshop manager. The latter was 24 years of age, and registered as a "barber." He had already been granted two months' extension as a "barber" by the Southwark Tribunal. The Mayor: How did he learn this trade—by singeing hair? Applicant: I suppose at the time he registered he was a barber, and came to me afterwards. He is a very good man, and had previously been in the trade. The Mayor: He is a general utility man. Ald. Bulmer: Then he will be of use in the Army. Applicant: If he had not been a good man I should not have appealed for him. One month's final exemption was granted in each case.

American and Japanese Shipbuilding.—An American Commerce report says that at present the U.S., for the first time in over half a century, is not only building more merchant shipping than any other country, but the American output for the year 1916 will probably exceed that of all the rest of the world. The report also states that the shipyards of Japan are fully occupied with work for two years, and have reluctantly been obliged to decline foreign orders in order to supply their own shipowners.

REVIEWS.

The Theory of Electricity and Magnetism. By W. S. FRANKLIN and B. MACNUTT. London: Macmillan and Co., Ltd. Price 8s. 6d. net.

This work is described as a text-book for colleges and technical schools, and it possesses several somewhat novel features. The authors have endeavoured to limit the purely mathematical aspects of the subject and to keep physical things always clearly and vividly in mind; or, in the phraseology of the preface, "The character of the treatment in this book has been determined throughout by the desire to keep the student's mind jammed up tight against physical things." Accordingly we find that in discussing electromotive force, electric fields, electric oscillations and electric waves, and so on, mechanical analogies are freely used, arranged in parallel columns, so that the student who has already a knowledge of mechanics may find less difficulty than he otherwise would in bringing to his mind definite ideas of the more abstract electrical conceptions. For instance, in dealing with the electromotive force required to make a current increase we find, set down in columns side by side, the following:—

"Imagine a boat moving without frictional opposition; then the propelling force would be used wholly to cause the velocity to increase (to produce acceleration) and we would have:

$$v = \int a \, dt,$$

where v is the propelling force, l is the mass of the boat, and $a \, dt$ the rate of increase of the velocity. If $a \, dt$ is negative it signifies decreasing velocity."

"Imagine a circuit having no resistance; then an electromotive force acting on the circuit would be used wholly to cause the current to increase, and we would have:

$$i = \int \frac{e}{l} \, dt$$

where e is the electromotive force acting on the circuit (of zero resistance), l is the inductance of the circuit, and $a \, dt$ is the rate of increase of the current. If $a \, dt$ is negative it signifies decreasing current."

This sort of thing is largely used, and we must confess to a sneaking regard for it. For many students find little difficulty in obtaining accurate ideas of mass, acceleration, etc., who have much trouble in forming mental pictures of inductance, rate of current increase, and so on. The former lend themselves naturally to better mental conception than the latter.

Another example may perhaps be mentioned as indicative of the method. The starting of a boat is compared to the growth of current in a circuit. In parallel columns we have:

"At a certain instant a constant force e begins to act on a boat, and it is required to find an algebraic expression for the increasing velocity v of the boat, on the assumption that the frictional drag of the water is exactly proportional to i , or equal to ri ."

"At a certain instant a constant electromotive force e begins to act on a circuit, and it is required to find an algebraic expression for the growing current i ."

"If we subtract the force which is required to overcome the backward drag of the water (namely, ri) from the total propelling force e , we get the portion of the propelling force which is used to cause the velocity of the boat to increase. Therefore we have:

$$e - ri = l \, dv \, dt$$

"If we subtract the voltage which is required to overcome the resistance of the circuit (namely, ri) from the total propelling electromotive force e , we get the portion of the propelling force e , which is used to cause the current to increase." Therefore we have:

$$e - ri = L \, di \, dt$$

A chapter which the student will find interesting is that on electric oscillations and electric waves. It opens with a schedule comparing the equations of mechanics and electricity, the former for both translatory and rotatory motion. It then deals with the electric oscillator, the equation of a travelling curve, equation of motion of a stretched string, differential equations of electrical wave motion on a transmission line, the ribbon wave, superposition of waves, reflection, transmission line surges which follow the switching on of a generator and when a circuit-breaker opens, impure and pure waves, immediate effects of wire resistance and poor insulation on a wave on a transmission line, wave distortion, electrical oscillation of a transmission line, moving wave trains, clock diagram of moving wave trains, and forced oscillations of a transmission line. Towards the end of the chapter there are a dozen pages of interesting matter on mechanical conceptions of magnetic and electric fields, in which Maxwell's model of the ether is made use of. A photograph is given showing the shape of the electromagnetic wave which shoots out along a telephone line when the syllable *kink* is spoken into the transmitter. This is really an extraordinary visual demonstration of the complexity and delicacy of such a wave, and when it is recognised that the reproduction of the original sound by the distant telephone receiver depends upon the delivery of this complicated wave, with all its fine detail, at the distant end of the line, the student has vividly brought to his mind the importance of such things as spreading and distortion.

The last chapter, also on the electron theory, gives very clear and concise results, the diagrams illustrating the theory and answers at their ends. Speaking generally, the book will be found most useful by advanced students who have already done some work in the laboratory. One of its best features is the clearness and appositeness of the diagrams, of which there are more than two hundred.

The Year Book of the Wireless Telegraphy, 1916.
London: The Wireless Press, Ltd. Price 3s. 6d. net.

This truly remarkable annual is now in its fourth year of publication, and it is difficult to commend it sufficiently without going into extravagance of language which might defeat its own object, at any rate so far as concerns those unfortunates who have hitherto overlooked the existence of this work. It is hardly necessary to say that this is the standard work of reference on all matters pertaining to wireless services and facilities. It is authoritative and surprisingly complete considering that this is the second "war number." It is remarkable value for money, and we trust its price will always remain as low, for though it is a volume for which one might reasonably be asked half-a-guinea or more, it doubtless reaches a much wider public and does proportionately more service at its present price. Among the regular features of the year-book which are still retained and, when necessary, brought up-to-date, are the almanac and various calendars, the record of wireless development, the list of useful formulae and equations, data and tables, the glossary and five-language dictionary of technical terms, and the reference and technical sections, and special contributions, concerning which more must be said.

In regard to the International Radio-Telegraphic Convention, the text of which is reprinted in the reference section, it may be remarked that Germany, who took a predominant part in the debates leading to the various regulations, systematically eluded the latter in time of peace, and has treated them on her usual international basis since the outbreak of war. A very valuable addition to the collection of laws and regulations peculiar to the various countries in which wireless telegraphy has been developed is an ingenious and complete index, which immensely facilitates reference to this section. The well-known list of land and ship stations now occupies 273 pages, and is as complete as permitted by present circumstances. The tables specify the call signal, normal range, wave length, and service particulars of shore and ship stations, and there is also an alphabetical list of call letters. We would again suggest that technical particulars concerning the equipment of the stations be added wherever possible, and, personally, we should prefer the special notes now collected at the end of each table or list to be set as footnotes on the page concerned.

Special contributions have always been a feature of this publication, and this year there is a very admirable collection (all new and specially contributed), including a fascinating article by Prof. Fleming on photo-electric phenomena, which is much more readable than its title might suggest. Mr. Arch. Hurd's essay on intelligence in naval warfare deals well with the possibilities of the subject chosen by that well-known expert, whilst Col. Maude's review of the Allies' strategy in 1915 will be read with the keenest interest and appreciation from end to end, though it must be confessed it contains little of "wireless" interest. A third article of interest to the general reader is an outline of radio-telegraphic progress under the title of "Long Distance Services." Among the more highly technical contributions must be mentioned Dr. Eccles' demonstration of the dictum that a knowledge of the wave lengths of an antenna is of greater practical and experimental importance than a knowledge of the electrostatic capacitance. This paper includes a number of original and instructive abacs.

There is a totally inadequate appreciation in this country of the remarkable progress which has lately been made in the field of radiotelephony. How many electrical engineers, let alone laymen, realise that on September 28th last wireless telephonic communication was established across the American continent from Arlington to Hawaii, a distance of nearly 5,000 miles, whilst on October 26th communication was effected by the same means between Arlington and the Eiffel Tower? Whatever may have been done in Europe during the past two years, the published record of wireless telephonic progress is almost entirely confined to the United States, and a good statement of this progress is included in the year-book. Other technical matter included comprises the report of the B.A. Committee for Radiotelegraphic Investigations, a valuable contribution by J. L. Hogan on the measurement of signal intensity, and an article by P. W. Harris on the problems of interference. The latter article is particularly instructive, and should be read by every operator and general reader alike. "Wireless Waves in the World's War," by H. J. B. Ward, is an interesting collection of war incidents in which wireless telegraphy has realised and exceeded the expectations raised on its behalf by those who saw far ahead through the difficulties of earlier years.

Very much more might be said in commendation of this book, but its size is such that we can only outline its scope

and testify to its consistent excellence. Dr. Erskine Murray is to be congratulated on the arrangement and utility of the "useful formulae" tabulated under 27 headings. The record of wireless patents, the particulars concerning wireless companies, the biographical notes, the bibliography of wireless literature, and the directory of wireless societies, are of the greatest possible value to all interested in radiotelegraphy. Finally, there is the folding wireless map of the world. The production of the work is as excellent as ever and reflects great credit on the editorial staff, who are, doubtless, pining for the day when the lifting of the war-cloud will permit the full tale and state of wireless progress to be told.

Overhead Electric Power Transmission: Principles and Calculations. By ALFRED STILL, A.M.Inst.C.E., M.I.E.E., &c., Assistant Professor of Electrical Engineering, Purdue University. London: Hill Publishing Co. Price 12s. 6d. net.

The question of overhead electrical transmission has received more attention in America than in this country and, owing to its deceptively simple appearance it is sometimes regarded as a comparatively easy and rather uninteresting subject.

The eight chapters, 310 pages, 115 illustrations, and voluminous appendix of Prof. Still's book prove by their existence that the building of the most economical line is not so simple as it may at first sight appear.

Like all the publications of this firm, the book is well printed, well bound, and contains only a few mistakes. On page 2 we notice "It is not . . . the cheapest . . . articles that wins in the long run." On page 53 occurs the word "cornona," and on page 97 "mutal." On pages 114 and 119 the author seems doubtful as to whether "arrestor" or "arrester" is correct, and a division of opinion between "impedence" and "impedance" is noticeable on pages 23, 68, 90, 114, 126, and 127, there being three cases of each spelling. On page 120 the word "intelligently" appears, and on page 123 "breifly." On page 170 we read that "Mr. H. J. Glaubitz as evolved an equation." Resistance is spelt "resistence" on page 118. On page 126 a parenthesis is left unclosed, and there are one or two other minor errors in punctuation.

As a contribution to the literature on the subject the book has much value. It provides many useful tables of data, and goes thoroughly into the theoretical as well as the practical side of the problem. The author gives reasons for his views, or for procedure that has been adopted in laying down systems, and explains the method of arriving at results. We are not confronted, as is too often the case, with pages of intricate mathematics followed by the bland remark, "This is a matter which must be largely left to the discretion of the individual engineer."

The economic side of the subject is never lost sight of, and the engineer is recommended not to try experiments, for instance, in voltages higher than may be justified by commercial considerations. At the same time, he is advised not to follow the fad of the day, but to think for himself.

The use of the unit "circular mils per ampere" does not appear to be attended by any advantage at all commensurate with the labour of discovering exactly what it means, and we do not see why Prof. Still is so fond of the horse-power. Surely we can shed this unit from purely electrical work, if not from steam and gas engineering. On page 56 mention is made of the cost of a generating station in dollars per horse-power, followed immediately by a table showing cost of details per kilowatt.

The demonstration of the fact that line losses are inversely proportional to the square of the power factor of the load, as given on page 19, might be simplified thus:—

$$\begin{aligned} \text{Loss} &= I^2 R = \cos^2 \theta \\ I &= \frac{P}{V \cos \theta} \\ \text{Loss} &= \frac{P^2}{V^2 \cos^2 \theta} \end{aligned}$$

where the symbols used have their customary meanings, and are those employed by Prof. Still.

The percentage drop in conductors is more often given in terms of the pressure at the generating, rather than at the receiving, end of the line, and we prefer this practice.

Chapter VI, 14 pages in length, is devoted to a consideration of the Thury system of transmission of energy by continuous currents, said by the author to hold its own in Europe. In spite of its adoption in 1911 by the Metropolitan Electric Supply Co., of London, and the existence of some 15 installations on the Continent, we do not think we should go so far as to agree with him. Prof. Still gives a careful and impartial summing-up of the advantages and disadvantages of the system, and quotes (on page 146) an interesting paragraph from the *Electrical World*, of New York:—

"Any engineer who wanders through one of the large Thury stations and then calls to mind the usual long concrete catacombs bristling with high-tension insulators and filled with dozens of oil switches, scores of disconnecting switches, webbed with hundreds of feet of high-tension leads and spatted with automatic cut-outs, will stop and think a bit before he complacently sniffs at high-tension direct-current transmission."

With the exception of the word "spatted," this fairly expresses the views we had formed on the matter.

Many more interesting points might be taken from the book, such as the consideration of waves on the line; the mechanical testing of insulators by shooting at them with guns; the reference, surprisingly open, to the rigging of the metal market; the cost at which line losses must be reckoned; the disadvantages of the two-phase three-wire system; the arguments for and against the use of protective devices and of apparatus for regulating the power factor of the system; skin effect and its diminution by coating conductors with a thin layer of high-resistance metal; the use of the earth as a return; and the effects of blizzards. Those interested can read of them for themselves.

The book should find a place on the shelves of all those whose work brings them in contact with the subject.

BUSINESS NOTES.

American Electrical Industry.—The total value of products of the electrical machinery industry in the United States increased practically 50 per cent. between 1909 and 1914. A summary of the census of manufactures for that industry in 1914 has been issued by the United States Bureau of the Census. The total number of establishments decreased by 30 in the five-year period, from 1,151 to 1,121; but, eliminating those which make electrical machinery as a subsidiary product, the total number engaged primarily in this industry increased by 21.

Of the 1,121 establishments reported for 1914, 234 were located in New York, 151 in Illinois, 129 in Ohio, 114 in Pennsylvania, 100 in Massachusetts, 83 in New Jersey, 46 in Connecticut, 46 in Indiana, 30 in California, 19 in Missouri, 18 in Minnesota, 17 in Rhode Island, 8 in Colorado, 7 in Maryland, 6 in New Hampshire, 5 in Iowa, 4 each in Delaware, North Carolina, Tennessee, Washington, and West Virginia, 3 in Kentucky, 2 each in District of Columbia, Louisiana, Nebraska, and Vermont, and 1 each in Alabama, Kansas, Oregon, South Carolina, Texas, and Virginia.

The comparative statistics for 1914 and 1909 are summarised in the following statement of values of products:—

Products.	1909.	1914.
Dynamios	\$17,231,804	\$23,233,437
Transformers	8,501,019	13,120,065
Motors	32,087,482	44,176,235
Batteries, parts and supplies	10,612,470	23,402,455
Carbons (including furnace, lighting, brushes, battery, &c.)	1,934,864	3,602,741
Arc lamps	1,706,359	742,142
Searchlights, projectors, & focusing lamps	935,874	2,081,545
Incandescent lamps	15,714,809	17,350,385
Sockets, receptacles, bases, &c.	4,521,729	5,512,609
Electric lighting fixtures	2,200,668	3,383,955
Telegraph apparatus	1,957,432	2,248,375
Telephone apparatus	11,259,357	22,815,640
Electric heating apparatus	1,954,112	4,034,436
Electric measuring instruments	7,800,010	8,786,506
Insulated wire and cables	51,624,737	69,505,573
Other products	66,694,153	115,416,577

Total \$240,037,479 \$359,412,676

U. S. Commerce Reports.

The Dominican Republic.—In a report on the Dominican Republic the American Vice-Consul at Santo Domingo says:—"This country is undeveloped and is said to have a great future. Many opportunities for American skill will offer themselves in connection with the present programme of the Government construction work. There are at present only a few roads and practically no bridges, and the few miles of railroad are often out of commission. Santo Domingo needs a new electric light plant, a street-car system, a new ice plant, and many municipal improvements. Lack of funds is the main cause of delay in carrying the plans into execution. . . . As soon as some system is devised which will ensure a steady revenue from the many sources at present exempted from taxes there will be sufficient money for all improvements." The Consul at Puerto Plata says:—"The present tendency is to purchase nearly everything except a few specialties in the United States, as there are no regular direct steamship connections with Europe. European goods have in most cases to pay the high trans-Atlantic freight rates in addition to the freight from New York, and are further subject to long delays. Germany, which formerly held the second place, was, during 1915, a negligible factor on account of the war, and German products have been in most cases replaced from the United States.

"The character of imports does not change greatly from year to year, since the bulk of them consist of staple articles, such as hardware. In view of the practical monopoly now existing, American exporters can hardly expect to secure a much greater proportion of the business. Increased consumption in the future will be largely dependent upon the further development of the resources of the country, which in turn

will be influenced by the investment of capital. A greater number of American salesmen have visited this territory during the past year than formerly. Manufacturers should realise that such visits are the most effective way to inaugurate business, and that the expenses of a trip to this country are moderate in view of its comparative nearness to the United States. . . . Some small new industries were started, among which may be mentioned a match factory and one or two new ice plants. The company controlled by American capital, which has been furnishing electric light in Puerto Plata since 1913, completed its transmission line to Santiago, and commenced the lighting of that city in December, 1915. The Royal Bank of Canada has established new branches in Santiago and Sanchez which will facilitate commercial transactions. Except these instances, however, no new enterprises by foreign capital have been inaugurated. The country needs the investment of capital and the work of skilled men to direct it."

Catalogues Wanted for China.—H.M. Consul-General at Yunnan-Fu says that the representative firm of British firms established in Hong Kong wants British firms' catalogues and price-lists of water turbines of small power, high-speed steam generating sets direct connected to three-phase alternators of 2,000 volts, 50 to 500 H.P., steam boilers for ditto, telephone exchanges for 50 to 500 subscribers, and many other manufactures of which particulars appear in the *Board of Trade Journal* for August 14th. Communications and catalogues should be sent to the Consul-General, at Yunnan-Fu.

Russian Customs Exemptions for Gold-Producing Machinery. In the list of machinery &c. connected with the gold-producing industry, particularly as regards dredges and excavators, which according to decree of the Russian Minister of Finance and the Minister of Trade and Industry under date June 15th 25th last, are now to be admitted free of duty into Russia are the following are the items that interest the electrical industry:—Dynamo machines, electric motors with cables, and wires and distributing equipment, safety and measuring apparatus, transformers, likewise complete equipment for electric stations situated on the banks of rivers, marshes, &c., or on barges for producing current to drive motors on electric generators, wire, and everything that is necessary to install such a station; all electrical parts of dredges. Generally speaking, the same statement applies to excavators, the lists including electric locomotives, also all manner of boring apparatus, including such, if electrically driven, and all electrical apparatus connected therewith.

This list is specified in more detail in the Government Gazette, and it may be stated in explanation that the object of this modification of the Customs list of the country is to enable the gold producers to obtain foreign-made dredges, and accompanying equipment, cheaper than is possible with the high protective duty that has been set up in order to bolster up the home dredge building and excavator construction industries; so that more gold may be produced, and the country's urgent requirement in regard to the metal may be better served than appeared economically possible when dredges and excavators had to pay enormous duties to be allowed into the country. The exemption applies whether the goods specified are imported with the dredges or excavators, or separately consigned.

Trade Conditions in China.—The Acting British Vice-Consul at Tientsin (Mr. D. B. Walker) writes that as the 1915 harvests were good, and the last export season was very successful, money should not be scarce in the Consular district during 1916. The chief difficulty as regards the British share in imports into Tientsin will be the high prices ruling in the United Kingdom for all lines of manufactured goods, and the restricted output. Under present conditions it seems futile to bemoan the comparatively small share which the United Kingdom takes in the import trade of Tientsin. The fact remains, however, that now is the time for British firms to endeavour to replace, as the Japanese have already taken steps to do, articles previously supplied by the factories of Central Europe. Unless the opportunity is grasped, and the position consolidated before a year after peace is declared, it will be lost altogether. On the conclusion of hostilities Germany will turn again to trade with redoubled activity; her traders are not likely to be welcomed or encouraged to stay in the countries and possessions of the Allies; what better market than that of China will be open for Germany to operate in? Driven from Tsingtau, and reluctant to return thither under new conditions, what port more suitable than Tientsin for the centre of their operations in the northern trade? United Kingdom manufacturers know whether the effort is possible, and they must decide immediately. Both the United States and Japan are ready to grasp the opportunity. One bright feature of existing conditions is that, owing to the enforced inaction of German importers, Chinese dealers are taking more kindly to the "cash on delivery" system, and some of them are now beginning to realise that this alone can prevent overtrading, which has always been the bane of the Tientsin market. Japan is reaping advantage from the disabilities under which the belligerents in Europe are labouring. Quick to grasp the opportunity, Japanese traders have taken steps to replace on the Tientsin market articles previously supplied by the Central European Powers, such as enamelled ware, tin and crockery ware, hardware, window glass, ribbons, needles; in fact, all classes of goods commonly known as "muck and truck." Efforts have been made by local British firms to make home manufacturers realise the present opportunity of capturing this trade, but little has as yet been done.

Trade Announcements.—MR. WILLIAM HARPER, electrician and motor engineer, 10, K. Square and Wharf Street, Shipley (Yorkshire), who has been set up for services in having the whole of his stock and tools sold by auction and is giving up the business.

MR. MICHAEL WRIGHT of Micklewright Ltd., of Aliperton, Wembley, has joined the R.N.A.S. The business of the firm will be continued as before.

Book Notices.—THE SECRETARIES' ASSOCIATION, LTD., Basinghaw House, Basinghall Street, E.C., has issued (1s. net) a pamphlet containing a verbatim report of lectures delivered during the 1915-16 session. One of these lectures is on "The War: its Effect on Commerce and Finance," and others deal with "Foreign Exchanges: the Part they Play in International Trade," "Curious Cases in Company Law," and "The Secretary and his Directors."

Text Book of Applied Mechanics and Mechanical Engineering, by A. Jamieson. London: C. Griffin & Co. Ltd. Price 6s. net.

"Proceedings of the Physical Society of London." Vol. XXVIII, Part 5. August 15th, 1916. London: *Electrician* Printing and Publishing Co. Ltd. Price 1s. net.

William Work: Employers' Experiments for Improving Working Conditions in Factories. By E. Dorothea Proud, B.A. London: G. Bell & Sons, Ltd. 7s. 6d. net.

Dissolutions and Liquidations.—HIGH-TENSION INSULATORS, LTD. This company is winding up voluntarily with Mr. G. T. Broadbridge as liquidator. A meeting of creditors is called for August 28th, at 32, Sackville Street, W.

FLINTLIE, WHITES, LTD. This company is winding up voluntarily with Mr. P. T. Hills, 65, Temple Chambers, London, as liquidator. Creditors' meeting, August 28th.

AVONL, ELECTRIC CO., LTD. A first dividend of 10s. in the £ is payable August 30th, at 6, Clement's Lane, E.C.

BARKERS, builders and electricians, Dean Street, Oxford Street, W., and Artillery Lane, E.C.—Messrs. E. M. Harvey & W. J. Barker have dissolved partnership. Mr. Barker attends to debts, and continues the business.

Catalogues and Lists.—MESSRS. DONOVAN & Co., 47, Cornwall Street, Birmingham.—A number of illustrated leaflets showing their insulated switch-holders, "Safuses," motor-starting gear, &c.

"When found, made a Note of," has been the case—or should have been—with all our gold coins since 1914, and we must therefore have a receptacle for "Notes," to mind them in safety until we exchange them for war-saving certificates—or something else. MESSRS. D. HARPER & Co., LTD., of Holloway Road, N., have studied the convenience of the public by introducing a reversible Treasury Note case, which is suggested as a very suitable advertising medium for the trade. One of these—a two-fold real leather one—is before us. Its special feature is that it is a patent one, and the 10s. and 20s. notes can be kept separate.

Belling Prices. MESSRS. BELLING & Co. announce that owing to increased cost of material and labour they have had to increase the advance on prices in their 1915-16 Fire catalogue (which still holds good for the coming season) from 10 per cent. to 20 per cent., as from September 1st, 1916. In view of the difficulties of obtaining supplies of material in the iron industry, they ask the trade to advise them as early as possible of their requirements for Belling electric fires.

Bankruptcy Proceedings.—TATTERSALL, J. W. & T. W., electrical engineers, Willesden Lane, London.—Trustee released August 14th.

BOULT, JOHN, electrician, Liverpool and Chester.—First and final dividend, 5s. in the £, payable September 11th, at 2, Bixteth Street, Liverpool.

BOULT, J. & J. H., electricians, trading as John Boulton.—First and final dividend, 8s. in the £, payable September 11th, at 2, Bixteth Street, Liverpool.

New Russian Electrical Factory.—THE ELECTRICAL EQUIPMENT CO. has begun the construction of a large electrical factory in Moscow, where telegraph and telephone apparatus will be specialised in, and orders therefor are already in hand to the value of 3,500,000 roubles. The concern is subsidised by the Government with 1,500,000 roubles.

Copper Prices.—The week's changes.—Messrs. F. Smith and Co. report:—Wednesday, August 23rd: Electrolytic bars rose from £125 to £127; ditto sheets, from £143 to £145; ditto rods, from £132 to £134; ditto H.C. wire, from 1s. 3½d. to 1s. 4½d. Messrs. James & Shakespear report:—Wednesday, August 23rd: Copper bars, sheet, and rod (best selected) rose from £146 to £148.

LIGHTING AND POWER NOTES.

Aberdeen.—The output of the Corporation electricity works for the financial year ended July 1915, was affected by the curtailment of lighting, public lighting being 77 per cent. down and private lighting practically 10 per cent. down compared with the previous year. Due, however, to the increase of power, 22 per cent., and heating and cooking, 39 per cent., the total output

for the year was 8 per cent. up. The year just finished, to July 1916, shows a greater decrease for lighting purposes, but a marked increase for power, and the total output of the undertaking will show an increase of about 20 per cent. Over 2,000 H.P. of new motors has been coupled to the mains.

Aldershot.—EXCESS PROFITS.—The Inland Revenue Commissioners have made a demand upon the U.D.C. for £73 excess profits duty on the electric undertaking. Inquiries are to be made, and an appeal is to follow if necessary. A recommendation not to entertain applications for the electric light to be connected to The Poles, the hospital, and the premises of Mr. Charkham, of Arthur Street, has been referred back to the Lighting Committee for reconsideration.

Alloa.—PLANT EXTENSION.—The Electricity Committee is installing a 700-H.P. National gas engine coupled to a generator by the British Electric Plant Co., consent having been obtained recently to the borrowing of £10,000 for plant extensions. The output of the station during the last financial year increased by about 45 per cent.

Amesbury.—Negotiations are proceeding with a view to a private company distributing electricity in the district. The County Council is to be approached in regard to the use of overhead wires on main roads.

Argentina.—At a meeting of the Rosario Municipal Council, the action of the Intendent in ordering the substitution of electric lighting for the gas lighting, in view of the Gas Co.'s suspension of the service, was approved. Also an expenditure of \$25,000 m/n. on the necessary electrical material in Buenos Aires, was authorised. The Gas Co. was obliged to suspend its service owing to being unable to purchase coal, due to the Rosario Municipality not having paid the gas bill of about \$350,000 m/n.

Australia.—With regard to the proposal by the Strathfield municipality for the supply of electricity for street lighting by the Sydney City Council from March 1st, 1917, the City Council has suggested the advisability of the postponement for a further 12 months, when the cost of materials may be more nearly normal.

On the recommendation of Mr. B. E. Rushton, chief mechanical engineer to the South Australian Government, the Government workshops at Islington are to be reorganised, electric power is to be installed, and £4,000 is to be spent in providing additional furnaces and boilers for steel making.

Owing to the Granville (N.S.W.) municipality deciding not to give any undertaking to refuse permission for the erection of electricity mains by another company along a route on which the Sydney City Council has provided electricity supply mains, the City Council is recommended not to proceed further with the proposal to extend its mains in the neighbourhood to supply power to various firms.

Bedford.—The B. of T. has consented to the T.C. supplying electricity to the new works of Messrs. W. H. Allen, Son and Co., Ltd., at Biddenham, which is outside the area of the borough.

Bingley.—The U.D.C. is recommended to reduce the minimum charge for electricity supplied to private consumers to 10s. per half year, inclusive of the meter rent, after the termination of the first two years of the supply.

Bo'ness. WOMEN NAVVIES.—According to the *Daily Chronicle*, women navvies are being employed in the laying of cables in connection with the electricity undertaking.

Canada.—The Shawinigan Water and Power Co. is making extensions to its power house, in order to give a supply of 2,000 H.P. to the Sherbrooke Railway and Power Co. The power will be transmitted over the Shawinigan transmission line between Victoriaville and Windsor Mills, and from the latter point a new transmission line is being built to Sherbrooke.

The Great Lakes Power Co. is extending its power house, and has on order with the Canadian Westinghouse Co. for that purpose 20 650-K.V.A., 25-cycle vertical generators, four 650-K.V.A., 60-cycle vertical generators, and one 660-H.P. motor-generator exciter set.

Owing to the increased demand for power, the city of Sherbrooke has decided to improve the city plant: the present rock-filled crib dam on the Magog river will be replaced by a concrete structure 225 ft. long and 49 ft. high. Three central-discharge turbines of 1,400 H.P. each will replace the present turbines, together with three new generators, each of 1,000 K.V.A., rating with the necessary additions to the switchboard equipment.—*Canadian Electrical News*.

Continental.—RUSSIA.—With a view to ascertaining the amount of electric power available for new industries, and to supply those displaced by the invading armies, the Electrotechnical Section of the Russian War Industries Central Committee has carried out a census of all the installations existing throughout Russia. Of the two inquiries made, 90 per cent. of the former, and 60 per cent. of the second, returned replies. They have come from 108 towns, 93 of which are situated in European Russia, 12 in Siberia, 5 in the Caucasus, and 5 in Central Asia, or a total of 115 electric stations. The 93 stations in European Russia have a total of 79,553 kw., of which 39,132 is continuous-current, 34,043 three-phase, and 6,378 single-phase plant. The 12 Siberian stations have a total power of 9,505 kw., 2,320 being continuous, 3,750 three-phase, and 3,435 single-phase plant. The five stations in the Caucasus have a total power of 3,026 kw., 676 being continuous and 2,350 three-phase

plant. The five stations in Central Asia have a total power of 379 k.w., all of which is continuous-current plant. Of the plant specified some 30,000 H.P. is available for new undertakings requiring an uninterrupted supply, and 60,000 H.P. for those able to use an interrupted supply. *L'Industrie Electrique.*

NORWAY.—The Union Carbide Co. finding its works at Niagara inadequate, and after seeking in vain in North America for an additional site, has decided to establish a branch in Norway. It has set aside \$2,000,000 for the purpose, and the works are now in course of construction at Sande. The increasing number of electrochemical and other concerns established at Niagara, the constant call for more room for extensions, the limitation of the power available, and the proximate increase in the price of electric current, are the motives for this departure. The migration of other American industries, under the pressure of similar requirements and considerations of a like nature, is said to be a matter of certainty in the near future.

Dundee.—**PROPOSED LOAN.**—The Corporation Electricity Committee has had under consideration the question of acquiring borrowing powers for £27,000. According to the treasurer the amount authorised to be borrowed is £487,000, and the capital expenditure to May 15th of this year was £469,175, leaving a balance of £17,825. In reference to the sum of £17,825 the T.C. is already committed to the expenditure of that amount, contracts having been placed for machinery, cables, &c. Mr. Richardson, the general manager, estimated that additional borrowing powers would be required to cover the cost of works to the amount of £27,000. With reference to the application which had been received from the Caledon Shipbuilding Co., and taking into account the power which would be required in the immediate vicinity for King George Wharf and other large consumers, it was suggested that the best method would be to build a new sub-station on the spot, and so reduce the length of heavy cables to the minimum. The motion for applying for borrowing powers was adopted.

Harrogate.—At the last meeting of the T.C. it was stated that the day-time use of electricity for domestic and power purposes now exceeded the load for lighting.

Japan.—At the annual meeting of the Tokio Electric Light Co. it was stated that the increased receipts were due principally to the sum received for the temporary supply of power to the municipal electricity station when it was short of energy, owing to the breakdown of the Kinugawa Power Co.'s plant. Receipts from the sale of power amounted to 200,000 yen. There was an increase in the general demand for electric light in the city during the year, and 65,000 additional lamps had been installed. *J.S. Commerce Reports.*

London.—**HAMMERSMITH.**—The Electricity Committee has received an application from the Chiswick Electric Supply Corporation for a supply of electrical energy for a factory in its area.

The borough electrical engineer reports that the estimated cost for cables and transformers, &c., will be £3,500, and he estimates the minimum annual revenue at £3,500.

The Committee recommends the Council to give the supply of electricity asked for, the minimum guaranteed payment to be £2,000 per annum, the corporation or the proposed consumers to advance to the B.C. the capital sum (£3,500) for laying on the supply, the B.C. to pay 5 per cent. interest upon the sum advanced each year the actual consumption of electricity exceeds £2,000 in value. The cables and apparatus to remain the property of the Council, and to be taken over at £2,000.

Market Drayton.—**STREET LIGHTING.**—The U.D.C. has agreed to the offer of the E.L. and Power Co. to accept £50 in settlement of its account of £100 under the contract for public lighting for the six months ending June 30th.

Newport (Mon.).—**PROPOSED LOAN.**—The Council is to apply to the L.G.B. for sanction to borrow any necessary sums for cables, &c., to give a bulk supply to a new consumer.

Perth.—**YEAR'S WORKING.**—During the last financial year the electricity department made a net-profit of £284, of which £200 has been placed to reserve, and £84 carried forward. The total revenue was £11,097, and expenditure amounted to £7,423, leaving a gross profit of £3,674. The reserve fund now stands at £1,481, or 75 per cent. of the total amount allowed.

The City Council has decided to increase the electricity charges for lighting by 12½ per cent., and for power by 5 per cent.; an amendment not to increase the price of energy supplied for traction was lost by a large majority.

Portuguese India.—The municipality of Goa has been authorised to install an electric lighting system in the town of Nova Goa. A contract for the work has been awarded to a Bombay firm.—*B. of T. Journal.*

Rawtenstall.—**LOAN SANCTION.**—The L.G.B. has sanctioned the borrowing by the T.C. of £1,447 for mains in connection with the supply of electricity in bulk to Haslingden. £584 for transformer, and £185 for other plant.

Reigate.—Speaking at a meeting of the T.C., recently, Councillor Priest mentioned the adverse conditions under which the electricity undertaking had been working, due to decreased lighting output. Heating units increased by 74 per cent., yielding a revenue of £101, and power output also increased by

47 per cent. The gross profit of £3,891 was £234 less than in the previous year, and it was decided that the net surplus of £33 be carried to reserve and renewals.

Rochdale.—**PROPOSED LOANS.**—At a meeting of the Electricity Committee, on August 16th, the borough electrical engineer recommended that the T.C. should apply for further borrowing powers for £50,000 for improvements and extensions at the electricity works. A scheme for spending £60,000 on the works was rejected in May by the T.C., but application for borrowing powers for £10,000 was made for the most urgent portion of the work—the provision of an additional chimney, induced draught plant, and additional economisers—and sanction for this has been received. The recommendation made last week that powers be sought for the further £50,000 was made owing to the irregularities in the supply of energy this month, which have caused great inconvenience to local firms dependent upon the Corporation for power. The Committee referred the recommendation to the Works Sub-Committee for consideration and report. In regard to the irregularities, a number of works were affected last week, and in the case of the cotton mills of Tyre Yarns, Ltd., and Fabric Weavers, Ltd., who are the largest consumers, it is stated that 75 per cent. of the machinery was idle owing to the difficulties referred to, and about 500 workpeople employed by the firms were thrown on to the funds of their Trade Unions. The Rushbearing Holidays are taking place this week (August 19th-26th), and the majority of local works and factories are shut down. It is hoped that necessary repairs will have been completed by the time the mills and workshops re-open on the 28th inst.

The Electricity Committee has accepted tenders for 34,000 tons of coal at advanced prices. The dispute between the Committee and Tyre Yarns, Ltd., respecting the interpretation of clauses in the agreement for the supply of current to the firm's mills, has not yet been settled.

Salford.—The House Committee of the B. of G. proposes to install a mechanical dough-mixer, to be driven by electricity.

U.S.A.—A recent issue of the *Journal of Electricity, Power and Gas* mentions that the Hammond "Delta Home," in the San Joaquin Valley, Cal., is provided with electric heaters in every room, and instantaneous water heaters in the bathrooms. Electric cooking apparatus and an electric boiler are in use, also an automatic electric pumping set for the garden. It is stated that 175 electric ranges are being used in the San Joaquin Valley, and the number will be increased to 400 by the end of the season.

TRAMWAY and RAILWAY NOTES.

Blackpool.—Last week the lifeguards on the cars prevented two accidents to children, who, in both cases, were picked up and escaped injury.

Caucasus.—The *Norvie Vremya* says the question of constructing the trans-Caucasian electrical railway is approaching solution.

Continental.—**SPAIN.**—The new electric tramway in the town of Palma de Mallorca, which has been constructed by the Sociedad General de Tranvia Electricos Interurbanos, has now been completed and opened for traffic. The electrical equipment was supplied by the Sociedad A.E.G. Thomson-Houston Iberica.

London.—**P.O. TUBE RAILWAY.**—A recent Parliamentary communication by Mr. Asquith stated that the tunnel for the above line was nearly completed. It runs from Paddington, *via* Mount Pleasant, the G.P.O. in Newgate Street, and Liverpool Street to Whitechapel, some 6½ miles, at a depth of 28 ft. to 37 ft. below the surface. Normally, it is a 9-ft. diameter tunnel with two 2-ft. gauge tracks, and double tunnels at stations with space for lifts, shoots and control cabins, the trains being operated by distant control and capable of attaining up to 35 miles an hour. The electrical system is that of the British and Colonial Pneumatic Tube and Transport Co.

New Zealand.—The Christchurch tramway plant was put through a final test last month, operating from the Lake Coleridge high-tension supply, the result being satisfactory in every respect. *N.Z. Shipping and Commerce.*

Northampton.—**YEAR'S WORKING.**—The accounts of the Corporation tramway undertaking for the year ended March 31st last, show a total revenue of £24,130, and a gross surplus, including bank interest, &c., of £14,452 (as against £10,411 in the previous year). Interest and sinking fund payments absorbed £10,200, and the net profit was £4,252, as compared with £1,581 in the previous year. Of the surplus £1,500 was transferred to the rates, and £2,600 to reserve. The track mileage amounts to 6½; 770,000 car-miles were run and 9,936,774 passengers carried, as compared with 8,423,884 in 1914-15, when a section of horse tramway was still in use.

Rochdale.—**WAGES.**—The Tramways Committee has referred to the Works Sub-Committee an application of local tramway employees for an advance of wages.

TELEGRAPH and TELEPHONE NOTES.

Arabian Telegraphs.—According to the *Times*, a Cairo report states that in addition to Jewish and Moslem telegraphic communication lines have been established with Tadmor and Wadi Halfa and Assiut.

Brazil Telephones.—There are at present in the Federal States and immediate vicinity 12,000 telephones in service in Rio de Janeiro, 1,200 in Niteroi, across the bay, 750 in Petropolis, the summer resort of Rio de Janeiro, 100 at Barra do Pirajy, 23 at Barra Mansa, and 19 at Rozendo. It is estimated that in this section of Brazil there is one telephone for each 100 inhabitants. Much of the wiring of the system is underground. In the State of Sao Paulo and the southern part of the State of Minas Geraes, the telephone systems are operated by the Companhia Telefonica do Estado de Sao Paulo, with headquarters at Sao Paulo, Santos, and Campos, and the Companhia Rode Telefonica Bragantina. The first-named company has about 2,500 subscribers in the three cities just mentioned, and a number of rural lines. There are also connections with the lines of the second-named company, which has its headquarters at Sao Paulo city. The Companhia Bragantina connects by its lines 171 cities and towns in the States of Minas Geraes and Sao Paulo, serving 1,500 subscribers. Besides these two companies there are numerous smaller local companies in many cities and towns of those two States, still further completing the facilities for connections. Conversations may be carried on between Sao Paulo and Riberao Preto, 211 miles, or between Riberao Preto and Santos, 206 miles, or with Guaratingueta, a distance of 342 miles. Connection may be obtained from Sao Paulo to Guaratingueta and from Rio de Janeiro to Barra do Pirajy; and the intervening unconnected distance to complete the telephone communication between the cities of Rio de Janeiro and Sao Paulo is but 103 miles.—*Telephony.*

Cable Rates.—The *London Gazette* announces that the rates for telegrams sent to the places named below are now:—
Albania, 43d. per word. Newtomland, by cable 1s., and via Marconi, 8d.; Labrador, by cable 1s. 2d., and via Marconi, 10d.

Jamaica.—A severe hurricane passed over the island on August 15th, causing great damage in cultivated areas and completely dislocating telegraphic communication.

Multiplex Wireless.—Mr. Burr V. Deitz has been granted a United States patent on a method of transmitting two or more messages, or signals, from one wireless aerial, and this with relatively high efficiency and without interference between the messages or signals.

Mr. Deitz has found that while the discharges of a radio-transmitter occur as frequently as five hundred times a second, each single discharge occupies so small a part of a second that the discharges in the aggregate consume only a small fraction of the time elapsing during transmission. In the invention he utilises a part of the time heretofore unused and existing in the intervals between discharges to transmit additional distinguishable messages or signals by applying additional transmitters which are used with a single or common aerial system. The results obtained are similar to those of the multiplex system of wire telegraphy, in which several operators can use one line at the same time.

Mr. Deitz states that the apparatus is comparatively simple, and possesses the great advantage of being reliable and durable, requiring no sensitive or delicate adjustments and little or no attention.—*Telegraph and Telephone Am.*

Telegraph Construction Bill.—This Bill passed its third reading in the House of Lords on Monday; the House of Commons also agreed to the Lords' amendments to the Bill (mentioned in our last issue), and on Wednesday it received Royal Assent.

United States.—According to *Telephony*, the House of Representatives has passed a resolution providing for the formation of a joint Sub-Committee to investigate the subject of Government ownership of all public utilities, such as telegraph, telephone and other companies engaged in inter-State and foreign commerce; and to report as to the efficiency of Government regulation and control as compared with Government ownership and operation. The joint Sub-Committee is instructed to report to Congress on or before January, 1917.

Venezuela Telephones.—American Commerce Reports mentions that the local company, Telefonos de Maracaibo, which has 300 telephones on its system, is proposing to extend its exchange equipment to cope with new business. It is interesting to note that a ground return system is in use, and that calling is by name, not by number, no directory being issued. The *Board of Trade Journal* mentions that Senores Sardi Hermanos has received permission to construct two telephone lines in Terorady district.

Wireless in the West Indies.—A wireless installation is in operation at Nevada Island Light Station, and will be controlled by the U.S. Light House Service.

Wireless in Police Department.—Besides a station at Police Headquarters in New York, U.S.A., the department is planning to establish 15 other wireless stations in the inspection districts of the five boroughs and on the police steamer *Patrol*. A school of wireless telegraphy for policemen is now being maintained by the department, and has a class of 27 men, who were telegraphers before joining the department. Eight already have passed the Government test for wireless operators.—*Telegraph and Telephone Am.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—September 6th. Powell-Duffryn Steam Coal Co. Electrical roads. Forms from Stores Manager, Aberdare Offices, near Aberdare.

Australia.—SYDNEY.—September 20th. N.S.W. Government Railways. One 50-ton electrically-operated overhead travelling crane for Zara Street power house, Newcastle. October 11th. One motor-driven air compressor for Zara Street power house. Electrical Engineer, 61, Hunter Street.

P.M.G.'s Department.—Telephone material (Schedule 128). See "Official Notices" August 18th.

ADELAIDE.—September 27th. Deputy P.M.G. Telephones, telephone material, instruments and parts. Schedule Nos. 429 to 437.*

PERTH.—October 4th. Deputy P.M.G. Telegraph and telephone measuring instruments and parts. Schedule 501 W.A.*

MELBOURNE.—November 1st. Victorian Railways. 50,000 flame arc carbons. Chief Storekeeper, Railway Offices, Spencer Street. October 18th. Victorian Government Railways. Electric time releasing mechanisms for automatic signalling. Cont. No. 30,343.*

Dublin.—August 29th. Electricity Committee. S.P. and three-phase meters for a year. See "Official Notices" August 18th.

Manchester. August 25th. Electricity Committee. High and low-pressure steam and feed pipes at Stuart Street station. Specifications (21s., returnable) from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

August 28th. Electricity Committee. Motor-car of from 12 to 26 H.P.

September 12th. Tramways Committee. (a) Permanent-way special trackwork, and (b) permanent-way point tongues and crossings. Specifications, &c. (£1 1s., returnable). Mr. J. M. McElroy, General Manager.

New Zealand.—INVERCARGILL.—September 28th. Borough Council. Steam turbo-alternator, condensing plant, and switchgear. Specifications from the Tramway Office. Contract No. 40.*

Portsmouth.—August 29th. Tramways Committee. Tramway stores, insulating materials, lamps, &c., for six months. See "Official Notices" August 18th.

Rochdale.—No date. Electricity Committee. 500 K.V.A. static transformer. Mr. C. C. Atchison, Borough Electrical Engineer.

South Africa.—JOHANNESBURG.—September 4th. Municipal Council. 10,000 drawn-wire metallic-filament traction lamps; 10 miles of 19/14 "Underwriters' wire" (lightly insulated wire for outdoor use). Contract No. 151.*

September 21st. Municipal Council. Tramcar spares. Contract No. 153.*

Spain.—The municipal authorities of Jijona (Province of Alicante) have just invited tenders for the concession for the electric lighting of the town.

MADRID.—October 7th and 11th. Direccion General de Obras Publicas, Ministerio de Fomento, Madrid. Electric tramway concessions in Barcelona and Madrid. Some particulars will be found in last week's *Board of Trade Journal*.

September 11th. Telephone system connecting the towns of Lerida, Balaguer, Tremp, and Sort (£5,000). Tenders to Departamento de Fomento de la Mancomunidad de Cataluña, Barcelona.—*Board of Trade Journal*.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

London.—ST. MARYLEBONE.—The Electricity Committee recommends the acceptance of the tender of Messrs. Babcock and Wilcox, Ltd., at £14f. for repairs to the coal elevator at the generating station.

Government Contracts.—List of new contracts during July, 1916

INDIA OFFICE STORE DEPARTMENT.

Cotton caps.—Peel-Comer Telephone Works.

Cells.—General Electric Co., Ltd.

Extension of switchboard.—Automatic Telephone Mfg. Co., Ltd.

POST OFFICE.

Telegraphic apparatus.—Automatic Telephone Mfg. Co., Ltd.

Telegraphic apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; Western Electric Co., Ltd.

Telegraph cable.—Craigpark Electric Cable Co., Ltd.; W. T. Henley's

Telegraph Works Co., Ltd.; I.R., G.P. & Telegraph Works Co., Ltd.

Telegraph Construction & Maintenance Co., Ltd.

Telephone cable.—B.I. & Helsby Cables, Ltd.; Fuller's Wire & Cable Co., Ltd.; London Electric Wire Co. & Smiths, Ltd.; Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.

Porous cells.—I.R., G.P. & Telegraph Works Co., Ltd.

Telephone cords.—London Electric Wire Co. & Smiths, Ltd.; Peel-Comer

Telephone Works, Ltd.; Phoenix Telephone & Electric Works, Ltd.

Galvanometers.—Edison Swan Electric Co., Ltd.; W. G. Pye & Co.;

Record Electrical Co., Ltd.

Tackle for cable ship.—Telegraph Construction & Maintenance Co., Ltd.

Telephones.—Western Electric Co., Ltd.

Galvanised-iron wire.—Dorman, Long & Co., Ltd.; F. Smith & Co.

Telephone exchange equipment extension, Leeds.—Siemens Bros. and Co., Ltd.

WORKS.

X-ray apparatus. A. E. Deas.
 Electric cable.—Liverpool Electric Cable Co., Ltd.; Siemens Bros. and Co., Ltd.
 Lighting discharge and part. Robert L. M. Ersson M.E., C.E., Siemens Bros. & Co., Ltd.
 Electric light and power sundries. General Electric Co., Ltd.
 Electric lighting sets.—Aster Engineering Co., Ltd.; Day Motor Co., Ltd.
 W. H. Dorman & Co., Ltd.; Fyfe, Wilson & Co., Ltd.; Norris, Hodge and Gardiner, Ltd.; Peters, Ltd.
 Electric crane gantry.—Butters Bros. & Co.
 Generating sets. W. H. Dorman & Co., Ltd.
 Electric generators and motors and parts. B.T.H. Co., Ltd.
 Electrical Co.
 Works services.—Rotary converter at Windsor. J. General Electric Co., Ltd.

NOTES.

Electrical Power from Low-Grade Fuel. It is now well established that hydro-electric power plants, though using no fuel, involve such high capital charges in comparison with modern coal-burning central stations, that the latter can sell electric power at a much lower figure, in countries producing coal. It is also well known that refuse-destructor plants cannot produce electric power at a price to compete with coal-fired plants; and experiments in using coke breeze, of nominal value, as a substitute for slack coal, have failed for the same reasons. In countries where coal is very dear, the use of poor lignite is justifiable, provided it is mined in dry condition. Experiments with very wet fuels, however cheaply obtained, seem doomed to failure. Such an experiment, in Prussian Saxony, was described in *Engineering*, of June 30th last. It appears that the Weisweiler central electric station, near Acken, was started two years ago, having two 7,500-K.V.A. turbo-generators, and six water-tube boilers, each of 150 sq. metres or 4,844 sq. ft. boiler heating surface, with superheaters for 380° C. or 716° F., and economisers. The fuel is raw wet lignite, only 2,700 B.T.H.U. per lb., and burnt direct on the boiler-grates. Adjoining the power station is a briquetting factory, arranged to convert each 3½ tons of raw lignite with 64 per cent. moisture, into 1 ton of dried briquettes of 9,000 B.T.H.U. per lb.; such dried briquettes would give about two-thirds the steaming duty per boiler as obtained with ordinary slack coal. A syndicate fixed the sale price of such briquettes, prior to the war, at 7s. 6d. per ton; but it seems clear this was an unprofitable price. It is certain that the artificial drying, or evaporation of 25 tons water from 35 tons of raw lignite, would take two-thirds of the product as fuel for the drying process, thus trebling the cost of the briquettes available for sale.

The cost of converting 3½ tons raw lignite into briquettes is stated to be at least 18d., plus 26d. for other expenses; the latter item is presumably labour cost for stacking the briquettes for sun-drying in summer. The cost of the raw material is assumed to be the difference between the sale price of 7s. 6d. per ton for the dried briquettes, viz., 45d. for 3½ tons, or, say, 13d. per ton of the bulky raw lignite, for the various operations of obtaining it from surface deposits, transporting by chain haulage, sorting and breaking and elevating it to overhead bunkers; but no proof is given as to the possibility of this low figure in practice. Taking, however, this figure of 13d. per ton of raw lignite crushed and delivered to bunkers, and falling thence direct to boiler grates, it is evident that the steaming duty per boiler will not exceed one-fifth of its normal output when burning coal, so that the capital outlay for boiler plant must be very high indeed.

It is estimated that when the Weisweiler power station is sufficiently enlarged to produce sixty million units yearly (average), say, 6,850 KW. hourly from this raw, wet lignite, the thermal efficiency will be very high, viz., 4 kg., or 8·8 lb., x 2,700 = 23,760 B.T.H.U. in fuel per KW.-hour. But as a large percentage of the fuel heat must be lost in vaporising in the furnace, the 2½ tons of water which accompanies every ton of combustible, high thermal efficiency is improbable. For comparison, reference may be made to Appendix II of Mr. Lackie's recent paper to the Municipal Electrical Association, showing that the actual result for 1915 at the Glasgow Corporation Port Dundas plant of similar output, 61,078,693 units, involved 3·16 lb. slack coal, of, say, 11,500 B.T.H.U., or 36,340 B.T.H.U. per KW.-hour, with chain-grate stokers. Considerably better efficiency has been obtained in large plants with multiple-retort grateless underfeed stokers burning good coal.

The Weisweiler estimate not only assumes a very high thermal efficiency with the wet lignite, but also abnormally low charges for other working costs (which must include wages, repairs and maintenance, rent, rates, taxes, and management, &c.); and ignoring the extra boilers necessary with poor fuel, it provides for the small sum of £11,550 per annum (60,000,000 KW.-hours at 0·0462d.) for interest and depreciation, which would be very low for a coal-fired plant of same output, viz.:—

Cost of raw lignite (4 kg., or 8·8 lb.) 0·434 pfennig, viz., 0·0521d.
 Additional working costs ... 0·180 " " 0·0216d.
 Depreciation and interest ... 0·385 " " 0·0462d.

0·999 pfennig, viz., 0·1199d.

Total estimated cost, say, 1 pfennig, or ¼d. per unit delivered.

Assuming this improbably low cost of production of ¼d. per unit, it is proposed to sell half the output, viz., 30,000,000 KW.-hours, at cost, to chemical, electrolytic, and similar manufacturers, though these do not appear to exist yet at Weisweiler or at the neighbouring small town of Acken in Prussian Saxony; the other half is to be sold at 2½ pfennig, so as to obtain an average sale price of 1½ pfennig, or 0·216d. per unit.

It is stated that a new electric station at Bitterfeld, another small town in Prussian Saxony, also using lignite, has been ordered for large demands at one pfennig, or ¼d. per unit; but the financial result of this "dumping" under cost is not stated. The bulky wet lignite might be used in destructor-type furnaces of large area; but it cannot be properly used on boiler-grates, owing to its very low steaming capacity.

Assuming a good load factor, then a low capital cost is the most important factor for cheap power production; and this involves a good fuel, capable, with a good mechanical stoker, of combining high thermal efficiency and high boiler duty at peak loads.

Electric Hot-water Supply.—Tank-heaters are generally installed in outside piping, so that the ordinary range boiler may be used, as shown in the figure. Obviously both the tank and as much of the hot-water piping as possible should be well heat-insulated, in order to cut down radiation losses to a minimum. A further "kink" is to place a diaphragm in the piping, in order to restrict the free circulation of water from the heater, which otherwise would be quite rapid. Without restricted circulation, a large amount of water is heated a few degrees only, and after a large quantity of hot water has been drawn off from the tank, it is a matter of hours with a small-sized heater before the water again reaches a high temperature. But if, with a medium-sized heater of from 750 to 1,000 watts, a diaphragm of copper leaf with a hole about ½ in. in diameter is inserted in a navy union near the top of the tank, the circulation can be so restricted that water near the boiling temperature will accumulate at the top of the tank, and a small amount will be available within a short time after all of the hot water has been drawn off.

A small heater, in this way, may be run at 100 per cent. load factor, storing very hot water between meals and over night. A heater as small as 500 watts, which may be attached to any lamp socket—requiring no special wiring—has been found to furnish sufficient hot water for a family of four or five persons when installed in this way. After the household had become accustomed to frugal consumption of hot water, there

was seldom any complaint over an insufficient supply. At the rates now being offered by many companies, electric water-heating is no longer a luxury, especially during the summer months. An electric heater may be installed for use in connection with an ordinary coal or wood range without disturbing the piping in any way.—A. R. HAYNES, in the *Electrical World*.

American Engineering Societies' Joint Building.—The August *Journal* of the American Society of Mechanical Engineers announces that the American Society of Civil Engineers has decided to accept the offer of the United Engineering Society to become an equal partner with the three Founder Societies (i.e., the Electricals, Mechanicals and Mining Engineers) in ownership, occupancy, and administration of the Engineering Societies' Building and all other activities which the societies may jointly undertake. Thus, the *Journal* remarks, the hope of Mr. Andrew Carnegie, the donor of the building, is fully realised—that the building should become the home and headquarters of the engineering profession in America.

Three storeys will be added to the top of the building for the use of the Civil Engineers, at a cost of not more than \$250,000, and the financial arrangements as to such that all four societies enter upon the same basis, and share equally in all respects. The building represents an investment of practically \$2,000,000, the societies owning it free of all encumbrance, and having a reserve fund of over \$70,000.

Eighteen societies, including the original Founder Societies, now make the building their headquarters; each is under its own management, and all live in independence and harmony.

With the accession of the Civils, the total membership will be 52,677, the resident societies being as follows:—

American Society of Civil Engineers	8,022
American Institute of Electrical Engineers	8,308
American Institute of Mining Engineers	5,597
The American Society of Mechanical Engineers	7,149
Aeronautical Society of America	200
American Society of Heating and Ventilating Engineers	705
American Gas Institute	1,530
Association of Edison Illuminating Companies	73
American Institute of Aeronautical Engineers	121
Empire Gas and Electric Association	115
Illuminating Engineering Society	1,350
Municipal Engineers of the City of New York	600
National Electric Light Association	14,000
National Association of Engine and Boat Manufacturers	175
New York Electrical Society	705
Society for Electrical Development	1,128
Society of Naval Architects and Marine Engineers	900
Society of Automobile Engineers	1,975
U.S. Naval Consulting Board	21

The Joint Library contains over 62,500 volumes, accessions being made at the rate of 3,000 annually; in future the valuable Civil Engineers' Library will be consolidated with the above. There has lately been an increasing amount of co-operation between the societies in matters affecting the welfare of the engineering profession and with the Government.

Inquiries.—A correspondent asks the name of maker of Ruby, containing cutting, and brass fitted to 10,000/10,000 of an inch.

American Views on Higher Steam Pressures.—Continued papers from a thermodynamic viewpoint an increase of pressure from 200 lb. to 250 superheat to 600 lb. at no superheat (250 lb.) the same steam temperature will theoretically permit a 32 per cent. increase in prime mover efficiency with atmospheric expansion and 15.1 per cent. with a 29 in. vacuum. On the other hand, however, mechanical obstacles must be surmounted to permit using the higher pressure. In the recent report of the N.E.L.A. Committee on Prime Movers, Robert Cramer pointed out that operating at higher pressures will probably require a complete revision in boiler design to withstand the increased pressure safely. Most boiler fittings, pipes and valves, as made at present, are of sufficient strength for 600 lb. pressure, but the latter may need slight modification to facilitate operation. The construction of engines and turbines may have to be strengthened, however. The greatest difficulty with regard to engine or turbine design will probably be to minimise friction and leakage.

Since higher steam pressure will mean higher water temperature in the boilers, the efficiency of heat transmission at the boiler surfaces will be reduced, and the stack temperature consequently increased. The heat discharged up the chimney may be recovered in part, however, by economisers, but these, too, will have to be designed to withstand the high pressure. Higher steam pressures also mean larger temperature differences during expansion. This does not present a serious difficulty in turbines or in uniflow engines, but it may in some reciprocating engines due to condensation. Entrained moisture, which is very liable to exist in unsuperheated steam, may, however, corrode turbine blades. In one way entrained moisture is beneficial, since it reduces the amount of condenser surface required. With higher pressures larger bearing surfaces, or better lubrication, will be needed in contact with steam, but these do not constitute an obstacle, in view of the conditions which are already satisfactorily handled in combustion engine operation. Leakage at pipe and fitting joints can probably be prevented by welding them. Mr. Cramer pointed out that, while it is hardly reasonable to expect the general introduction of pressures as high as 1,500 lb., pressures of 400, 500, and even 600 lb. seem to be in immediate prospect. As far as constructing boilers for operating at such pressures is concerned, one large manufacturing company has stated that if the demand is sufficient, it can turn them out in commercial designs.—*Electrical World*.

Japanese Electrical Developments.—American Consul-General Seidmore, of Yokohama, in a report dated June, 1916, states as follows:—"A few years prior to the outbreak of the war there was a boom in electrical enterprises in Japan, and the number of companies manufacturing electric wire increased remarkably as a result. Financial depression supervened, however, and electrical enterprise suffered a setback, says the *Japan Chronicle*. The result was a falling off in the demand for electric wire and an over-production of these goods. The European war, however, has had the effect of increasing demands from China and India, and also from Russia. This has brought prosperity to the manufacturing companies, according to the *Chronicle*. While foreign orders have thus increased, the demand for domestic requirements has also developed, chiefly as a result of a revival of activity in general electrical enterprises and the Government extension of the telephone service. In addition to wire, electrical apparatus is being manufactured very largely. Since the war began it has been very difficult to import dynamos, and Japanese manufacturers have endeavoured to make the larger class of dynamos that were formerly imported. This ambition has now been achieved."

American Consuls at Work.—The following extracts from recent issues of the U.S. Commerce Reports form a few illustrations of the fruits that are being reaped by American traders owing to the timely co-operation of Government Consular agents:—

"An American electrical supply firm has notified Vice-Consul Carl C. Hansen that, as the result of information supplied by him, a Bangkok company has placed an order with it for 22 meters, accompanied by an inquiry for 400 additional meters.

"Through the activities of Mr. Joseph Heim, American Consular Agent at Penang, Straits Settlements, a Pennsylvania gas engine company has received \$1,400 worth of business from that territory.

"So satisfactory were the portable boat motors supplied by an American concern to a Bangkok firm, with which it got in touch through the 'Trade Opportunity' service of the Bureau of Foreign and Domestic Commerce, that the Siamese company has ordered 36 additional motors.

"The district office of the Bureau of Foreign and Domestic Commerce in New York City is informed by a South American business man that through connections he effected as a result of assistance given by the New York office during his recent visit to the United States, he has sold over \$250,000 worth of American goods in the past five months. He further states he is convinced that he could have sold four times the amount if American manufacturers had been in position to make better and prompter deliveries, irrespective of the fact that South American importers were obliged to pay cash in New York City before shipment of the goods, instead of long credits, to which they had been accustomed. The business man is now on a return visit to the United States with a view to placing orders and securing additional lines of goods for sale in South America. He states that there are good opportunities for the sale of American products in various South American Republics."

How Standard Time is Distributed in the U.S.A.—Time is obtained accurately by the astronomers at the United States Naval Observatory at Washington, D.C., observing the transit of certain stars every clear night, which are due to cross the meridian at a known time. The exact instant of their transit is recorded electrically by means of a chronograph, which also records the seconds from a sidereal clock. The difference between the time the stars cross and the time of the sidereal clock, as recorded on the chronograph, shows the error of the clock.

The time signals sent out each day are wholly automatic and consist of a series of short marks produced on an open telegraphic circuit by the beats of a transmitting clock located at the observatory. The signals are given the widest possible dissemination over the lines of the Western Union Telegraph Co. for an interval of three and five minutes immediately preceding noon, and ending at exactly noon of the 75th meridian, standard time.

For the country east of the Rocky Mountains, the signals are sent from the observatory at Washington, D.C.; for the country west of the Rocky Mountains, the signals are sent from the United States Observatory at Mare Island Navy Yard, California.

The electric connections of the transmitting clock sending these signals are such as to omit seconds of each minute. These breaks enable anyone who is listening to a telegraph instrument at any office that is cut into the circuit during the transmission of the signals to recognise the middle and beginning of each minute. At the 59th minute there is an interval of 10 seconds, which is followed by the final noon signal. During the last long interval, or 10-second break, those who are in charge of time balls and of clocks that are connected electrically at noon throw their local lines into circuit so that the noon signal drops the time balls and corrects the clocks.

Two chronograph relays are connected, one to the Washington time service circuit and the other to the Western Union grand master clock circuit, and are operated by electric impulses from these sources. The operation of each relay is recorded on a tape. As the tape moves at the uniform rate of 2 in. a second, the longitudinal difference, if any, in the position of the two lines on the tape shows the error of the Western Union grand master clock.

Time is transmitted daily from Washington to the Panama Canal for the purpose of correcting ships' chronometers. Correct time is highly important for a vessel, because in making observations of heavenly bodies, a variation of 1 second means an error of about one-fourth of a nautical mile in location. The time signal is sent by wire from Washington to Key West, whence a relay transmits it by wireless. The Darien wireless station in the Canal Zone in turn transmits the signal by ordinary telegraph to the port captains' offices.

The signal is sent from Key West in a series of dots. Five minutes before noon the wireless begins counting off the seconds by dots. After the 28th second there is a pause, the 29th dot being omitted; similarly there is a pause from the 54th to the 60th second. The count is resumed exactly on the minute. This procedure is kept up until 10 seconds before 12 o'clock, when there is a pause followed by a long dash at exactly 12 o'clock. The aerial transmission is recorded at Darien by a current too slight to permit ordinary relaying. Consequently an operator with a wireless receiver at his ears sends dots through an ordinary telegraph wire to the port captains. With practice he can strike the dots on his sending key in almost perfect synchronism with the dots received. The principal difficulty is in sending the final dash after a wait of 10 seconds. Here the tests show that the lag is between two-tenths and three-tenths of a second. By making allowance for this lag the chronometers in the Canal Zone can be adjusted to within about one-tenth of a second of the correct time. Arrangements are being made to install a clock at Darien which will transmit the time exactly as received from Key West.—*Telegraph and Telephone Age*.

The Municipal Tramways Association Meeting, 1916.—This year's meeting of the M.T.A. will be held at the Surveyors' Institution, Great George Street, S.W., on September 21st-22nd. The programme for the first day includes the Presidential address, by Mr. Peter Fisher (Dundee), and papers by Mr. J. M. McElroy (Manchester), on "Some Notes on Passenger Transportation in Large Cities," and Messrs. G. W. Holford (Salford), and W. Clough (Bury), on "Utilisation of Tramways for Goods Traffic." On the second day the annual general meeting will take place.

The headquarters will be the St. Ermin's Hotel; as last year, no social functions will take place. The hon. secretary is Mr. C. J. Spencer, 7, Hall Ings, Bradford, to whom communications should be addressed.

Austrian Patents.—According to the *Times*, the Austro-Hungarian Government has decided that patents and trade marks of subjects of France and Great Britain can, on request, be restricted or abolished in the public interest by the Minister of Public Works, or charged with royalties. The same regulation can be applied to Russian patents without regard to public interest. Applications for patents and trade marks by subjects of enemy States will be accepted, but not granted.

Metal Workers' Wages.—A meeting of delegates representing the metal, wire, and tube workers in Birmingham and district, held on Saturday, passed the following resolution:—"That this meeting of delegates hereby declare their earnings altogether too small to live on and to pay rent and clothing; and, in order to help us, our employers be requested forthwith to agree to pay an extra 5s. to day workers and 12½ per cent. to pieceworkers, payable from the first week in July last."

Electric Furnaces at Salt Lake City, U.S.A.—The *Mining and Engineering World* mentions that the Utah Iron and Steel Co., of Salt Lake City, is considering the installation of a 12 or 15-ton electric furnace for converting scrap material into soft steel for its rolling mills at Middale. The American Foundry and Machine Co., of the same city, is installing a 3-ton Rennerfelt electric furnace in connection with its foundry.

Educational Notes.—SOUTH-WESTERN POLYTECHNIC INSTITUTE.—The next session commences on September 25th. Particulars of the electrical engineering day and evening courses are given in our advertisement pages to-day.

ROYAL TECHNICAL COLLEGE, Glasgow.—Session 1916-17 begins on September 26th. Particulars are given in our advertisement pages.

The "One-Man" Car in U.S.A.—In a paper recently read by Mr. J. B. Ervin, of the Westinghouse Co., the author mentioned that it was estimated that light-weight one-man cars were in use on 100 systems in the country.

He suggested that lines of short headway and heavy traffic appeared at present to be beyond the field of usefulness of the one-man car. With large crowded cars one-man operation would increase the time of stops to such an extent that schedules would be lengthened and street congestion made worse. Granting that there must be some limit to the traffic handling capacity of one-man cars, beyond which conditions would be uneconomic or intolerable, the question of their field of application became involved with considerations of headway, street congestion, schedules, character of traffic, &c.

Although the one-man car is best fitted for light service, it is probable that the future will witness a gradual extension of its field. There are some periods of the day on all except the very heaviest trunk lines when the big cars are run half empty or when headways are increased to the point where considerable revenue is sacrificed. At such times the smaller one-man cars could be used to advantage if there was some way to take care of the rush-hour traffic without congestion or sacrifice of economy. It has already been found feasible to use a second man for the rush hours only, and probably under certain conditions it will be found practicable to have the conductor ride the cars and collect fares in the downtown zone and transfer from outbound to inbound cars at certain points.

A possible future method of taking care of the rush hour may be to couple two smaller motor-cars together to be controlled by one man while the second man collects fares.—*Electric Railway Journal*.

Institution and Lecture Notes.—SOUTH AFRICAN INSTITUTION OF ENGINEERS.—The inaugural address of Mr. Bernard Price, to a section of which we referred in our issue of Aug. 11 (p. 151), dealt in its early stages with the position of the Institution, which Mr. Price considered was in danger of slipping downhill just at a time when it should be exerting itself to the utmost. The establishment of new industries had been advocated for many years, but apart from mining and agriculture, little headway had been made, and progress had been left almost entirely in the hands of private enterprise. Mr. Price reminded the members of the steps taken by local scientific bodies in this connection leading to the formation of a representative Central Committee for Industrial Research; he believed that the Committee's recommendations, when they matured, would receive the sympathetic consideration of the Union Government. It was the desire of the Council of the Institution that the whole question of industries and industrial research should be made a special feature of the Institution's procedure during the session. Mr. Price remarked on the poor attendance and steadily falling membership of the Institution, and appealed for more active interest in the work. He also briefly described the work of the power companies on the Rand, mentioning that the output was still increasing, and had reached 800 million units per annum. The companies were now consuming coal at the rate of over a million tons per annum. In his opinion, the Victoria Falls was a most valuable potential asset of the country, and he looked forward to seeing the power developed in the future for industrial purposes within an economical radius of the Falls themselves.

Iron and Steel Institute.—The annual meeting takes place at the Institution of Civil Engineers, London, on September 21st and 22nd.

Electric Cooking Poster.—The Newcastle-upon-Tyne Electric Supply Co., Ltd., which years ago distinguished itself by most enterprising publicity efforts, has almost surpassed in excellence all its earlier achievements by a poster which is both immense and magnificent. It will be sure to make an immediate and a lasting impression on the minds of all who see it on hoardings. Electric cooking is the theme, and the designer is Mr. W. S. Bagdatopolus, a well-known poster artist. In size it is 16 ft. double crown; we had to spread it on the floor of our editorial sanctum in order to examine it, and at once its brightness illumined the gloomy den.

Plant for Sale.—The trustee in bankruptcy, Mr. W. Hart, has for sale by tender the engineering plant and machinery of the McKenzie Engineering Co., Borrowash, Derby. See our advertisement pages to-day.

Beck Engineering Co., Ltd.—In the debenture-holders' action *in re* Beck Engineering Co., Ltd.—Dunne v. the Company, Mr. Justice Sargent, sitting as Vacation Judge, on Wednesday appointed a receiver and manager of the defendant company. Leave was given to the receiver to apply in Chambers for liberty to borrow for the purpose of meeting current wages.

Change of Names.—The Edison and Swan United Electric Light Co., Ltd., has changed its title to the EDISON SWAN ELECTRIC CO., LTD.; the Bastian Electric Heating Syndicate, Ltd., has changed its name to the BASTIAN ELECTRIC CO., LTD.

Volunteer Notes.—1ST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place. Orders for August by Lieut.-Col. C. B. Clay, V.D., Commanding.

The Headquarters will be closed during August except on Tuesday evenings. The range will be open on Thursday evenings only. Instruction Classes at Regency Street will be held as usual for Platoons Nos. 9 and 10. The Camp at Otford will be available until August 31st. Members wishing to attend should enter their names at Headquarters.

Sunday Entrenching Parades. Parade in Uniform at Victoria Station (S.E. and C. Railway) Booking Office, 8.45 a.m.

MACLEOD YEARSLEY, *Adjutant*.

Wages on the C.P.R.—As a result of a conference between the management and the Unions, the machinists, boiler-makers, pipefitters, carmen, and electrical and sheet metal workers of the Canadian Pacific Railway have secured an increase in wages of 80 per cent. and better working conditions, which they consider equal to 25 per cent.—*Times*.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—Mr. H. PILCHER, who is severing his connection as inspector with the Dover Corporation tramway department, to take an appointment elsewhere, has been presented by the staff with an inscribed half-hunter watch and a cigarette-holder and case.

At the last meeting of the Huddersfield Council, Coun. T. Shires made courteous reference to the impending loss of Mr. MOUNTAIN as the manager of the electricity department, and stated that that gentleman, who had been with them since the inception of the department, had engineered the works in a way that could not have been surpassed.

The marriage was solemnised at Marton, on August 17th, of Private JOS. H. DOWNING, of the A.S.C., formerly employed at the Blackpool Electricity Works, and Miss Helena Cardwell, of Marton.

Mr. WM. FRASER, station superintendent at the Barking Urban Council's electricity works, has been appointed electrician-in-charge of important shell and projectile factories in the Midlands. He has been in the employ of the Barking Council for 17 years.

Mr. R. D. SHEPPARD has been appointed junior engineer-in-charge at the electricity works, Newport (Mon.).

The salary of Mr. C. T. ASTBURY, resident electrical engineer to the Atherton District Council, is to be increased from £185 to £240 per annum. The allowance that he is now receiving as a war bonus, and for electricity used at his residence, is to be discontinued.

Mr. GEORGE LEWIS, traffic inspector in the Manchester Corporation tramways department, retires next week. From 1876, until the old tramway system in Manchester was taken over by the Corporation, he was employed by the Manchester Carriage Co.

General.—At Keighley, last week, the marriage took place of Mr. HERBERT WHITAKER, M.Sc., analytical chemist to the British Westinghouse Co., Ltd., of Manchester, and Miss Elsie Margaret Smith, second daughter of Ald. J. Smith, of Dalesmoor, Keighley.

Roll of Honour.—It is with the deepest regret that we record the death in France, on August 1st, from wounds received on July 30th, of Lieutenant HAROLD ASHCOMBE CHAMEN, Bedfordshire Regiment, aged 22, younger son of Mr. W. A. Chamen, engineer and general manager of the South Wales Electrical Power Distribution Co. Lieutenant Chamen, before the war, was a student at Reading University College, in the agricultural department. On the proclamation of war, he volunteered for service, and, after a month's special training in camp at the Queen's University, Belfast, was gazetted to the South Wales Borderers as Second-Lieutenant. After two or three months, however, he decided to make the Army his permanent profession, and proceeded to the Royal Military College, Sandhurst, from which he was given a commission in the Bedfordshire Regiment. He went out to France in May, 1915, and came home, accidentally wounded, at the end of July, 1915, but returned to France in January, 1916. He was in the heavy fighting at Trones Wood on July 12th and 13th, and came through without injury, but in an attack on the German position south of Guillemont on July 30th his battalion was heavily shelled, and young Chamen

was badly wounded by a shell. He died from his wounds on August 1st, 1915, near Arras, in France. His Commanding Officer, Lieut.-Col. H. S. Poyntz, in a letter to Lieut. Col. H. S. Poyntz, writes: "He was generally loved by all. A better officer never stepped. I cannot tell you how we miss him, and I cannot speak too highly of his character and ability as a soldier."

Second-Lieutenant A. J. PEARSON, Machine Gun Section, one of the telephone engineers of the Western Electric Co., Ltd., has just been awarded the Military Cross.

Sergeant H. BRYAN, D.C.M., who was, before the war, engaged with Messrs. W. H. Allen, Son & Co., Ltd., Bedford, has fallen in action in France. He gained the D.C.M. in February, 1915, by bravely rescuing wounded comrades under heavy fire.

Private PORTON, of the Oxford and Bucks. Light Infantry, who has died of wounds, was on the Rugby staff of the British Thomson-Houston Co., Ltd.

Private BERT BUNKER, of the Cheshire Regiment, killed in action in France, was formerly engaged at Stafford with Messrs. Siemens Bros. Dynamo Works, Ltd.

Private JAMES DUNKERLEY, of the R.A.M.C., killed in action, aged 20 years, was formerly employed by Messrs. S. H. Heywood & Co., Ltd., electrical engineers, Redditch.

Private HAROLD HOLT, of the King's Own Royal Lancasters, who was employed at the British Westinghouse Works, Trafford Park, has been killed in action, aged 25 years.

Private JOHN WATKINS, of the Duke of Wellington's Regiment, who has been killed, was an electrician in the employ of the Craven and District Private Telephone & Electric Co., at Skipton.

Sergeant WM. GRACE DUKE, of the Oxford and Bucks Light Infantry, of Oxford, an electrical engineer, has been wounded in action.

Second-Lieutenant H. C. DAVIS, of the Lancashire Fusiliers, who was secretary for Messrs. Pearson's (Electricians), Ltd., of Manchester, has been killed in France, aged 28.

Private WILLIAM TITTINGTON, of the Manchester "Pals," aged 19, employed at the British Westinghouse Works, Trafford Park, has been killed in action.

Sergeant FRED DEVEY, of the Loyal North Lancashire Regiment, formerly an electrician with Messrs. Dick, Kerr & Co., Ltd., Preston, aged 20 years, has died from wounds. Private DANIEL ROUND, of the Royal Fusiliers, reported missing, and Private P. DOYLE, of the Loyal North Lancashires, wounded, were also in the service of the same firm.

Private JOSEPH HOLLINGS, of the Manchester Regiment, reported missing, was employed by the British Westinghouse Co., Ltd., Trafford Park. Sergeant W. E. JONES, of the Loyal North Lancs. Regiment, aged 26, who has died of wounds, was also employed by the same firm.

Private EDWARD LYON, of the Manchester "Pals," reported wounded, was employed by Messrs. Slater Bros., electrical engineers, Manchester.

Second-Lieutenant CECIL GEORGE SHADDICK, Dorsetshire Regiment, who was killed on August 8th, aged 23, entered the service of the Western Telegraph Co., and, according to the *Times*, was home on sick leave from Cape Verde Islands at the outbreak of war.

Sergeant F. WAITE, West Yorkshire Regiment, who has been killed in action, was employed in the Harrogate Corporation electricity department.

Corporal J. MAJOR, of the King's (Liverpool Regiment), wounded in action, was an electrical wireman on the Lancashire and Yorkshire Railway.

The *Times* states that Second-Lieutenant S. L. FAITHFULL, R.E., who has been accidentally killed in action, aged 40, was a qualified electrical engineer. He served in the Boer War. In 1911 he was selected from 200 candidates to be Inspector of Electrical Plant of the Gold Mines on the Rand.

Second-Lieutenant A. J. BROCKMAN, King's Own (Royal Lancaster Regiment), who has been killed while leading his platoon, was the son of a director of F. Braby & Co., Ltd. He spent many years in the East with the Eastern Telegraph Co., Ltd.

Obituary.—MR. HAROLD BILLE.—We regret to learn from the *Times* "Deaths" Column, that Mr. Harold Bille, M.I.E.E., of Croydon, joint managing director of Messrs. Creed, Bille and Co., Ltd., telegraph instrument makers, died on August 19th, as the result of a railway accident. He was 37 years of age.

MR. GEORGE KEITH.—We regret to read in the *Financial Times* of the death, which occurred on Tuesday, in London, of Mr. George Keith, chairman or director of a number of South American telegraph and telephone companies, including the Cuba Submarine Telegraph Co., the United River Plate Telephone Co., American Telephone Co., and the Chile Telephone Co.

Will. The *Times* states that Mr. HENRY MACDONALD GILL, aged 43, of Lowestoft, electrical engineer, who had recently been appointed Munition Engineer for Central Scotland, formerly chief engineer at the Isle of Wight electrical works, left £14,370.

NEW COMPANIES REGISTERED.

East Kent Road Car Co., Ltd. (144,585).—Registered August 14th, 1916. Mowd & Mowd, Canterbury, Capital, £125,000 in £1 shares. Objects: To run over all or part of the business carried on in East Kent by Thomas Tilling, Ltd., the British Automobile Traction Co., Ltd., the Metropolitan Motor Co., Ltd., and District Motor Services, Ltd., and the Kent and the Kent and Maidstone Gasworks (Grange), Ltd., or some of them, and to carry on the United Kingdom and elsewhere as owners, lessors, or otherwise the businesses of tramway, railway, light railway, pier, motor-car, omnibus, van, wagon, cab, and carriage proprietors, store and garage keepers, contractors by land and sea, manufacturers of and dealers in motor-cars, omnibuses, cycles, carriages, trucks, locomotives, vehicles, electrically propelled vehicles, and other motor vehicles, and to do all such other business as may be deemed expedient. Directors: Thomas Tilling, director; Walter J. French, 314, Hugh Road, Bournemouth, S.W., engineer; Richard J. Howley, 1, Kingsway, W.C., M.I.C.E. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than 12) are: Sidney Leslie Garcke (chairman), George Griggs, Frederick William Wachter, Thomas Walsey (deputy-chairman), Walter Walsey, John Walter E. French, Richard J. Howley, and Richard H. Grant. Any trust deed for securing debentures or debenture stock may, if so arranged, provide for the appointment from time to time by the directors of a person nominated by them to be a director. Quorum for £20 shares. Remuneration, £140 per annum Chairman £30 extra, and each other £20 (plus 1s. 6d. per share). Mowd & Mowd, Canterbury. Registered office: 68, Castle Street, Canterbury.

British Aero Magnet Manufacturers' Association, Ltd. (144,585).—This company was registered on August 14th, 1916, as a company limited by guarantee with 20 members, each liable for £100. Objects: To promote and protect the interests of manufacturers of aero planes and aero magnetics in the United Kingdom, to promote the construction and development of subjects affecting such manufacturers, to conduct and direct and to control and to manage the business of the company, to produce the electric spark in aero combustion engines, &c. The subscribers are: W. C. Lusk, 53, Cannon Street, E.C., director of British Thomson-Houston Co., Ltd.; D. E. Morris, Victoria Works, Kenton, director, the M. L. Magneto Syndicate, Ltd.; C. H. Kirby, 14, Soho Square, W., director of Nicol, Nielsen & Co., Ltd.; B. Steeley, Arden Works, Chesapeake, Birmingham, director of Thomson-Bennett Magnetos, Ltd.; P. F. Bennett, Arden, director of Thomson-Bennett Magnetos, Ltd.; E. Garton, C. A. Lister, 3, North, St. Wilfrid's, Hagden Lane, Watford, manufacturer. Members must be bona-fide British manufacturers of aero magnetos or their authorised representatives. The first members are the British Thomson-Houston Co., Ltd., the M. L. Magneto Syndicate, Ltd., Nicol, Nielsen & Co., Ltd., and Thomson-Bennett Magnetos, Ltd., P. F. Bennett, E. Garton, C. A. Lister, and R. B. North. All other candidates are to be elected by the company. The first directors for the first year is £25 per month, afterwards, the company shall decide. Solicitors: R. A. Monks, 123, Cannon Street, E.C.

Hill Bros. (Magnetos), Ltd. (144,612).—Registered August 15th by Waterlow & Sons, Ltd., London Wall, E.C., Capital, £50,000 in £1 shares (20,000 6 per cent. cum. pref.). Objects: To take over the business carried on by W. A. Hill at Phoenix Works, Morley Road, Bedminster, Bristol, as Hill Bros., and to carry on the business of manufacturers of and dealers in magnetos, engineers, electricians, machinists, fitters, manufacturers of electrical or other machinery, founders, mill and wheelwrights, smiths, wire drawers, tube makers, metallurgists, &c. The subscribers (with one share each) are: W. A. Hill, The Carlton, Portland Street, Southampton, electrical engineer; W. Roberts, Park Avenue, Handsworth, Staffs., gentleman. Private company. The first directors (to number not less than three or more than seven) are to be appointed by the subscribers. Remuneration, £200 each per annum. Solicitors: Forsyth, Bettinson & Co., 36, Cannon Street, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

D. P. Battery Co., Ltd. (44,084).—Capital, £10,000 in £1 shares (4,396 "A," 4,996 "B," and eight others). Return dated July 21st, 1916. All shares taken up; £10,000 paid. Mortgages and charges, £12,000.

Brilliant Arc Lamp & Engineering Co., Ltd.—Memoranda of satisfaction (a) in full on July 27th, 1916, of debentures dated June 18th, 1915, securing £1,200, (b) to the extent of £50 on June 17th, 1916, of debenture dated June 22nd, 1916, securing £90, have been filed.

S. Bill & Co., Ltd.—Particulars of £600 debentures, created June 14th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being raised. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

A. Hirst & Son, Ltd. (57,889).—Capital, £5,000 in 100 pref. and 400 ord. shares of £10 each. Return dated June 17th, 1916. All shares taken up; £2,000 paid on 100 pref. and 100 ord.; £3,000 considered as paid on 300 ord. Mortgages and charges, £1,000.

Lancashire Power Construction Co., Ltd. (77,202).—Capital, £120,000 in 12,000 "A" and 12,000 "B" shares of £10 each. Return dated July 6th, 1916. 18,000 "A" and 11,836 "B" shares taken up; £283,360 paid on 18,000 "A" and 10,336 "B"; £15,000 considered as paid on 1,500 "B." Mortgages and charges, £30,000.

New General Traction Co., Ltd. (47,321).—Capital, £302,000 in £1 shares. Return dated June 28th, 1916. All shares taken up; £250,000 paid; £12,000 considered as paid. Mortgages and charges, £32,500.

Barnsley & District Electric Traction Co., Ltd. (72,962).—Capital, £50,000 in 5,000 pref. and 5,000 ord. shares of £5 each. Return dated May 2nd, 1916. 4,400 pref. and 4,007 ord. shares taken up; £42,085 paid. Mortgages and charges, £21,000.

Venner Time Switches, Ltd.—A memorandum of satisfaction to the further extent of £550 on August 2nd, 1916, of debentures dated July 10th, 1911, securing £5,000, has been filed. (Amount outstanding, £2,950.)

Hong-Kong Tramway Co., Ltd.—A memorandum of satisfaction to the further extent of £400 on July 14th, 1916, of a trust deed dated July 1st, 1903, securing £105,000, has been filed.

Barford Electric Supply Co., Ltd.—A debenture dated August 11th, 1916, to secure £700, charged on the company's undertaking and property, present and future, including uncalled capital, has been registered. Holders: J. B. Cardlake, 7, Cannon Street, Birmingham; Major G. W. Richard, Wingham Manor, Andoverford, and H. D. Smith-Kyland, Barford Hill, Warwick.

Shanghai Electric Construction Co., Ltd. (86,795).—Capital, £320,000 in £10 shares. Return dated June 2nd, 1916. All shares taken up; £317,900 paid; £3,000 considered as paid. Mortgages and charges, Nil.

Pitter's Ventilating and Engineering Co., Ltd.—Memorandum of association in full on August 4, 1916, of 1,000 Registered Shares, and Memorandum of Change, both of 1916, of 1,000, showing increase from time to time made by the London & Provincial Bank, Ltd., have been filed.

Siemens Bros. & Co., Ltd. (14,777).—Capital, £600,000 in 45 shares. Return dated June 30, 1916. Amount taken up £600,000 paid. Mortgage and charges £150,000. A consolidated number of the shares of the London & Provincial Bank, Ltd., showing the names of the directors, and the date of the meeting, has been changed, according to George Chauvin.

Sheerness and District Electric Power & Traction Co., Ltd.—Capital, £75,000 in 3,000 shares, and 2,000 preference shares of £10 each. Return dated June 30, 1916. Amount taken up £247,000. Shares taken up, £247,000 paid. Mortgage and charges £22,250.

CITY NOTES.

Tyneside Tramways and Tramroads Co. The half-yearly meeting was held in Newcastle-on-Tyne on 15th inst. Dr. J. T. MERZ, who presided, said the figures for the half year showed a considerable difference compared with the slow, but pretty certain, improvement on former occasions. For the first time they had to report a considerable decrease in revenue. The receipts were £1,048 less, and the costs were £267 more, than in the corresponding half-year, so that they had £1,285 less to deal with. That amount could only be met from three sources: partly by reducing the dividends, partly by not increasing the reserve fund to the same extent as last year, and partly by reducing the amount carried forward. The reduction in the dividend from 3 to 1½ per cent. meant £837, the reduction of the amount to the reserve meant £261, and the reduction in the carry-forward meant £291. In spite of reducing the amount to reserve, they had increased, in the course of the last twelve months, that fund from £20,666 to £23,936, a very considerable amount coming from the interest on investments and loans. They need not be discouraged by the reduction in the dividend, because it was largely explained by the fact that the holiday traffic, which in former years always showed up so well, had practically disappeared for the present. It was, he hoped, only a temporary incident. The ordinary traffic had been reduced by £465. There was a small increase on the workmen's traffic. For the second half of the year, they had hoped some time ago they would get the holiday traffic, but at present it appeared as if there would be no general holidays which would give them much in holiday receipts; the week-end traffic was regular, and, especially in fine weather, was larger than last year. It was quite possible that in the course of the second half-year there would be an increase on the receipts of last year. To date the traffic had increased. On the whole, unless things changed considerably, they might look forward to a better time during the second half-year.

Metropolitan Electric Supply Co., Ltd.

	Inc. or dec. on previous year of units sold.	Approx. revenue from all sources.	Inc. or dec. on previous year of revenue.	Approx. revenue from all sources.	Amount available for reserve, dividend and carry forward.
Six months ended June 30th.	No. of units sold.				
1913	8,847,281	£11,306,710	£111,635	£110,416	£57,011
1914	9,638,755	+791,744	114,635	+2,947	58,220
1915	9,536,691	-102,064	114,312	-323	54,475
1916	11,600,918	+2,064,227	132,960	+18,648	55,611

"The above table shows that, except for a slight decrease in the first six months of 1915, there has been a steady increase in the number of units sold in each succeeding half-year. The increase is most marked in the last half-year (1916), notwithstanding the adverse effect produced upon the lighting load by the Daylight Saving Act and by the restrictive regulations under the Defence of the Realm Act. The directors consider the half-year's trading satisfactory, especially as the costs of production have largely increased owing to the war, the price of coal, alone, being 50 per cent. higher than in 1914." As announced last week, an interim dividend of 1s. per share (being at the rate of 2 per cent. per annum) on the ordinary shares has been declared, less income-tax. This will absorb £10,000, and leave an unappropriated balance of £25,368.

For the year ended December, 1915, the gross receipts were £12,068, a decrease of £259. There is a balance on the revenue account of £2,380 after providing for renewal of distributing cables, feeders, and pilots in Portsmouth Road, conversion of boilers, renewal of stokers, and renewal of chimney, totalling £1,634. To help meet this special expenditure, which had to be carried out in order to maintain the supply efficiently, £1,000 was transferred from reserve to revenue account. After providing for debenture and loan interest, and preference dividend for the half-year ended June, 1915, the net revenue balance of £222 is to be carried forward. The number of connections increased from 1,195 to 1,235; the total revenue fell from £12,356 to £12,098; the total costs increased from £7,409 to £9,924; and the gross profit fell from £4,947 to

£3,074. The company suffered considerably owing to the greatly increased cost of production of electricity, also to a large extent by the enormous decrease in the sale of current for lighting purposes. This decrease has been partly made up by the increased sale of low-priced units for power purposes. Charges for current for all purposes were increased as from the end of September quarter, 1915. Mr. C. W. Dixon, who has been in France on Red Cross duty from the commencement of the war, ceased to be a director during the year.

Russian Electrical Companies.

The *Russian Siemens & Halske Co.* records gross profits amounting to £134,700 for 1915, and net profits of £84,800. It is intended to distribute 8 per cent. on the share capital, or £3 2s. per share.

The accounts of the *Russian Siemens-Schuckert Co.* indicate gross profits of £179,300 for 1915. The allocation made to the depreciation fund is £48,000, whilst the proposed dividend of 6 per cent. will absorb £90,000.

The *Kieff Electricity Co.*, whose undertaking was placed under State control in 1915, is now to be liquidated by Ministerial order. The ordinary shares number 24,000, of which 23,892 are in the possession of the Berlin Electrical Undertakings Co., and the technical and economic management have been found to have been in the hands of the A.E.G.

The report of the *Russian General Electricity Co.* for 1915 states that the activity of the undertaking was less productive than in normal periods, although the final results could be considered satisfactory, having regard to the difficulties created through the war, including the removal of the Riga works. The company was mainly engaged on the execution of Army contracts, which had reached a large scale, and which rendered necessary the provision of additional capital. As net profits, the accounts show the sum of £223,800, and a dividend has been declared at the rate of 10 per cent., as in 1914, but the date of payment has been postponed to a more favourable time. The directors present at the recent annual meeting were all Russian subjects, and authority was then given for the share capital to be raised from £1,200,000 to £2,000,000 by the issue of new shares for £800,000.

The report of the special administration of the *Petrograd Electric Lighting Co.* of 1886 states that the financial results in 1915 were not on the same level as those realised in the preceding year, as the working of the Lodz station was not included, and sale prices were not increased, despite the growth in the cost of production, and all communication with Lodz had ceased since November, 1914. At the end of 1915 the value of the connections of the Petrograd and Moscow works was 194,476 kw., as compared with 172,771 kw. at the close of 1914; the number of consumers rose from 83,701 in 1914 to 91,705 last year, and the total production advanced from 193,948,000 kw.-hrs. to 230,209,000 kw.-hrs. in the two years respectively, the works engaged on Army contracts having been exceptionally large consumers. The special committee, which assumed control of the undertaking in July, 1915, is composed of members of the board of directors, and representatives of the Ministries of Trade and Industry, War, Navy, and of the Town Councils of Petrograd and Moscow. The net profits are returned at £680,900 for 1915, as compared with £683,800 in 1914. It is proposed to pay a rate of 10 per cent. on the preference shares, as in 1914, and 7 per cent. on the ordinary shares, as against 8 per cent. in the previous year, but the amount available for these purposes has been credited to the dividend account, as in 1914, for disposal at an appropriate future period.

The *Electro-Mechanical Equipment Co.* (Duflon Constantinovitch & Co.) has paid 14 per cent. dividend.

The *Russian Regional Electrical Stations Co.* (capital 4,000,000 roubles) made a profit of 402,340 roubles in the year 1915, and will pay a dividend of 4 per cent., as for the preceding year.

The *Russian (Tudor) Accumulator Factories Co.* made a profit of 377,061 roubles in 1915, and will pay a 10 per cent. dividend, against 9 per cent. in the preceding year.

The *Moscow Electrical Factories Co.* has been formed to exploit the I. Struckhoff and V. Chibisoff Electrical Factories in Moscow. Capital, 300,000 roubles.

The *Donetz Basin Electrical Co.* (offices in Petrograd) began operations on June 25th/July 8th.

Cuban Telephone Co.—A dividend of 12 per cent. on the preferred shares for the period to June 30th is announced.

Tubes, Ltd.—At the general meeting of Tubes, Ltd., on 2nd inst., a resolution was submitted to increase the capital from £100,000 to £150,000 by the creation of 50,000 shares of £1 each, which are to be offered to shareholders in the proportion of one new share for every two shares held. It is proposed to declare, about two months after the general meeting, a bonus of 5s. per share, payable out of the reserve fund, and to ask the shareholders to authorise the application of this bonus to the payment of the amount due on the new shares.—*Financial Times.*

Spanish Telephone Co., Ltd.—The directors recommend a dividend of 5 per cent., less income-tax, for the year ended May 31st, leaving £1,281 to be carried forward.—*Financial Times.*

STOCKS AND SHARES.

TUESDAY EVENING.

Very much better news is reported from Mexico. It came in the shape of an intimation from Carranza to the effect that the Mexican Railway Co. will be handed back to the proprietors of the line, and upon terms which the latter are not likely to quarrel with. This was a complete surprise, and the immediate result was to put up the prices not only of Mexican Rails, but of all other securities connected with the country. The utilities, of course, have gone with the rest.

It is not so much a question of actual prices as of change in the condition of the market which really matters to the stockholders. Whereas they found it hard to sell just lately, now the position is that there are many buyers, with no stocks to supply them. It is hardly likely that, after wandering in the wilderness of gloom and depression for the last two years, the holders of Mexican stocks will be anxious to sell them now.

Mexico Tramways at 30, and the Firsts at 42, are both 2 higher. The Light and Power Co.'s first bonds at 42 are similarly better. Pachuca Fives at 33 are up 2 points nominally, though in the actual market it is doubtful whether \$1,000 could be bought at anything like 34. Mexican Electric Light 5 per cent. bonds at 34 are 3 points better. The assumption is that Carranza will see to it that proprietors of these utility companies are treated equally well with the stockholders in the railways, because, if the disturbed areas are really to settle down, there is a highly important part for these light and power undertakings to play—a part, indeed, which is indispensable to Mexico's return to commercial activity. Mexican Northern Power Fives have come into demand at 14½. Monterey Fives at 30 are ¾ points up on the week.

These may be early days to sketch with any generous hand the prospects of the country; and disappointments have befallen too often on previous occasions for anyone to exaggerate the pleasant promise which seems to offer at the present time. Nevertheless, after the many false starts, this may well turn out to be the turning point in the situation; and it is not difficult to understand why bondholders refuse to part with their securities.

Another good spot is that for the British Columbia Electric stocks, which have made further progress, following upon their previous substantial rises. The quartet of stocks quoted in our lists, which gained 1—4 points last week, shows rises of 1 or 2 now; the reason, as we mentioned before, is the expectation that the forthcoming report will make cheerful reading for the shareholders. With the improvement in these stocks has come a sympathetic rise in Vancouver Power 4½ per cent. debenture stock, taking it to 67, which is a point below the similar security of the B.C. Co.

Other foreign and colonial issues are somewhat irregular. Anglo-Argentine Tramway Firsts fell back to 3 13/16, and the 5 per cent. debenture stock to 76. Brazil Tractions picked up to 62½, around which price they have been revolving for the past few weeks. Buenos Aires Lacroze Fives at 84 are somewhat easier on the week. The Canadian-American list of power companies has for its feature a rise to 245 in Montreal Light and Power, this being a jump of about 6 points. Canadian General Electrics reacted to 122, after being 125. The remaining stocks in this group are firm, with a slightly better tendency.

The Home Railway market is still forlorn and unbefriended. So far as the electrical stocks are concerned, Districts at 18½ are ¼ down, Metropolitan fell ¼, London & South-Western deferred has gone back to 25½. The Underground group is fairly steady, the Income bonds remaining at 91½, sustained by their forthcoming dividend payment. The Labour situation is not calculated to attract much general buying of the stocks, and it seems likely enough that prices will have to go back still further before the public come in.

The hope for domestic securities of all kinds lies in the obvious fact that there is a lot of money being made in the country, that many folks are chary of touching what are called "war stocks" at the present time, and that money available is seeking employment in other channels in addition to those provided by the Government borrowings. Even nowadays it is by no means an easy matter to get a perfectly sound 6 per cent. stock, notwithstanding the current Bank Rate.

Kensington ordinary and Metropolitan ordinary, in the electricity supply section, have both recovered their dividends. Westminster has been lowered ¼, and the same fraction has been deducted from both classes of Charing Cross shares. The Metropolitan dividend, as we showed last week, is at the rate of 2 per cent. per annum. The market is firm throughout, with very little supply to meet a consistently steady demand.

Great Northern Telegraphs at 40½ are 30s. higher, making a rise of £2 10s. in a fortnight. Cable shares are good. Westerns are ¼ up at 15½, and Anglo-American Telegraph preferred at 104 is ¼ higher. Rises have occurred in "China" shares, in Eastern ordinary, and in Chile Telephones. In the Marconi section, the parent shares are strong at 34, but the subsidiaries have given way a trifle—Americans to 18s. 9d., the Canadians to 10s. 9d. Animation has died out of the market of late, speculators preferring to wait for the next developments before giving the shares another run. But the market certainly looks decidedly good at the moment.

Henleys have risen to 16½, a gain of the fraction, on the declaration of an interim dividend on the ordinary shares at the rate of 10 per cent. per annum, the same as a year ago. Even now the shares pay over 7½ per cent. on the money, allowing for inclusion of the dividend, provided they are to be obtained. Callenders pay a little more. British Insulated, which have gained 5s. at 12½, return about 7 per cent. on the money. Electric Construction debenture stock at 69 is 2 points higher, and the shares hold all their rise at 17s. 6d. General Electric ordinary have hardened to 134.

In the chemical shares, the popular favourite of the moment is Salt Unions. Castner-Kellners are quiet at 34. Babcock and Wilcox remain a little under 3. Edison & Swan 43-paid shares are 1s. up at half-a-guinea. There is no particular variation elsewhere in this list.

The rubber anomaly continues of the share market being good in the face of dullness in the raw material. The usual sequel to the latter is once more in evidence, namely: the complaint that the price of rubber itself is being manipulated by interested parties. The expansion in America's demand for the article is expected to reach 50 per cent. above last year's consumption of 90,000 tons. With the Continent closed to Americans and to the money that they are making by reason of the war, the United States holiday-makers are confined to a large extent within their own country, to see which they must, of course, have motors, motors, and ever more motors.

Amongst copper and tin shares, there have occurred no changes of interest. The prices of the metals remain somewhat quiescent after their recent activities. More business is moving in armament shares; and investors in the North are evidently not afraid to buy at the current prices, notwithstanding the caution shown by the Southern capitalists in their selection of war stocks.

SHARE LIST OF ELECTRICAL COMPANIES.

	HOME ELECTRICITY COMPANIES.		Price Aug. 22, 1916.	Rise or fall this week.	Yield p.c.
	Dividend				
	1914.	1915.			
Brompton Ordinary	10	10	6½	—	27 18 2
Charing Cross Ordinary ..	5	5	34½	—	7 2 10
do. do. do. 4½ Pref. ..	4½	4½	34½	—	8 8 7
Chelsea	5	4	8	—	6 18 4
City of London	9	8	10½	—	6 3 0
do. do. 6 per cent. Pref. ..	6	6	10½	—	6 14 8
County of London	7	7	11½	—	6 8 9
do. do. 6 per cent. Pref. ..	6	6	10½	—	6 14 3
Kensington Ordinary	9	7	65½	—	6 7 2
London Electric	4	4	13	—	6 10 5
do. do. 6 per cent. Pref. ..	6	6	4½	—	6 13 4
Metropolitan	34	3	28½	+1/1	6 6 4
do. do. 4½ per cent. Pref. ..	4½	4½	8½	—	7 4 0
St. James' and Pall Mall ..	4	3	6½	—	6 16 4
South London	5	5	22	—	6 18 10
South Metropolitan Pref. ..	7	7	1½	—	8 4 5
Westminster Ordinary	9	7	6½	—	6 14 3

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	6	6	104	+ ½	6 15 6
do. do. Del.	30½	33½	23½	—	7 8 9
Chile Telephone	5	5	8	+ ½	6 16 6
Cuba Sub. Ord.	5	5	8½	—	6 1 8
Eastern Extension	7	8	14½	+ ½	6 7 6
Eastern Tel. Ord.	8	8	10½	+ ½	6 8 8
Globe Tel. and T. Ord. ..	6	7	12½	—	6 5 8
do. do. Pref.	6	6	10½	—	6 10 4
Great Northern Tel.	22	22	40½	+1½	6 8 9
Indo-European	13	13	48	—	6 15 8
Marconi	10	10	8½	+ ½	3 1 6
New York Tel. 4½	4½	4½	99½	—	4 10 3
Oriental Telephone Ord. ..	10	10	2½	—	6 0 0
United R. Plate Tel.	8	8	6½	—	6 18 5
West India and Pan.	1	1	15½	+ ½	6 5 10
Western Telegraph	7	8	15½	+ ½	6 5 10

HOME RAIL.

Central London, Ord. Assented	4	4	74	—	5 8 1
Metropolitan	1½	1	24½	—	4 0 10
do. District	Nil	Nil	18½	—	Nil
Underground Electric Ordinary	Nil	Nil	13½	—	Nil
do. do. "A"	Nil	Nil	6½	—	Nil
do. do. Income	6	6	91½	—	6 11 2

FOREIGN TRAMS, &c.

Adelaide Sup. 6 per cent. Pref.	6	6	5	—	6 0
Anglo-Aust. Trams, First Pref.	5½	6	9½	—	7 4 3
do. do. 2nd Pref.	5½	6	8	—	6 11 7
do. do. 5 Dts.	5	5	76	+ ½	6 8 0
Brazil Tractions	4	4	63½	+1	6 8 0
Bombay Electric Pref.	6	6	115½	—	6 14 3
British Columbia Elec. Rly. Pnce.	5	5	65	+ ½	7 7 1
do. do. do. Preferred ..	49	49	2	+ ½	Nil
do. do. Debent.	Nil	Nil	46	+1	Nil
do. do. Debent.	44	44	68	+2	6 5 0
Mexico Trams 6 per cent. Bonds	Nil	Nil	42	+2	Nil
do. do. 6 per cent. Bonds	Nil	Nil	35	+1	Nil
Mexican Light Common	Nil	Nil	90	—	Nil
do. Pref.	Nil	Nil	84	—	Nil
do. 1st Bonds	Nil	Nil	42	+2	—

MANUFACTURING COMPANIES.

Babcock & Wilcox	14	15	12½	—	5 2 0
British Aluminium Ord. ..	5	5	7	—	6 7 8
British Insulated Ord.	15	17½	12½	+ ½	7 2 10
British Westinghouse Pref. ..	7½	7½	50½	—	6 0 0
Callenders	15	20	12½	—	6 3 4
do. 5 Pref.	5	5	44	—	6 17 8
Castner-Kellner	20	20	33	—	6 6 8
Edison & Swan, 43 paid ..	Nil	Nil	106½	—	Nil
do. do. fully paid	Nil	Nil	12	—	Nil
do. do. 6 per cent. Deb. ..	5	5	60	—	8 6 8
Electric Construction	6	7½	17½	—	8 11 6
Gen. Elec. Pref.	6	6	9½	—	8 1 6
Henley	20	25	16½	+ ½	7 13 10
do. 4½ Pref.	4½	4½	4	—	5 12 3
India-Rubber	10	10	12	—	6 6 8
Telegraph Con.	20	20	89	—	6 4 0

* Dividends paid free of income-tax.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JULY, 1916.

ALTHOUGH the July returns of electrical exports and imports show a considerable reduction in business as compared with the preceding month, the values attained satisfactory dimensions.

The exports reached a total value of £487,575, as compared with £603,510 in June, when, however, telegraphic exports were on an exceptional scale.

The imports for the month were valued at £213,714, as compared with £316,697 in the preceding month; and the re-exports reached a total of £13,513, being some £9,000 down on the month.

During the month machinery, battery, and telephonic exports somewhat exceeded in value those of the previous month, but a considerable falling off occurred in the telegraphic, cable and lamp

sections. It is somewhat noteworthy that France was our best customer, while other European countries, Australia, India and China were good markets. Compared with pre-war times South American trade was dull.

There was a fairly general falling off in imports, traceable to a decrease in purchases from the United States, whose contribution of £125,960 value towards the total compares with £245,622 in June.

An exception must be made in the case of lamp imports, however, which reached some £45,000 in value. Holland contributing £32,500 worth—the totals being much in excess of those for June. It may be noted that Japan figures this month as an importer into this country of various classes of goods.

Registered Exports of British and Irish Electrical Goods from the United Kingdom*

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting apparatus and accessories.	Electric glow lamps.	Electric incandescent lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus.	Telegraphic cable and apparatus.	Total.
Russia, Sweden, Norway and Denmark ...	770	4,051	153	1,181	371	2,032	14,083	1,734	389	994	825	5,530	32,116
Netherlands, Java and Dutch Indies ...	336	20,457	819	...	...	273	2,042	1,589	19	41	4,911	356	30,843
Belgian Congo ...	...	...	...	...	...	...	...	...	...	...	...	...	...
France ...	2,780	710	839	266	279	516	19,304	888	614	3,346	16,156	27,061	72,759
Portugal ...	255	1,361	131	609	...	257	887	622	51	108	1,386	8,826	14,493
Spain, Canary Isles and Spanish N. Africa...	233	300	385	15	...	1,308	9,998	478	120	323	54	407	13,621
Switzerland, Italy and Austria-Hungary...	170	362	277	...	42	1,859	2,197	630	534	46	146	10,241	16,504
Greece, Roumania, Turkey and Bulgaria...	29	...	51	13	...	...	222	...	...	4	...	...	319
Channel Isles, Gibraltar, Malta and Cyprus...	92	150	25	2	...	...	315	...	...	...	17	819	1,423
U.S.A., Philippines and Cuba ...	698	...	97	21	15	14	1,473	...	64	...	39	745	3,166
Canada and Newfoundland ...	403	389	34	239	45	399	1,073	...	23	674	54	3,393	...
British West Indies and British Guiana ...	383	...	141	199	...	...	292	...	84	16	26	350	1,491
Mexico and Central America ...	...	...	46	13	...	...	...	...	...	...	2,188	...	2,269
Peru and Uruguay ...	74	...	41	50	45	...	...	...	130	...	...	10	427
Chile ...	...	1,382	869	208	...	849	1,824	...	192	...	22	142	5,496
Brazil ...	...	1,184	135	38	...	109	2,072	1,036	...	89	...	907	6,171
Argentina ...	1,692	6,812	967	412	...	2,542	2,199	1,110	1,329	55	489	693	18,300
Colombia, Venezuela, Ecuador and Bolivia...	67	48	16	...	...	595	226	...	30	...	159	59	1,200
Egypt, Tunis and Morocco ...	87	775	206	164	...	229	271	13	690	...	1,060	83	3,578
British West Africa ...	72	47	...	48	...	...	107	...	39	...	286	618	1,217
Cape of Good Hope ...	863	5,592	309	723	...	1,584	2,481	42	5,452	11	689	10	17,756
Natal ...	805	9,143	228	307	20	28	5,517	595	56	15	64	277	17,055
Rhodesia, O.R.C. and Transvaal ...	147	2,329	307	2,405	...	233	2,348	...	684	11	86	687	9,537
Zanzibar, Brit. E. Africa, Mauritius & Aden	112	51	17	24	...	...	468	...	...	...	102	115	889
Azores, Madeira and Portuguese Africa ...	117	53	117	22	...	169	96	...	...	...	...	10	584
French African Colonies and Madagascar...	10	...	...	24	...	...	1,496	...	...	22	...	...	1,552
Persia ...	...	...	...	...	...	...	...	...	...	...	...	1,291	1,291
China and Siam ...	1,039	4,553	266	677	46	1,606	13,795	497	268	51	47	1,871	24,716
Japan and Korea ...	1,411	...	18	...	44	894	8,451	...	1,533	83	...	3,420	15,854
India ...	1,841	15,132	3,416	3,554	238	5,251	16,994	4,256	5,036	161	2,147	738	58,764
Ceylon ...	328	654	211	209	...	...	237	3,205	122	...	100	...	5,066
Straits Settlements, Fed. Malay States and Sarawak ...	528	2,129	188	285	...	159	784	455	533	265	287	367	5,980
Hong Kong ...	278	1,074	615	165	12	564	920	...	174	43	123	509	4,477
West Australia ...	168	387	47	20	...	1,173	799	...	131	...	55	29	2,809
South Australia ...	164	5,869	68	207	...	157	1,392	...	5,398	2	7,838	...	21,095
Victoria ...	374	4,959	2,269	686	...	756	10,642	2,700	157	21	1,030	473	24,067
New South Wales ...	2,046	6,503	865	1,320	104	518	8,093	...	1,222	156	2,139	496	23,462
Queensland ...	205	661	50	262	12	52	690	613	593	25	743	...	3,906
Tasmania ...	...	...	...	...	...	...	72	...	...	...	...	...	72
New Zealand and Fiji Islands ...	413	6,443	546	834	157	424	5,377	321	2,579	88	2,573	162	19,917
Total. £	19,891	103,601	14,781	15,197	1,388	21,550	139,336	20,784	28,223	6,007	46,461	67,356	487,575

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark	...	...	...	965	...	8,487	...	2,078	...	1,246	12,776
Holland	72	1,752	...	26,118	6,425	...	385	...	140	965	35,857
France	16	86	...	382	199	951	1,306	...	6,512	1,824	10,136
Switzerland	899	2,810	206	150	956	5,015	145	...	80	1,250	11,511
Italy	3,763	5,994	...	...	...	...	536	...	22	...	10,315
United States	21,184	3,410	133	5,822	2,036	1,633	9,643	64,810	5,764	7,008	4,517
Japan	1,637	...	44	430	2,005	...	...	55	...	210	4,381
Total. £	27,571	14,052	383	33,867	11,621	7,599	20,502	64,832	14,629	10,082	7,038
											212,176

Additional imports.—Spain, carbons, £755. Natal, electrical goods, £20; Canada, electrical goods, £423; batteries, £40; electrical machinery, £300.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	1,455	3,850	...	1,714	23	272	2,358	...	849	77	2,815	13,713
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TOTAL EXPORTS: £487,575

TOTAL RE-EXPORTS: £13,513

TOTAL IMPORTS: £213,714

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

ELECTRIC POWER ON A RUSSIAN PEAT BOG.

MR. N. MILSTEIN writes in the *Elektrichestvo* that the increase in the price of wood, coal and petroleum has urgently directed attention to the search for cheaper fuel. One of the leading substitutes proposed is peat, which is widely distributed in Russia, particularly in the north. It will be of particular service, he says, to the electrical industry, for electricity, compared with steam, offers valuable facilities for operating peat presses.

The electrification of the Zhuravfino-Melechensky marsh, he continues, has certain characteristics that, in his opinion, may be of interest.

The central electrical power station belongs to the Bieloretzsk (Pashkovich Bros.) Co., and is equipped entirely for the service of the 11 peat presses (Hendun system) installed on the marsh. Neither lighting nor power transmission for other purposes is to be found on the marsh. The plant consists of three combined Fitzner & Hamper steam boilers, two single-cylinder horizontal Goerlitz engines, without condensers, and two three-phase Siemens-Schuckert generators.

The system is designed for the simultaneous operation of all the 11 presses, each of which requires 60 H.P., with a power factor of 0.7; a loss of energy in distribution up to 10 per cent. is allowed for. Bare aluminium cables, 50 mm.² in cross-section, were used for the main, and 35 mm.² for the branch lines; aluminium was chosen in preference to copper for economical reasons. The difficulty in soldering was got over by the use of special couplings, the mechanical strength and reliability of which are quite as good as those of soldered joints. A great advantage in using the coupling is the rapidity with which a joint may be made or separated.

The overhead lines that run down to the respective excavations are situated about 18 to 20 sazhen (1 s. = 7 ft.) distant. This distance is chosen so that the supports, as the peat is worked, may be removed every third working season. The depth of the turf at the Zhuravfino-Melechensky marsh averages 4 metres.

The current is conveyed to the electric motor that drives the peat press by a flexible rubber-insulated cable of 3×6 mm.² for 2,000 volts pressure, tested at the factory to 4,000 volts. The length of cable for each press is calculated so that for an average production per press of 40,000 to 45,000 briquettes daily, and at a depth of 3.5-4 metres, a transfer of the coupling-box in consequence of the removal of the press, may take place every five or six working days. The motors are connected to the presses by belts.

The motors are mounted on small hand sledges, and are fixed to the sleepers which form the frames of the platforms of the peat press. The motor, bedplate, press, and distributing-box with a 25-mm.² section conductor are connected to a galvanised iron plate which is carried in the direction of the transfer of the press, and sunk $1\frac{1}{2}$ arshins (3 ft. 6 in.) in the ground.

The power used in running the peat presses is irregular, not only for the individual presses compared with each other, but also for each press. This variation is due chiefly to the properties of the peat dealt with by the presses, the degree of its humidity, the quantity of material thrown into the elevator, the presence in the mass of non-rotted branches, and, finally, the mechanical condition of the belt. The great difference inherent in the factors named can be appreciated by comparing the work of presses Nos. 1 and 7. The former stands on very dry ground, and often meets with unrotted pieces of wood. The motor driving shaft is often badly aligned with regard to the shaft of the press. At press No. 7 the transmission is properly mounted; the mass is friable, with an average quantity of water. The

number of workmen in the pit loading the elevator for both presses was at first the same—namely, 12 per pit.

Observations were made with the aid of the ammeter at the distributing box and a wattmeter. There was no other apparatus at hand. On connecting the elevator of press No. 1, the ammeter reading varied between 23 and 26 amperes. This press used about 60 kW. It was stopped, the number of workmen to feed the elevator was reduced to eight, and water was poured on the mass. This reduced the load to 19-21 amperes. Meantime, the load of No. 7 during work varied between 15 and 17 amperes, making an average of about 40 kW. Thus the H.P. of the motors (60) chosen may be considered correct, except in section No. 1, where the motor-power had to be increased to 75 H.P. But to estimate in advance the many factors that might affect the work of the motors, as shown in section No. 1, is almost impossible.

SPANISH INDUSTRIES AND TRADE.

INFLUENCES OF THE WAR.

(Continued from page 195.)

The mineral wealth of north eastern Spain, the most mountainous part of the country, has not yet been fully exploited, but progress has been made in this direction during the past year, owing to the stimulus given by increased demand for metals of all kinds. Some difficulty has been experienced through the lack of proper transportation for ore from the mines to smelting works. In some instances, however, improved facilities have been afforded. Among minerals in which this district is especially rich may be mentioned coal, iron, zinc, lignite, peat, rock salt, fluorspar, limestone, and potash. During the past year embargoes have been placed on the export of many of these and their by-products, with the object of protecting domestic industries against lack of raw material. These measures have had a direct bearing upon local mining interests, especially as to the export of minerals, but cannot be regarded as having any permanent damaging results.

Mining in this district has to contend with various obstacles to its development. Some serious strikes have threatened to paralyse the industry, but they have been averted by concessions made to the miners. Much foreign capital is invested in the mines of Catalonia, and while this has often been advantageous, it sometimes results that proprietors of mines, for reasons of their own, obstruct exploitation, thus immobilising mineral wealth of the district.

After summarising the position of coal mining, iron mining, and potash deposits, Mr. Hurst reviews Spanish measures for commercial expansion. During the year 1914 a special agent was sent to Barcelona by royal order to study the export relations of this port with Latin America and suggest such means as would tend to increase commerce with the Republics of South and Central America. The report of this expert was published late in 1915, and shows an intelligent and comprehensive analysis of the subject. Another indication of the practical interest taken in foreign markets may be inferred from the fact that the University of Barcelona gives a course in commercial expansion, with lectures, excursions to principal industrial centres, and meetings with chambers of commerce and boards of trade. Lectures are delivered by specialists, not only in Spanish, but in French and German and enthusiasm is expressed in pushing the trade of this country abroad.

To the other South and Central American Republics much attention is devoted with the avowed purpose of gaining a stronger foothold in lands where the tastes of the public are largely Spanish. The common language is a strong factor in negotiations and several well-fitted lines of navigation are a constant bond of union.

The exceptional circumstances which have called for enormous quantities of merchandise from the Barcelona district for various European markets are recognised, while of vital importance for the moment, are not likely to continue indefinitely. For this reason, the Catalan does not wish to neglect an opportunity to entrench himself in trans-Atlantic markets which will, it is anticipated, require increasing supplies. The system of permanent expositions abroad of Spanish products has been agitated, but many faults have been found in the project. It is claimed that such expositions require a perfection in the way they are conducted and the manner of presenting merchandise which is difficult to accomplish at a great distance. The efforts of travelling salesmen who show the goods to those actually interested in a special line, accompanied by oral explanations, more or less persuasive, are regarded as more efficacious. High freight rates in Spain and lack of sufficient railroads tapping the hinterland are obstacles with which the Spanish exporter has to contend, and serious effort is being made to alleviate this state of affairs in behalf of the commercial expansion of this district.

The facilities of the Harbour of Barcelona are next discussed, and the report then proceeds to refer to the coming electrical exposition. This is planned for the year 1917 for Barcelona, to be called the *Exposición Internacional de Industrias Eléctricas y General Española*. There will be sections or departments for commerce, forestry, each of the great national industries, works of charity, bookmaking arts, social institutions, and several special sections for electrical industries. Various concessions have been offered to the exposition committee by the Madrid, Zaragoza and Alicante Railroad and the waterworks company of Barcelona. The Bank of Barcelona has undertaken to place a comprehensive bond issue in behalf of the City Council for the completion of the works already in progress.

The American import trade into this district has taken on a new aspect during the past twelve months. Competition with Austrian and German goods has been for the present almost entirely eliminated, and the demand for American products to replace supplies formerly drawn from Austria and Germany has been greater than our merchants could meet. Again, the supply from Belgium, whence merchandise of many kinds, especially large quantities of metallurgical manufactures, had formerly been received, is now shut off. In several lines, notably coal, machinery, and textiles, the export from England is restricted and freight rates have risen enormously.

Some helpful ideas for American exporters may be gained from the means employed by Germany and Austria to hold this trade before the war. A leading factor has been the establishment of a German bank in Barcelona with connections throughout the district. This facilitates financing shipments and handling credit, and lends assistance to schemes of trade promotion. Such banks with their agencies and correspondents also offer efficacious aid in reaching new customers. They frequently supply their home offices with the ratings and characteristics of firms or individuals in this district and study the credit problem from a mercantile point of view. The detailed information they have gathered has been largely influential in enabling European exporters to extend the long credits which have appealed strongly to local merchants.

German banking facilities in this district are so well organized and effective that they have become a powerful adjunct in the furtherance and grip of German trade here. The system renders not only prompt and careful banking service, but performs takes in a measure the place of a chamber of commerce, the establishment of which certain foreign merchants avoid. For thoroughness, patience, contentment with narrow margins of profit, and ultimate prospect of becoming an inseparable participant in the trade of the country the German commercial worker here along these lines has no superior.

With the unparalleled advantages now in favour of a heavy and immediate American trade with this district every effort must be made, not so much to increase the volume, but rather to keep what has been gained. Regular and more adequate means of transportation are imperative and indispensable. The need of such transportation has been signally demonstrated in the coal question. Several large shipments have arrived from the United States since the removal of the duty and transport tax, but importers complain that the lack of ships for this purpose renders it impossible for the local coal trade to count upon receiving supplies with any regularity. Other commodities are affected in like manner, and the shipping problem has become one of the most important in the maintenance of our trade with this district.

One of the greatest handicaps to American trade in this district is the lack of banking facilities. At the present time nearly all banking operations are carried on through London or Paris, with consequent increase in cost to exporters and importers.

Towards the end of the year it was reported that an American bank would be established in this country, to develop and facilitate Hispano-American trade. The newspapers commented favourably on the proposition, especially with regard to obviating commercial difficulties at present complicating the cotton trade, which is of vital importance in the district. It has been stated that this bank will be in Barcelona and constitute a part of a banking system which will extend throughout Latin America and Europe. No definite steps have thus far been taken in relation thereto.

The importance of straight, first-hand credit information concerning local merchants is vital, as on it naturally depends the benefit to be derived from spreading our products in this territory. Especially where a transaction involves long credit the business standing of the importer must be determined beyond all doubt. Mercantile credit agencies of the type familiar in our country exist in Barcelona, and a New York house is established here through which trustworthy inside information may be promptly obtained.

Many merchants here, when soliciting the aid of this consulate-general for connections with business concerns in the United States, give bank references as to their credit, and some refer to firms in the United States with which they have already established relations. Besides these, there is a vast number of men desirous of securing agencies, who in some cases are not known to the mercantile world, having small capital and business strength as yet untried. In some of these cases the would-be agent aspires to build up a business on a commission basis, and naturally there is some risk

to the American exporter in entrusting his interests to him, but, again, there is a certain advantage where the prospective agent is endowed with push and honesty. The consular officer is sometimes impressed with the appearance of the applicant for agencies and is desirous of enlisting his services for the extension of the sale of American goods, even though no exact data as to his business solvency can be secured.

Numbers of agencies have been given out to such persons by American merchants, and there is reason to presume that the men chosen will prove good factors in the extension of trade in this market. The Catalan has a good reputation for business integrity and his instinctive business ability and natural pride in the reputation of his country render him generally reliable.

American engineering skill has been practically demonstrated in this district by the construction work done in connection with hydro-electric development and irrigation, especially by the Ebro Irrigation & Power Co. What is stated to be the greatest work of its kind in existence is a dam near Talamon de la Noguera Pallaresa River for the purpose of regulating the flow of this branch of the Segre River. The dam is approaching completion and will remain a monument in this district to American skill and enterprise. When completed it will be over 269 ft. in height above the general level of the river bedrock, over 328 above the lowest point of the foundation in the upstream cut-off wall, and will raise the water level 243 ft. above the present level. American manufacturing skill is also highly rated here, as is shown by the fact that cotton spinning and weaving are carried on largely along American lines, and in connection therewith a considerable part of the machinery used has been imported from the United States. Of other industries the same may be said to be the case in a more or less marked degree. Agricultural, ice-making, and knitting machinery, dynamos, turbines, electric engines, and many other classes of machinery of American make are in constant use here. Recently one of the principal clinics of this city, having large orders to place for scientific and orthopedic articles, applied at this office for addresses of houses in the United States that could supply its wants. American electric meters, transformers, and apparatus of all kinds are used here extensively, and it is interesting to note that those interested here always expect something new in this line from American manufacturers and exporters and constantly inquire for novelties.

The large and varied line of American goods now on this market and in general demand here would indicate that there are splendid opportunities for further products from American mills and factories. The local merchants are in constant search of novelties in every line, and seem to feel that there is always something new in America.

The decrease in imports of electrical supplies from the United States should be checked and the coming Electrical Exposition is suggested as a rare opportunity for our manufacturers to exhibit their products and bring our goods in this line fully before the Barcelona purchaser.

The exports of electric carbons to the United States from this district rose in value during 1915 to 6,691 dols., as compared with 3,965 dols. in 1914. This would apparently indicate that these carbons have proved satisfactory to American purchasers, who were the first to buy here in 1914, when former sources of supply were cut off. The electric carbons exported to the United States from this district are all produced by the *Compañía Fabril de Carbones Eléctricos, de Barcelona*.

Other reports have also just been issued by the American Consular representatives in the following places:—Madrid, Malaga, Almería Province, Jerez de la Frontera, Seville, Cadiz, Huelva, and Valencia. Consul Putnam, at Valencia, reports a demand for household mechanical appliances, machinery in general, including gas engines, pumps and pumping machinery, machine and other tools, electric motors, leather belting, and electric motor-cars. He says:—

Under conditions ruling in Europe at present the opportunity for extending American trade with this district is excellent, and there is no reason why the American exporter should not do a good business, provided he is in a position to make deliveries with reasonable promptness, sell his product at fair prices, and grant to responsible buyers terms such as they have been accustomed to receive. If he is not in a position to fulfil the last two conditions, sales will be limited to those articles which are absolutely essential to the purchaser and unobtainable in other markets. By arranging for payment on receipt of goods, sales of our products will be greatly facilitated and a long step taken toward establishing a permanent foothold in the market. Many American firms do not find it feasible under present conditions to sell except for cash against documents at port of shipment, while the Spanish buyer has been accustomed to pay for his purchases on arrival at the earliest and more often at 30, 60, or 90 days. Firms in the United States have written to this office stating their willingness to grant more liberal terms when conditions become settled; but the Spanish importers require such terms at the present time—not later when all the markets of the world will be open to choose from. To secure the Spanish trade and to retain it, American exporters should supply the buyer in Spain with the goods required promptly, reasonably, and on terms similar to those he has been accustomed to receiving. It is necessary to supply samples of the larger part of the American products for which a market is desired, and the trade should be solicited by capable agents. The market must be studied just as much as the home market is

studied. It may be necessary to meet new conditions as to quality, &c., which will require changes in the product. Goods suitable for the American market may not be suitable for this market, and the producer must be prepared to adapt himself to local requirements. Trade with this district can be materially assisted if the Spanish buyer is furnished promptly with accurate information, in his own language, regarding the goods offered, the price and terms of payment, also the time of delivery. Such information may best be provided through responsible agents having a thorough knowledge of local conditions, requirements, and the Spanish language. A single agent could represent several non-competing firms, and thus be able to handle the business economically."

THE JOHANNESBURG MUNICIPAL ELECTRIC POWER STATION.

(Abstract of paper read before the SOUTH AFRICAN INSTITUTION OF ENGINEERS, by J. H. DOBSON, M.Sc., M.Eng.)

THE assets owned by the Johannesburg Lighting Co. were acquired by the public of Johannesburg in 1895, and those of the Johannesburg Tramway Co. in 1904.

The first Council appointed by the Government after the termination of the Anglo-Boer War immediately set to work to place the future of the electric supply on a sound and permanent footing, and Messrs. Morley and Dawbarn were appointed consulting engi-

The order for the gas plant was placed on April 6th, 1901, and the guarantors were Messrs. W. Beardmore Ltd., Glasgow. Messrs. Stewart & Co. of Glasgow, became the main contractors.

The first set, a 1,000-H.P. D.C. set, was started up on April 1st, 1901, and from thence onwards at various intervals the remaining units were put into commission, and all engines actually ran for limited periods with the exception of one 2,000-H.P. A.C. set, which was never started.

In October, 1906, after six months of most unsatisfactory running, the Council decided to take drastic measures to see that the contract was carried out satisfactorily. Accordingly, the contractors for the plant entered into an agreement with the Council, known as the "running agreement," whereby they guaranteed to run the plant for a period of 12 months.

On May 15th, 1907, the contractors themselves abandoned the "running agreement," and the town was faced with an appalling situation. The Council decided to reject the whole of the gas-engine plant, and to claim through the Law Courts the whole of their enormous losses, which litigation was only terminated in February, 1912, nearly five years after the rejection of the plant.

The Council claimed for £391,872, and was awarded £340,177, made up of £115,134 against Messrs. Stewart & Beardmore, and £225,043 against Messrs. Stewart & Co. Defendants decided to appeal, but before the appeal was heard negotiations were entered into through which the Council accepted a cash payment of £100,000, and Messrs. Beardmore retained an option on the plant for six months at a purchase price of £5,000. This option was never exercised, and the sale of the plant realised £7,000. The difference between the Council's claim and what was actually obtained was £284,872.

The plant consisted of gas producers for producing power gas from incandescent coal by means of an air blast working in conjunction with steam applied at the bottom of the fuel. The gas had to be

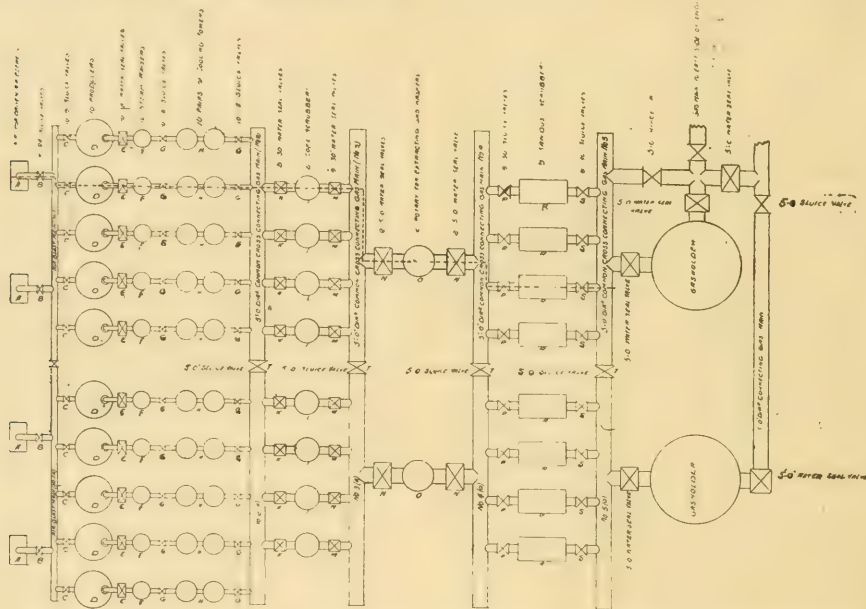


FIG. 1. DIAGRAM SHOWING ARRANGEMENT OF DISCARDED GAS PLANT, JOHANNESBURG ELECTRICITY WORKS.

neers to the Council in July, 1902. They relinquished their connection with the Council in 1908, and from January, 1909, the author has been responsible for all work carried out up to the present day.

THE GAS ENGINE SCHEME.

The date of the consulting engineers' report on the choice of power plant coincided with a period at which the internal combustion engine had made great progress, and they were imbued with enthusiasm to give Johannesburg what they considered was the best possible scheme, viz., gas engine plant.

It was arranged to invite alternative tenders for steam and gas power plant. On March 2nd, 1904, tenders were dealt with for three 1,350-KW. D.C. sets, two 675-KW. D.C. sets, two 1,350-KW. A.C. sets, and one 675-KW. A.C. set. In the opinion of the engineers the most favourable tenders for steam plant and gas plant were:—

Gas Plant.—Messrs. Poetter & Co., gas producer plant, £50,600; Messrs. D. Stewart & Co., gas engines, and Messrs. Siemens Bros. dynamos, £154,320; other additions, £18,630; total, £223,550.

Steam Plant.—Messrs. Dick, Kerr & Co., £195,495.

Coal and water costs of steam and gas plant were reported upon, and, although the capital cost of gas plant was over £28,000 more than steam plant, there was to be an estimated saving of £15,000 per annum on the coal and water bill, and other charges for labour, oil, repairs, &c., were regarded as the same for both schemes.

cleaned by means of cooling and purifying plant before being used in the gas engines.

Fig. 1 shows a plan of the layout, and an elevation is seen in Fig. 2.

As Messrs. Beardmore & Co. did not exercise the option to take over the derelict gas plant, it became the property of the Council, and this was the first time the author became officially connected with it: as technical adviser to the Council, it became his duty to make recommendations as to what should be done with it. With all the information at his disposal, obtained during a period extending over four years, from a close study of the plant and a perusal of the various reports made during the unsuccessful period of attempting to run it, he finally advised the Council to dispose of it. There was a strong predisposition on the part of the author to utilise it if at all possible, but there was no similar gas-engine scheme in existence, and it was necessarily a purely experimental plant, more especially the gas-producer plant. With the modern boiler and its auxiliary apparatus, such as mechanical stokers, &c., it is possible to burn the very cheapest grades of coal, such as dross, peas, and nuts, for the purpose of steam-raising. Assuming that certain of the Transvaal coals are suitable for burning in gas producers, the cost would be appreciably higher than the coal which can be used under ordinary steam boilers with mechanical stokers. The coal actually used in the gas producers cost nearly twice as much as coal used with the ordinary boiler plant. This

fact alone eliminated any benefit in thermal efficiency which may be claimed for a gas-engine scheme. Experience showed that it was necessary to modify the design of the interior of the gas producers to prevent the ashes clinkering, and to allow of uniform and continuous gasification. Irrespective of the bituminous nature of the Transvaal coals, much investigation work was required to determine the correct design for the proper gasification of Transvaal coal, because of the large percentage of ash. The steam raisers could have been eliminated by erecting suitable boilers for the production of steam to actuate special steam engines to drive the air blowers directly, and for the attainment of efficiency to utilise the exhaust steam from these engines in the gas producers through suitable receivers, instead of drawing steam from the steam raisers. From the results obtained, and from the coals which were suitable, it would have been necessary largely to increase the cooling and purifying plant; in fact, to obtain gas free from dust and tar, it might easily be stated that the coolers, the coke scrubbers and the centrifugal tar separators, as well as the sawdust scrubbers, must have been doubled. Over and above these points, there was the question whether the gas producers were able to gasify the amount of coal in accordance with the specification, and, if actual results were to be taken as a guide, it would have been necessary to increase the number of gas-producing units, to give the amount of gas required for the power demand in the gas-engine room. These practical points were matters simple enough from the purely mechanical engineering point of view, but they involved large capital expenditure and additional working costs (especially in the amount of water required), and the financial aspect was altered entirely.

With regard to the gas engines, experience proved that the compressed air plant for starting would have to be increased and the method of driving completely altered. The question of lubrication was another matter of great importance, and it would have been necessary to design an improved system of lubrication to attain successful running. This point can be appreciated when one is acquainted with the phenomenal dust of Johannesburg and the

necessary communications between the business portion of Johannesburg and the suburbs. All plant which the Council had at its disposal was quickly put into service, and the only steam power available was a collection of isolated and heterogeneous belt and direct-driven plants, some of which were rescued from the scrap heap; altogether there were 15 boilers, making a total of only 1,660 H.P., and no fewer than 10 reciprocating sets, giving a maximum of only 840 KW. D.C. and 400 KW. A.C. These were pressed into the service, and every available electric unit extracted therefrom. To those acquainted with Johannesburg conditions it will be realised that it takes under normal conditions 12 months or more to obtain generating plant from the time of inviting tenders and having the same under working conditions. Two 500-KW. non-condensing D.C. sets and three boilers (each of 14,000 lb. per hour), without superheaters or economisers, were procured and set to work within six weeks after the gas-engine plant was abandoned. There were also one 1,000-KW. condensing D.C. set and two similar boilers set to work by the end of 1907, and during 1908 were erected two 1,000-KW. sets and one 500-KW. set (only one of which was condensing), and four boilers of the same size as before. The reciprocating engines were made by Messrs. Belliss & Morcom, and the boilers by Messrs. Babcock & Wilcox. Astonishing records were made by the contractors, Messrs. Reunert & Lenz, in the expeditious manner that some of the plant was erected; on the other hand, the Council had to pay "famine prices" for the plant under the exceptional conditions. The conditions under which the plant had been installed during a period extending over 18 months up to the end of 1908, subsequent to the closing down of the gas-engine plant, were those of meeting urgent and immediate requirements for power at any cost, and plant had been hurriedly erected regardless of layout or future extensions. Floor space was exceedingly limited, as most of the ground was occupied by the gas-engine room and the derelict gas-producer plant, the future of which was unknown.

In 1909 the arrangements in the boiler house were most unsatisfactory, ashes had to be withdrawn in front of the boilers, which

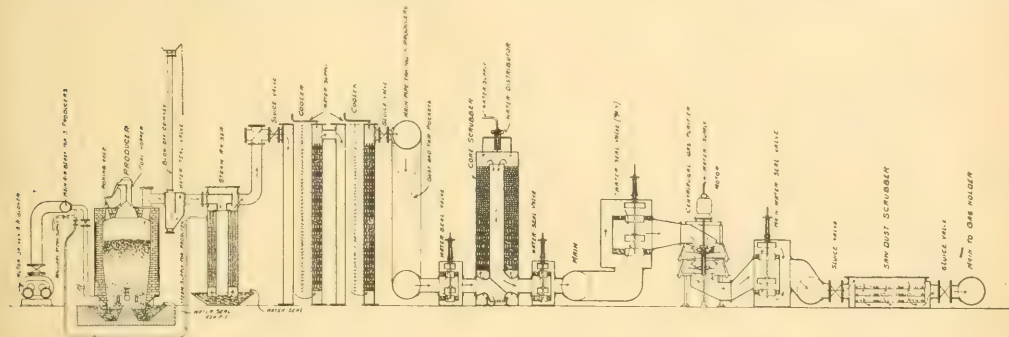


FIG. 2. DIAGRAM SHOWING ARRANGEMENT OF DISCARDED GAS PLANT, JOHANNESBURG ELECTRICITY WORKS.

enormous weights of the moving parts, such as the fly-wheels (up to 70 tons on the 2,000-H.P. engines) and the electric generator armatures (up to 35 tons on the 2,000-H.P. engines). These points, in the same way as those of the producer plant, could no doubt have been overcome with good mechanical engineering, but appreciable capital expenditure would have been involved. The cost per unit as obtained by the hurriedly erected steam plant up to February, 1912, when the law case terminated, was such as to render it unnecessary to attempt any scheme of setting the gas-engine plant to work for the production of electric power.

Investigations were carried out as to whether it would be economically feasible to utilise the gas-producer plant for the production of tar and other by-products, and to burn gas instead of coal dust in the Bettington boiler, which forms part of the present steam plant. Here also, when the cost of suitable coal for burning under the gas producers was considered, together with the cost of necessary alterations to the plant, as well as the working costs, and the question of the variable revenue obtained from tar and other by-products, such as sulphate of ammonia, it became evident that it was a very risky proposition from the financial point of view to attempt to utilise the gas plant in this way.

The final termination of the gas-engine scheme was that tenders were invited on separate occasions for the removal of the mechanical and electrical sections respectively, and the plant was finally disposed of for £7,000, this being greater than Beardmore's option of £5,000.

The discarded plant was taken to the steel works at Vereeniging ready to be melted up, and the gas-engine house has been transformed into workshops.

Three years after the placing of the contract for the gas-engine generating plant, Johannesburg found itself in a worse position than prior to placing the orders. During the three years, April, 1904, to May, 1907, the number of houses in Johannesburg had increased enormously, the electric distribution system had made steady progress all over the municipal area, and would-be consumers were waiting anxiously for electric supply. The new system of electric tramways, to the extent of about 30 or 40 track miles, had been gradually completed, ready for supplying the

was also the only space available for the coal used for stoking. The distance between the two rows of boilers was exceedingly small, only some 18 ft., and only 7 ft. between the coal-hoppers, and, as a consequence, ashes and coal were inevitably mixed, and the boiler-house presented a most disorderly appearance, due to the circumstances of its origin. Although the gas plant had been shut down, the main distribution switchboard in the gas-engine house was still used for the distribution of the electricity generated in the new steam station, some 300 yards away. The generator panels were erected in temporary positions in the steam station, the power being transmitted from thence to the gas-engine switchboard for distribution. The difficulty of issuing instructions from one station to the other during times of trouble can be imagined, and this was accentuated when it is stated that this switchboard, like the gas-engine plant itself, was ultimately discarded. The problem in the early part of 1909 was to battle with the rapidly growing requirements. The load was 5,400 KW., this being more than the total plant then available.

(To be continued.)

U.S.A. Government Nitrogen Plants.—According to the *Electrical Review and Western Electrician*, Congress has passed a Bill authorising the development of hydro-electric power for the electrical fixation of nitrogen, which will be used in the manufacture of munitions of war, and thus make the Government independent of imported nitrates for this purpose. The President is authorised to cause an investigation of the best means for producing nitrates, &c., by water or other power; to obtain exclusive use of any necessary site for the purpose of the Act, and to provide the necessary equipment, &c. Any surplus product may be sold and disposed of, and may be used in the manufacture of fertilisers. The sum of 20 million dollars is appropriated for the scheme, which will be operated solely by the Government, and not in conjunction with any other industry or enterprise carried on by private capital.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

RUSSIA.—The Department of Assessed Taxation, acting in conjunction with the Customs Department, has issued an official notice to the effect that when commercial travellers coming from abroad as representatives of foreign firms to obtain orders through samples have not taken out the licences required by law, the Custom Houses shall immediately exact from them their address and the nearest commercial points they intend to visit, for the information of the tax inspectors. The latter are to require commercial travellers to lodge a deposit equal to the cost, and as security for the payment, of the necessary licences which they have failed to procure. In cases of refusal to lodge the deposit, the tax inspectors have power to seize the goods, to the amount of the deposit, for sale by auction.

URUGUAY.—A Presidential Decree dated May 3rd amends Articles 211-13 of the Consular Regulations concerning the manifests of goods shipped to Uruguayan ports. The Decree repeals the Decree of September 13th, 1915, relative to certificates of origin and that of January 25th last respecting manifests—*vide* the REVIEW of April 21st.

Manifests of goods shipped to Uruguayan ports must now state the declared value of the goods in local currency, in accordance with the respective bills of lading or certificates of origin. Three copies of each manifest are to be presented to the Uruguayan Consular Agent, of which at least one must be drawn up in, or translated into, Spanish; this copy is to be "legalised" by the Consular Agent. A certificate of origin and nationality must be provided in all cases, in the form to be prescribed by the Uruguayan Foreign Office. For the "visa" of each certificate in respect of goods to be shipped with bill of lading or parcel receipt, the Consular fee is 50 centavos (about 2s. 2d.); and in respect of goods to be sent by parcel post, 20 centavos (about 10d.).

From October 1st, 1916, the Uruguayan Customs authorities will not allow the clearance of any goods through the Custom House until the accuracy of the declaration of the goods has been verified by comparison with the certificate of origin. Such certificate must, therefore, in all cases be produced by the person clearing the goods.

UNITED KINGDOM AND CERTAIN FOREIGN COUNTRIES.—A Supplement to the *Board of Trade Journal* of August 17th contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported from the United Kingdom and certain foreign countries, viz., Denmark, France (and Algeria), Greece, Italy, Japan, Netherlands, Norway, Portugal, Roumania, Russia, Spain, Sweden, and Switzerland. The list of articles prohibited to be exported from Sweden is based upon information received at the Board of Trade up to August 14th, and should be of considerable interest to British exporters to Russia in view of the application of the Swedish prohibitions to goods passing in transit through Sweden to Russia. The present Supplement supersedes that issued on May 18th last. Copies may be obtained price 3d. (4d. post free) from the usual sale agents for Government publications.

CANADA.—An official warning has been issued that the Department of Customs is now strictly enforcing a regulation (which has been actually in force since August 1st, 1910), to the effect that in invoicing goods for Canada, the value to be shown must be the "Fair market value as sold for home consumption at time shipped." This value must be given in the first parallel column on invoices, and care should be taken that the heading of the column contains the proper wording.

The warning appears to have become necessary owing to a number of shippers still using the older form of invoice (which was cancelled in 1910), which required only the "Fair market value as sold for home consumption." Many shippers also seem to be under the impression that in cases where orders are booked for delivery at a future date, the Canadian Customs Department are prepared to accept in the first column of the invoice the price at the time the orders are booked, irrespective of the prices ruling at the actual time of shipment. This, however, is not the case, and shippers are accordingly advised to see that invoices for goods sent to the Dominion are made out in accordance with the requirements set forth above.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 11,099. "Spark plug for internal-combustion engines." D. MCGREGOR August 7th.
11,100. "Electrical signalling apparatus for mines, &c." I. H. PARSONS AND H. R. WADDINGTON. August 7th.
11,114. "Battery cells or tanks." W. C. FARMWATER (Lake Torpedo Boat Co.). August 7th.

- 11,125. "System of electrical distribution." W. H. COLE. August 7th. (U.S.A., August 12th, 1915).
11,130. "Method for producing high-frequency oscillations." I. CHORTIK. August 7th.
11,146. "Electric chest-warmer." A. SEVASTYAN. August 7th.
11,169. "Suspensors for electric cables, &c." P. HUNTINGDON. August 8th.
11,175. "Magnetic interrupter and induction coil." I. B. MILLER. August 8th.
11,189. "Means for applying heat produced by passage of electricity." A. S. CHURCHMAN. August 8th.
11,191. "Motor controllers." LEONARD EISENBERG Co. (Cutler-Hammer Manufacturing Co., U.S.A.). August 8th.
11,212. "Removal point-sparking plug and high-tension connection." H. C. C. BEAUMONT & B. HAYDON. August 9th.
11,214. "Spark plug for internal-combustion engines." E. H. HODGKINSON & J. A. KENNEDY-MCGREGOR. August 9th.
11,229. "Production of electric incandescent lamps." G. T. HUTCHISON AND E. C. HUTTON. August 9th.
11,240. "Means for connecting electrical conductors." F. W. UREN. August 9th.
11,242. "Controlling electric circuits from a distance." INDO-EUROPEAN TELEGRAPH CO. & A. H. MORSE. August 9th.
11,254. "Generation of electric energy." W. S. SIMPSON. August 9th.
11,267. "Apparatus for medical treatment by electricity." L. MAYOR. August 9th. (Switzerland, September 25th, 1915).
11,286. "Spark plug for internal-combustion engines." T. CROSBIE AND SONS & H. R. WILKS. August 10th.
11,326. "Dynamo-electric machines." G. SCHROEDER. August 10th.
11,327. "Alternating-current dynamo-electric machines of the compensated commutator type." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. (Westinghouse Electric & Manufacturing Co., U.S.A.). August 10th.
11,337. "Ammeter for measurement of alternating currents and electric oscillations." I. WILLIAMS. August 11th.
11,348. "Starters for electric motors." G. H. NEAP AND SWITCHGEAR AND COWANS. August 11th.
11,358. "Automatic selecting devices for telephone systems." SIEMENS AND HALSKE AKT. GES. August 11th.
11,360. "Electric heaters for water, &c." C. R. ALLENSBY AND BENHAM AND SONS. August 11th.
11,361. "Spooling filament for metal-filament lamps." J. A. ALLISON AND MORRIS & WHITHAM. August 11th.
11,362. "Electrical apparatus for obtaining synchronous motions at a distance." W. KINGSLAND. August 11th.
11,363. "Apparatus for passing through the human body currents derived from town main electrical supply." E. E. GREVILLE. August 11th.
11,368. "Alternators for high frequencies." M. W. W. MACRIE. August 11th.
11,371. "Systems of ship propulsion." BRITISH-THOMSON HOUSTON CO. (General Electric Co., U.S.A.). August 11th.
11,381. "Electric knife switches." R. LISTER. August 11th.
11,382. "Electric transformers." A. F. BERRY. August 11th.
11,397. "Means for telephonic communication to and from moving railway trains." K. H. WARFINGE & V. G. WERNER. August 12th. (Sweden, August 21st, 1915).
11,425. "Use of relays for telegraphic, &c., purposes." H. W. SULLIVAN. August 12th.
11,428. "Electro-magnetic switches." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). August 12th.
11,429. "Bipolar electrode electrolyzers." G. G. HEPBURN. August 12th.
11,433. "Electrical machines." ALLGEMEINE ELEKTRICITÄTS GES. August 12th. (Germany, August 6th, 1915).

PUBLISHED SPECIFICATIONS.

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- 5,511. INSULATORS. AKT. GES. BROWN-BOVERI ET CIE. April 12th. (April 25th, 1914).
7,758. ELECTRICAL IGNITION SYSTEMS FOR INTERNAL-COMBUSTION ENGINES. C. F. KETTERING & W. A. CHRYST. May 25th. (July 16th, 1914).
10,711. COOLING OR VENTILATING DEVICES FOR DYNAMO-ELECTRIC MACHINES. A. MORD (Maschinenfabrik Oerlikon). July 23rd.
10,726. ELECTRO-MAGNETIC LEVITATING APPARATUS. E. BACHELET. July 23rd.
10,755. COIL FOR ELECTRICAL PURPOSES, AND METHOD FOR WINDING SAME. H. WADE (Lesson). July 24th.
11,011. PROCESS FOR ELECTROLYTICALLY DEPOSITING A STRONGLY ADHERENT AND MALLEABLE LAYER OF TIN ON IRON AND OTHER METALLIC SURFACES. P. MARINO. July 29th.
11,603. CONTROL OF ELECTRIC MOTORS FOR DRIVING HYDRO-EXTRACTORS. Thomas Broadbent & Sons, Ltd., British Thomson-Houston Co. and W. L. Wise. August 11th.
11,658. ELECTRIC MOTOR CONTROL SYSTEMS AND PNEUMATICALLY-OPERATED CONTROLLERS EMPLOYED THEREIN. British Thomson-Houston Co. (General Electric Co., U.S.A.). August 11th.
12,379. ELECTROMAGNETICALLY-OPERATED SWITCHES. G. WILKINSON. August 24th.
12,747. PROTECTIVE DEVICES FOR ELECTRIC SYSTEMS. British Thomson-Houston Co. (General Electric Co., U.S.A.). September 6th.
17,419. BRAKING ELECTRIC MOTORS ACTUATING LIFTING, LOWERING, HAULING, WINDING AND LIKE APPARATUS. Maschinenfabrik Oerlikon. December 13th. (December 11th, 1914).

1916.

- 1,176. SAFETY DEVICES FOR ELECTRICALLY-OPERATED LIFTS AND OTHER VEHICLES. J. T. CLARKE. January 25th. (190,916).
1,526. ELECTRIC MOTOR PUMP. S. KAWAKAMI. February 5th, 1915. (100,056).
2,020. SPARKING PLUGS AND THE METHOD OF MAKING SAME. W. J. MELLERSH-JACKSON (Champion Ignition Co.). February 10th, 1916. (100,933).
5,841. ELECTRICAL SYSTEMS FOR INTERNAL-COMBUSTION ENGINES. C. F. KETTERING & W. A. CHRYST. June 24th, 1914. (Divided application on 7,757/15) (100,261).
6,977. ELECTRICAL CONNECTING DEVICES. GES. SIEMENS-SCHUCKERTWERKE. May 22nd, 1915. (100,533).
7,567. SEPARATORS FOR SECONDARY BATTERIES. W. J. MELLERSH-JACKSON (India-Rubber Co.). May 27th, 1916. (100,994).
8,111. ELECTROLYTIC APPARATUS. Siemens & Halske Akt. Ges. June 24th, 1915. (100,739).

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"AMONG all the changes which the great war has brought in its train, none is more significant, and none more likely to have lasting effect than the revolution in the structure of British industry. . . . The factories are alive with new workers; the State assumes new responsibilities; fresh needs and opportunities arise; industrial conditions are in solution."

With these words Mr. Lloyd George commences a foreword to a book on "Welfare Work"—employers' experiments for improving working conditions in factories—by Miss E. D. Proud, B.A., which has just been published; and they form by no means an exaggerated picture of the extraordinary conditions which now obtain in British industry. Nothing less than a world-war that shook the British Empire to its very foundations could have brought about changes so vast and so unprecedented, or could have induced our workers to divest themselves, even temporarily, of the rights and privileges which, as the result of years of industrial strife, they had succeeded in wresting from their employers, and even in placing on the Statute Book. Who, before the war, could have conceived, by the wildest flight of imagination, that an army of women would one day be engaged in manufacturing shells by the million, or that, as was recently stated, 14,000 women would be employed in general engineering work other than shell making on the Clyde alone? The volume before us in itself is a remarkable production—the work of a woman, a graduate from an Australian University, who has made an intimate study of the conditions of "welfare work" in factories, and possesses a knowledge of the subject of unique extent and understanding. The fact, too, to which Mr. Lloyd George calls attention, that it is out of the manufacture of weapons of destruction that the opportunity to humanise industry has arisen, is another singular feature of the situation, recalling the riddle with which Samson perplexed the Philistines: "Out of the eater came forth meat; and out of the strong came forth sweetness." "The effort now being made to soften asperities, to secure the welfare of the workers, and to build a bridge of sympathy and understanding between employer and employed" may leave behind "results of permanent and enduring value, to the workers, to the nation, and to mankind at large," says Mr. George. So may it be.

In itself, of course, welfare work is no new thing; it has been practised in isolated instances for years, even for generations, and the fact that it is not only socially, but also commercially profitable, has been recognised in many quarters. But never before has

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it been taken up so generally and so earnestly, and the State, though it has set up what Miss Proud defines as a "minimum objective standard" by factory legislation, has hitherto confined its efforts to such requirements as can be regarded as essential to the maintenance of the health and to the preservation of the life of the workpeople, without attempting to secure for them greater physical and mental comfort or to increase the efficiency of their productiveness. Now, however, when the Government has become by far the greatest employer of workers in the State, and also controls thousands of privately-owned concerns, whilst the necessity for securing the highest possible efficiency of production has become imperative, entirely new conditions have arisen, and we are glad to add that the Government has fully recognised the new responsibilities that it has incurred.

The Departmental Committee appointed to consider the question of the Health of Munition Workers has issued a series of reports which will prove of permanent value: some of these have already been dealt with in our columns. Financial assistance has been afforded, to enable employers to provide canteens, cloak-rooms, rest-rooms, lavatories, &c., and the importance of welfare work has been so fully demonstrated that a new department of the Ministry of Munitions has been created to secure a high standard of conditions for all workers in munition factories, and the training of "welfare supervisors" has actually become the subject of special courses at several Universities.

To review Miss Proud's book adequately in the space and time available would be an impossible task; it constitutes so thorough and exhaustive a treatise that, as Mr. George remarks, it bids fair to become the standard work on the subject. It first deals with the history and development of the efforts made by employers to improve the working conditions of their employes, and of the legislation to which they gave rise—for it was largely to the initiative and support of the mill-owners themselves that factory legislation was due. One of the earliest discoveries made by certain manufacturers was that a reduction of the long working hours then in vogue actually led to increased output, a fact which has been re-discovered in connection with the manufacture of munitions of war. The importance of distinguishing between philanthropy—which the workers resent—and real welfare work, which they feel to be their due, is emphasised by the authoress; justice, not charity, or even the suspicion of charity, must be the foundation. In the second part of her book Miss Proud treats in detail of the actual conditions and methods obtaining in factories, wages and hours, the necessity of rest and recreation, sanitation and housing, mental development, regard for the dignity and self-respect of workpeople, and matters of organisation. In every section she displays a mastery of her subject, a breadth of view, and a judicial balance of mind which impress the reader with the value of her treatise, and we most cordially commend this timely work to the attention of all employers and works managers.

Identifying the Enemy Trader.

It will be remembered that in the early months of the war some of the popular newspapers, and many of their and our correspondents, inspired no doubt by the worthiest of motives, and anxious to clear out thick layers of Teutonic influence from the Augean stable of British trade, sometimes allowed their zeal to get the better of their discretion. All and sundry who were suspected, or whom the writer wished, or thought he ought, to suspect, were open to attack. The slowness of the Government Departments in coming into line with public opinion and fully recognising the necessities of the case, was in some measure responsible for this tendency, and no doubt the more recent progressive policy of the Government has been consequent upon the pressure of public agitation, according to the teaching of Lord Haldane, though we happen to know something of the extremely difficult nature of the problems that have arisen, rendering the exercise of careful discrimination most necessary. But the attacks, indiscriminate and otherwise, have also been due to the method of the German in secretly getting in here and there, and managing, by the aid of characteristic devices, to conceal his whereabouts. Even now there are difficulties in the way of those who have strong suspicions, amounting almost to convictions, regarding certain traders, but can neither confirm nor disprove them. The best thing in such a case is for them to lay the matter before the Board of Trade—they can do that without running any risk, and they will not put upon the Press a burden that it ought not to be required to carry. We learn from Australia that the Press out there, which has attacked many concerns about which it has been difficult to ascertain the true facts relating to their connections, ownership, and interests, has, after bearing the burden of risk involved, now been protected by a special War Precautions Act which was passed in June. This Act prohibits any person from taking action, without the written consent of the Attorney-General, against any other person, for relief, "in respect of anything said or done, or permitted to be said or done, by the defendant, which states or implies that the plaintiff is an enemy subject or a person of enemy origin or associations, or influenced or controlled by enemy subjects, or having, or intending to have, any connections with enemy subjects . . . either personally or in his trade or business." It is provided that the Attorney-General shall not withhold his consent where he is satisfied that the statement or implication has been made maliciously or recklessly. With this provision included, it seems to us that the measure is a very desirable one under the prevailing conditions. In many respects during the war Australia has been far more advanced in its methods than the Mother Country. Here the Government leaves the Press to fight its own battles, and preserves privileges to the man of straw against the well-intentioned newspaper.

ALTHOUGH the situation in pig lead has remained under the close supervision of the Ministry of Munitions, the market has admittedly again felt the effect of the enormous requirements for munitions in one direction or another. Until a few weeks ago, the selling operations on the part of the authorities in connection with the surplus parcels which could be spared out of the controlled supply from Spanish and Australian sources tended to keep prices down. Subsequently market movements have been apparently chiefly determined by the preparations which were made by the Government to make adequate provision for Russian requirements over the winter months. This, coinciding with a temporary considerable contraction of the arrivals through delayed

shipments, no doubt has naturally enough left the market rather bare of near metal. Hence the tendency became sensitive, which with a more insistent demand from consumers in other directions has resulted in a steady advance in prices, more especially in near positions.

In the course of the past week, the market was particularly bare of sellers, so much so, in fact, that purchases were more difficult, and only a comparatively limited amount of business could be got through. The premium on spot delivery was forced up to quite £2 a ton, which is not surprising, for so far as can be gathered there is very little metal held in warehouse to meet urgent needs. The position still seems rather tight, and some further hardening of prices in near positions may ensue, but there is good reason for assuming that some relief is now pretty near at hand, judging by the fact that more liberal supplies have reached this side lately from Spain. For one thing, there is not much doubt that Russian needs have been satisfied for some considerable time to come, so that there should be more lead to spare to meet requirements in other directions. Considerable quantities went to Russia *via* Archangel and also Vladivostok, and it is not expected that much more will be diverted to the latter port. It is well to bear in mind that the market is absolutely under Government control, and since it is understood that the latter have now made pretty full provision for all their munition contracts for several months to come, it is suspected that a change of feeling may eventually ensue should controlled lead at any time come on the market in appreciable quantities. History is likely to repeat itself in that respect, for it is an open secret that the authorities will neglect no opportunity to prevent an undue inflation of values. The fact, however, that France continues to draw supplies from Spain on a large scale by rail tends to keep the Spanish exports to this side on a rather restricted scale.

Shipping conditions may possibly improve since the requisition of German ships released by the Portuguese Government, and this would facilitate the accession of fresh supplies, but under present conditions it is hardly likely that surplus supplies will accumulate to any very large extent. For some time past the American position has been tight, partly due to the considerable quantities shipped to Russia *via* Archangel, and New York prices have again risen, but this feature is not calculated to have any material influence on this market. A set-back in prices in America would cause no surprise, since the Russian demand has been met. The market here this week re-opened with a firm tone, sellers being still reserved pending developments.

The B.A. on the Tyne. On Tuesday next the 86th annual meeting of the British Association for the Advancement of Science will be opened at Newcastle-upon-Tyne.

As at the previous war meetings, there will be no excursions or festivities, and the sittings will be confined to four or five days, but we have no doubt that, as last year, good work will be done and results of national value will accrue. The Association has a long record of usefulness to its credit, and in its title, which we purposely quote at full length, may be discerned the aspirations of its far-sighted founders, who recognised the importance of propagating a due appreciation of the value of science in the public mind. We rejoice to think that the aims of those wise men are now approaching fruition, though nothing less than a war directly involving the destinies of at least 14 nations, and indirectly affecting the whole world, has been necessary to awaken the British people to the perilous condition to which the apathy and ignorance of their rulers had brought them.

Details of the programme have not yet been

received, but we are glad to note that prominence will be given to such questions as "Education after the War," "Economics after the War," and "Fuel Economy and Smoke Prevention"—all subjects of first-class importance to the nation. Mr. Gerald Stoney will preside over the Engineering Section, in which a number of papers on matters of immediate interest are set down for reading by distinguished authors. The interim reports of the Fuel Economy Committee and the five Sub-Committees which were deputed to examine specific questions are expected to be of exceptional value and importance. There is good reason to anticipate, therefore, that the meeting will be noteworthy from a scientific point of view, and we wish it every success.

Science and Industry. YESTERDAY the report of the Committee of the Privy Council for Scientific and Industrial Research for the year 1915-16 was published,

together with the vastly more loquacious report of the Advisory Council and its five Appendices. The latter commences with a review of the past 16 years purporting to show that the Government during that period had done much to encourage "organised scientific support for our trades and industries," but in view of the niggardly and absurdly inadequate grants to the National Physical Laboratory (still only £7,000 a year), and the meagre recognition and assistance afforded to the Engineering Standards Committee, the Imperial Institute, and the Imperial College of Science and Technology, the instances cited by the Council as evidences of the said "encouragement," we are unable to join even in the faint praise with which the Council damns the authors of its being.

Optical glass, dyestuffs, magnetos, drugs, and zinc are once more paraded as the chief items whose conspicuous scarcity compelled the Government to take action just two years ago, with the result that the first meeting of the Advisory Council was held one year ago, and the organisation of science in aid of industry was at last commenced.

The necessities of the case compelled the Council to give attention first of all to science in its immediate applications to industry rather than to the development of pure science, upon which those applications ultimately depend. The first proceeding of the Council was to rescue from abandonment certain researches which were being carried on by professional associations, by means of grants to the societies concerned, some of which have been recorded in our pages. Conferences were held with representatives of all the scientific and engineering societies in the Kingdom, and several trading associations, with gratifying results. A register of researches in progress at the outbreak of war was drawn up, and grants were made to some 40 individuals. Standing Committees have been appointed to deal with specific subjects, and other committees will be formed. A large part of the Report consists of a running commentary on the doings of other bodies interested in the maintenance of British trade supremacy, many of which have been recorded in our columns, and the practice of our American and German competitors is reviewed; we hope to deal with it more fully at an early opportunity. At the moment we can only give the terms in which the Council summarises the conditions that appear to be necessary for the success of its work; these are, in the briefest form: "First, a largely increased supply of competent researchers; secondly, a hearty spirit of co-operation among all concerned, men of science, men of business, working men, professional and scientific societies, universities and technical colleges, local authorities and Government departments. And neither condition will be effective without the other."

SWITCHBOARDS FOR POLYPHASE TESTING.

By A. T. BULLEN.

To the electrical engineer, the value of a switchboard is not its cost in pounds, shillings, and pence, but is rather the amount of work and number of operations it is capable of performing. Yet, on account of the expenditure involved, switchboards are more often than not designed for one specific purpose and for but one distinct set of operations.

The cost of erecting and thoroughly equipping a testing switchboard for polyphase currents is, as a rule, much more than the central-station engineer is prepared to spend, and so we often find that the testing of two or three-phase

possible method for pressure is the use of wall-sockets. An arrangement as shown in diagram 3 covers all possible connections.

The phases are brought in according to the letters on the plugs.

The above is a very useful, although a very simple, board; and, moreover, it is not costly.

It is, however, limited in its scope, and is hardly suitable for unbalanced circuits. To meet these requirements, therefore, a more elaborately designed board is in use.

The equipment consists of three single-phase transformers, each of 6 K.V.A. output, the primaries and secondaries of which are both wound in two equal sections, which can be joined in either series or parallel. The ratio of transformation is 6 to 1, the primary volts being 415. Each

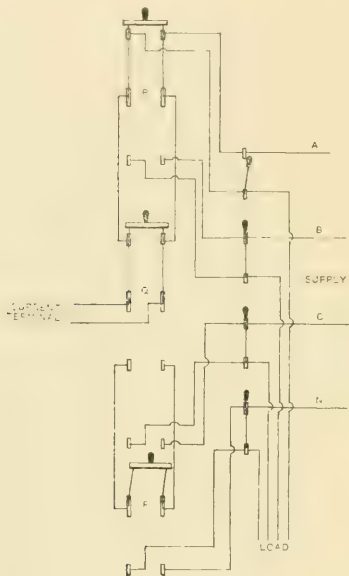


DIAGRAM 1.

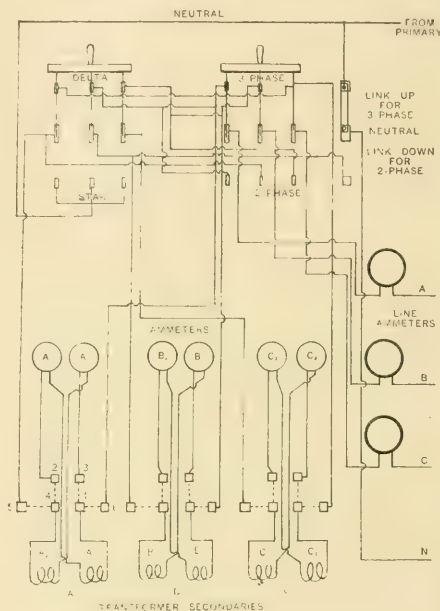


DIAGRAM 2.

meters, for instance, is sadly neglected, or is, on the other hand, carried out by the use of single-phase current, which, while giving approximate results, does not cover all the possibilities of a three-phase circuit.

One of the greatest obstacles in the way of three-phase testing is the cost of the necessary instruments. The writer, therefore, proposes to illustrate and explain a simple arrangement of switches adopted in one of our municipal testing departments, whereby the current in any phase of a three-phase system can be measured on a single instrument without stopping to change the connections.

The arrangement is shown in diagram 1.

A, B, C, and N are single-pole switches inserted in the three phases and neutral of a star system.

P, Q, and R are double-pole, two-way switches. The centre contacts of Q are taken to the current terminals, where an ammeter or the current coil of a wattmeter is inserted.

The two top contacts of switch Q are connected to the centre contacts of switch P, and similarly the bottom contacts of Q are connected to the centre of R.

The top and bottom contacts of P and of R are then connected across the switches A, B, C, and N respectively.

By opening the switches A, B, C, and N in turn and altering the two-way switches accordingly, it is obvious that without disturbing the circuit we can measure the current in any phase or the neutral.

This arrangement is particularly suitable for balanced loads, and is used almost exclusively for motor testing.

A somewhat similar arrangement might be used for the pressure, but it is the opinion of the writer that the simplest

transformer connected singly is, therefore, capable of giving secondary voltages, as under:—

Primary volts.	Primary connections.	Secondary connections.	Secondary volts.
415	Parallel	Series	138
"	"	Parallel	69
"	Series	Series	69
"	"	Parallel	34.5

When the transformers are connected to form a three-phase system, there is a much greater range of secondary voltages.

Below is a tabulated list of the connections and secondary voltages, for both star and delta combinations:—

THREE-PHASE.			
Primary volts.	Primary connections.	Secondary connections.	Secondary volts.
415	Parallel-Δ	Series-Y	239
"	"	Parallel-Y	119.5
"	"	Series-Δ	138
"	"	Parallel-Δ	69
415	Parallel-Y	Series-Y	138
"	"	Parallel-Y	69
"	"	Series-Δ	80
"	"	Parallel-Δ	40
415	Series-Δ	Series-Y	119.5
"	"	Parallel-Y	60
"	"	Series-Δ	69
"	"	Parallel-Δ	34.5
415	Series-Y	Series-Y	69
"	"	Parallel-Y	34.5
"	"	Series-Δ	40
"	"	Parallel-Δ	20

In addition to this each transformer is provided with tapings to allow for Scott connections for transforming to two-phase. In this case, of course, only two transformers are used, the secondary voltages obtainable being as under:—

TWO-PHASE.			
Primary volts.	Primary connections.	Secondary connections.	Secondary volts.
415	Parallel	Series	138
"	"	Parallel	69
"	Series	Series	69
"	"	Parallel	34.5

The switch-board is designed to give all the above arrangements with a minimum of trouble.

Diagram 2 shows the arrangement on the secondary side of the transformers. The primary connections are similar, but with an additional panel for Scott connections.

The half-windings of the secondaries are brought to contacts, on the lower panel of the board, numbered 1 and 2

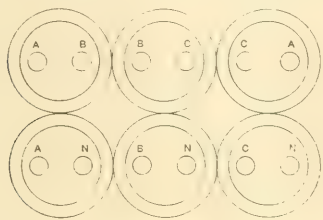


DIAGRAM 3.

for one coil, and 3 and 4 for the other. It is clear that by linking numbers 2 and 3, the coils are connected in series, and that by linking 2 and 4 and 1 and 3 they are joined in parallel. Ammeters A_1 , A_2 , &c., are placed in circuit in each half winding, which can be reversed or entirely cut out by means of contacts 5 and 6.

Two three-pole two-way switches on the top panel control the connections, and are wired to give three-phase Δ with the left-hand switch up, and three-phase Y when down.

The right-hand switch is thrown up for three-phase, and down for two-phase, when, of course, the left-hand switch is out of use.

The neutral is brought through from the primary board on to a special link, which also has to be changed over for two-phase working, since the neutral then forms the fourth wire of the two-phase system. Ammeters are placed in the three lines A, B and C.

The maximum secondary line current, without over-loading, is 150 amperes on the three-phase and 90 amperes on the two-phase.

It is obvious that when the primaries are connected in series, only half the output is available.

The pressure arrangements are dealt with as before, being brought to six wall-sockets, as in diagram 3.

At present no phase-shifting device is installed, but there is a plentiful supply of inductances, which, so far, has met all requirements.

The chief merits of the board are its adaptability, and, at the same time, its simplicity of operation. In construction it is not elaborate, but it will do all that is required for ordinary purposes, and a good deal more than many a more costly board.

Electricity on Aeroplanes.—From the annual report just issued by the Advisory Committee on Aeronautics, we learn that during the past year two wireless telegraph sets of very light weight have been designed and tested at the Royal Aircraft Factory. A number of special tests have also been carried out in connection with the ignition magnetos of aeroplane engines, and an improvement has been effected in the system of electric lighting of aeroplane instruments.

B.T.H. TURBO AIR COMPRESSORS.

THE turbo-compressor, which is to-day constructed in single units of the largest output, has been developed within a period of about ten years.

Compressors of this type have been built in sizes ranging up to 60,000 cu. ft. per min. of free air, up to a pressure of 170 lb. per sq. in. gauge when running at a speed of 3,000 R.P.M. This output corresponds to an input of 12,000 to 13,000 H.P. measured at the shaft.

The outstanding advantages of turbo-compressors as compared with reciprocating compressors may be summarised as follows:—

(a) The floor space occupied is much smaller, the capital expenditure is less, and the over-all efficiency is higher.

(b) Much lighter foundations are required, and the turbine drive permits of the condenser being placed immediately below the turbine, with a consequent reduction in the length of the eduction pipe.

(c) No internal lubrication of the compressor is necessary, and since with turbine drive forced lubrication is provided to all bearings, a considerable amount of oil is thus saved and less attention is required.

(d) The turbo-compressor permits of the use of exhaust steam from winding, hauling, rolling-mill engines, &c.

(e) The supply of air from a turbo-compressor is free from oil, which is a *sine qua non* in the case of certain chemical processes.

(f) The air delivered by a turbo-compressor is continuous in supply, and not pulsating, as in the case of reciprocating machines.

In designing turbo-compressors, the British Thomson-Houston Co., Ltd., have kept before them the vital importance of producing a machine which will be reliable in operation and of high efficiency.

The multistage construction employed permits of the advantages of cooling, and it is possible to approach the isothermal pressure curve more closely than in a piston compressor with staged compression and intermediate cooling; the air, which is inhaled through a suitable duct, passes through

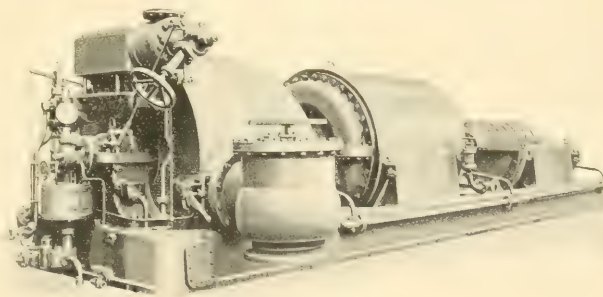


FIG. 1.—B.T.H. TURBO AIR COMPRESSOR, STEAM END.

a number of stages in series, the stages being divided over two casings, since the number of impellers is too large to be carried on one shaft. The work done in compressing the air in each set of stages is approximately of equal value.

Each casing contains a number of diaphragms, the space between the diaphragms forming the stages; the ends of the casings are provided with covers which have the inlet and outlet ducts cut in them. The impellers are mounted on shafts which revolve in bearings of patented design, which permit of high speeds of rotation without appreciable vibration. The impellers are constructed of high tensile strength steel of the best quality,

accurately turned and bored, and are forced on to the shafts by hydraulic pressure, the fit between the impeller and shaft being provided by means of special bronze rings embedded in the bore of the impeller, according to the patented practice of the British Thomson-Houston Co., Ltd. Thanks to this construction, which is standard both for turbo-compressors and turbines, loose fits, with consequent vibration, are unknown.

The vanes of the impellers are attached to the impeller disks in such a manner that trouble due to loose vanes is an impossibility; this defect has been known to occur in the case of impellers of the usual riveted type, with the result that serious vibration troubles have been incurred.

The shroud plates of the impellers are machined from pressings of extra high tensile strength steel plate.

The flow of air through the two sets of impellers is so arranged that the end thrust of one set of impellers is eliminated by that of the other set of impellers, the two shafts butting together between the bearings to be found in the centre pedestal situated between the two casings.

The connection between the two shafts for driving purposes is through a flexible coupling of the

The water jackets surround the impeller chambers, the diffusers, and the return passages, whilst the hollow partitions separating the return passages from the diffusers are also supplied with circulating water. All the water connections are external.

Cooling blades of cast-iron are attached to the hollow partitions between the stages for the purpose of increasing the cooling surface. These blades, furthermore, ensure correct flowing of the air in the direction of the following impeller.

Due to the method of construction employed, the surfaces over which the air will pass can be easily ground and machined to a smooth finish and by this means the friction losses are greatly reduced, with a consequent increase in the efficiency of compression.

The sealing of the openings in the diaphragms, through which the shaft passes from stage to stage, and also in the covers of the casings is effected by a patented construction consisting of an internally-grooved ring split into four parts, and held together by leaf openings. The ring fits in a groove turned in the diaphragm, which prevents it moving inwards on to the shaft, but at the same time allows it free movement outwards. This effectually guards against any possible risk of damage due to inaccu-

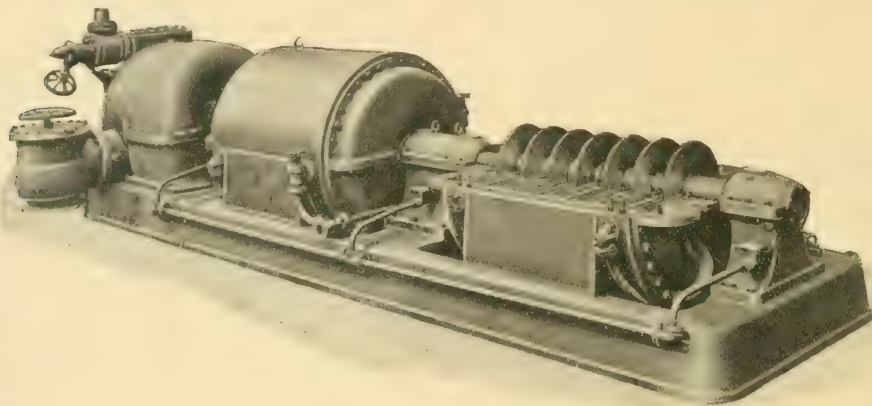


FIG. 2.—B.T.H. TURBO-COMPRESSOR, WITH CASING REMOVED.

claw type, and the coupling between the turbine and the compressor is also of the same type.

The position of the two sets of impellers relative to the casing is determined by a multi-collared thrust bearing situated in the outboard pedestal of the compressor. The value of the load carried by the collars of this thrust bearing is very slight, due to the excellent balancing of end thrust between the two sets of impellers.

The two casings are connected together by means of piping, and if a comparatively low temperature of air at the delivery of the compressor is required, an inter-cooler may be connected in at this point in place of the pipe mentioned above. By this means the temperature of the air can be reduced to approximately 136 deg. F. with an inlet cooling water temperature of 50 deg. F., the final air pressure in this case being 120 lb. per sq. in. gauge.

After the air has passed through an impeller, it passes through a set of guide vanes in the diffusers, by means of which a high efficiency is obtained, and by the suitable design of these vanes a very silent operation of the compressor has been secured.

The cooling of the air as it passes through the casing is very effective. Cooling is necessary, of course, in order to reduce the power required to compress the air, and also to reduce the final temperature of the air, which would otherwise be excessive.

rate assembly, and enables fine shaft clearances to be used without danger. The shrouding of the impellers at the inlet annulus is also provided with similar packings to reduce the short-circuit losses.

In order to maintain a constant pressure of air at the delivery of the compressor, independent of the quantity of air being used, the speed of revolution of the turbine and compressor is varied. This effect is produced by means of a piston moving in a cylinder, which is acted upon by the delivery air pressure from the turbo-compressor. The piston operates the pilot valve, which controls the supply of steam to the turbine.

In actual operation it is found that this type of governor will maintain the pressure at the delivery of this compressor constant to within 2.0 to 3.0 lb. per sq. in., with a variation in output on the delivery mains from practically full load to no-load and *vice versa*.

The compressor illustrated herewith is driven by a mixed-pressure turbine of the Curtis type. The details of construction of the Curtis type of turbine are now so well known that they need not be recapitulated.

The turbine in the case of the machine illustrated is in operation at a well-known colliery in the Midlands, and receives its supply of exhaust steam from winding, hauling, and other engines at the pit brow.

The capacity of the machine is 5,000 cu. ft. of

free air per minute up to a pressure of 80 lb. per sq. in. gauge. It has also an overload capacity of 6,250 cu. ft. of free air per minute at the same delivery pressure.

The normal speed of rotation is 4,600 R.P.M. at full load.

The machine is not provided with an inter-cooler, as a low temperature of air at delivery was not specified.

The compressed air in the case of this machine is employed in coal-cutting, operating haulages, ventilating, &c. Although the demand for compressed air in the case of this machine varies very considerably, and ranges at times from 5,000 cu. ft. per minute down to 1,500 to 2,000 cu. ft. per minute in less than 30 seconds, the variation in pressure of the air at the delivery of the compressor does not exceed 2.0 lb. per sq. in.

THE JOHANNESBURG

MUNICIPAL ELECTRIC POWER STATION.

(Abstract of paper read before the SOUTH AFRICAN INSTITUTION OF ENGINEERS, by J. H. DOBSON, M.Sc., M.Eng.)

(Continued from page 223.)

THE PRESENT STEAM PLANT.*

Coal Arrangements.—The Council has a branch railway siding which runs from Braamfontein station to within the power station yard. When the coal trucks are shunted into the yard, the coal delivered is weighed on an Avery triple combined weigh-bridge which has been erected some 200 ft. from the boiler house. Between the weigh-bridge and the boiler house is an underground coal boot into which the coal is delivered. The coal trucks are generally fitted with bottom hoppers, which when opened allow the coal to fall into the coal boot without any handling. The boot has a capacity of 360 tons. There are four discharge doors in the bottom of the coal boot, through which the coal falls on to a tray conveyor, 50 ft. long. The coal falls from the tray conveyor into a rotary automatic filler, which in turn feeds the coal into a gravity bucket conveyor. The coal is then elevated from the shaft at the end of the coal boot to the coal bunkers, which have a capacity of 400 tons and run the whole length of the boiler house.

The gravity bucket conveyor is capable of dealing with 40 tons of coal per hour; the total length of the conveyor, including the return, is 580 ft.

The kind of coal used at the power station is chiefly nuts from the Middelburg district. Investigations were carried out as to the economic value of nuts, peas, and duff; unless peas and duff coal are purchased at an appreciably lower price than nut coal, the latter is far more economical. As the price of duff peas landed at the power station is only between 1s. and 2s. a ton less on a price of about 10s. per ton, nut coal is almost entirely used. The coal is purchased in accordance with a specification based chiefly upon calorific value.

For removing the ashes a shaft was first put down at the south end of the boiler house, and a tunnel was driven underneath the centre line, the distance from floor level to the bottom of the tunnel being 27 ft. This tunnel extends the whole length of the boiler house.

The ash gullies or chutes connecting the back of the chain grate stokers were then driven upwards and connected to the tunnel, which is lined with hard blue bricks.

All the above work was carried out departmentally, without interfering with the working of the boiler house.

The ashes fall directly into the ash gullies through mouth-pieces. In the tunnel pans are filled with ashes by opening the chute doors; they are then run along rails at the end of the tunnel, and are elevated to the receiving bin by means of a tray conveyor. At present the ashes are removed from the bin by mule wagons, although arrangements have been made, when a suitable dumping site has been obtained, to remove them by electric freight cars capable of holding eight tons of ashes.

A large amount of patience and foresight were involved in the process of installing chain-grate stokers, superheaters, and economisers in those boilers which were originally installed without these accessories.

Three chimneys were removed to provide the boilers on the east side of the boiler house with economisers and proper draught arrangements. Before the chimney stacks could be removed the new draught arrangements had to be erected ready for connecting to the boilers. There is now only one

natural-draught chimney, which is connected to Nos. 6, 7, and 8 boilers, which are not fitted with economisers.

There were installed six sets of indirect induced-draught plants on the Schwabach system, which is similar to the well-known Prat system. The discharge air ducts of the fans are carried inside the chimneys and fitted with nozzles, the opening of the nozzles being varied by means of specially formed regulating bodies, which are operated by hand winches placed conveniently near the boilers. An emergency steam jet is fitted into each chimney. This provides an effective stand-by in case of trouble with a fan or motor, and, again, the jet may be used in conjunction with the fan should it ever be necessary to force the boilers due to a very sudden increase of steam demand, or if any of the other boilers are thrown out of action.

Each draught plant deals with two boilers, and operates satisfactorily with all the coal required for evaporating 34,000 lb. of water per hour. The fans are driven by direct-coupled motors of 50 H.P., running at a speed of 1,080 R.P.M. on 460 volt direct current. The temperature of the gases entering the economisers is about 520 deg. F., and when entering the chimney is about 308 deg. F. The draught at the end of the boilers is about .375 in., at the foot of the chimney $\frac{1}{2}$ in. natural draught, and 1 in. when the fan is working.

After an experience of five years it may be stated that these draught plants have given general satisfaction.

The question of installing mechanical stokers had to receive early consideration. The final choice was between the Erith underfeed stokers and Babcock & Wilcox chain-grate stokers. The underfeed stokers were cheaper by several thousands of pounds, and the principle of their action is generally admitted to be perfect, in that combustion takes place within the burning fuel itself without any necessity for specially built arches as required by the chain-grate stokers. Before the final choice of stokers was made the Johannesburg representatives of the underfeed stokers, at their own expense, fitted up a Babcock & Wilcox boiler with their stokers, and their working was compared with that of a chain-grate stoker on a similar boiler. The underfeed stokers certainly showed great flexibility, and combustion could be obtained as nearly as possible perfect. Taken over a period of six hours' running, the tests for lb. of water evaporated per lb. of coal were always favourable to the chain-grate stokers, but the chief point which made the adoption of the underfeed stokers absolutely impossible was the necessity to open the furnace doors at regular intervals for cleaning purposes, as the ashes cannot be disposed of as in the case of chain-grate stokers, and, in addition, there was the tremendous clinking of the Transvaal coals. Accordingly, chain-grate stokers with the necessary brick arches were installed one by one in all the boilers.

Five "Auto" CO₂ recorders are connected to the various groups of boilers. With boilers working under normal conditions, with a draught at back of boiler of .375 in., the average percentage of CO₂ is 10 to 12.

The Bettington boiler is of relatively new design; the chief pioneering and experimental work was carried out on the Witwatersrand by the late Lieut. Claude Bettington and Mr. Robeson, formerly consulting mechanical engineer of the Central Mining & Investment Corporation. Facilities were given to the manufacturers (Messrs. Fraser & Chalmers) to install one of these boilers, which was in the experimental stage—to be paid for provided the boiler gave satisfaction. The particulars of this boiler are as follows:—

Evaporative capacity, per hour	...	34,000 lb.
Heating surface, 240 tubes, $3\frac{1}{2}$ in. dia., 22 ft. long	4,480 sq. ft.	
Heating surface of boiler shell	460 sq. ft.	
Heating surface of superheater tubes	1,200 sq. ft.	
Heating surface, 75 economiser tubes, $3\frac{1}{2}$ in. dia., 22 ft. long	1,400 sq. ft.	
Heating surface, 138 air-heater tubes, $3\frac{1}{2}$ in. dia., 10 ft. 10 in. long	1,730 sq. ft.	

As the above boiler is the largest of its kind that has been made, some particulars will probably be of interest.

Fig. 3 shows the arrangement of the boiler. It consists briefly of solid drawn steel vertical tubes connected at the top and bottom to mild steel annular headers. The top header is fitted with doors for drawing out the tubes whenever necessary. The steam drum is fitted into the annular space of the top header, large holes being made in the periphery of the steam drum to form one common water and steam space at the top of the boiler. The top and bottom headers, together with the vertical tubes, form a circular structure like a huge cage. The interior part of this structure forms the combustion chamber, where the fuel is burned. The coal is placed in the coal bunker, fed into the coal hopper, and falls by gravity on to a worm gear, which forces the coal into a combined pulveriser and blower. This latter arrangement is simply an ordinary centrifugal fan with heavy blade or beater tips, and with a constricted space between the ends of the beaters and the casing. The boiler under review is fitted with two sets of combination blower-pulverisers, each directly driven by 100-H.P. motors at approximately 1,400 R.P.M. Each pulveriser is capable of giving the full rated output of the boiler. In this way the coal is driven outwards by centrifugal force, and is crushed to fine dust and blown into the dust chamber. The heavy particles fall back again into the pulveriser to be further crushed to fine dust. This is carried upwards to the air and fuel pipe, which terminates in a large

* A full illustrated description of the present power station appeared in the ELECTRICAL REVIEW of January 21st–February 11th, 1916. The following are supplementary details taken from Prof. Dobson's paper.

tuyere, and the coal dust when ignited burns like a large Bunsen burner. The ignited coal dust forms a mushroom-shaped flame within the closed ring of vertical tubes which form part of the steam producing plant. The flame strikes the bottom of the steam drum, is deflected downwards, and passes over the interior row of tubes, which are protected from the high temperature of the combustion chamber by special shaped firebricks. The hot gases are then deflected upwards and pass over the outer rows of vertical water tubes and the superheater tubes, and finally round the economiser tubes through which the boiler feed passes before it gets to the boiler. There is also another set of tubes through which the gases pass before entering the chimney and passing to the atmosphere. This latter set of tubes forms a separate air heater, and is connected to the pulveriser blower, which draws the air around the hot tubes, thus heating the air before it passes into the boiler and enabling the pulveriser to deal with fairly wet coal. The superheater tubes are connected to the upper part of the steam space of the top header by means of a steel expansion pipe, and the superheated steam is led away to the mains in the usual way. The firing of the boiler when cold is done at the municipal station by inserting a 2-in. gas pipe into a 4-in. air pipe to form a large Bunsen burner, the whole being placed inside the tuyere, and the boiler is started up instantly by simply lighting up the large gas jet.

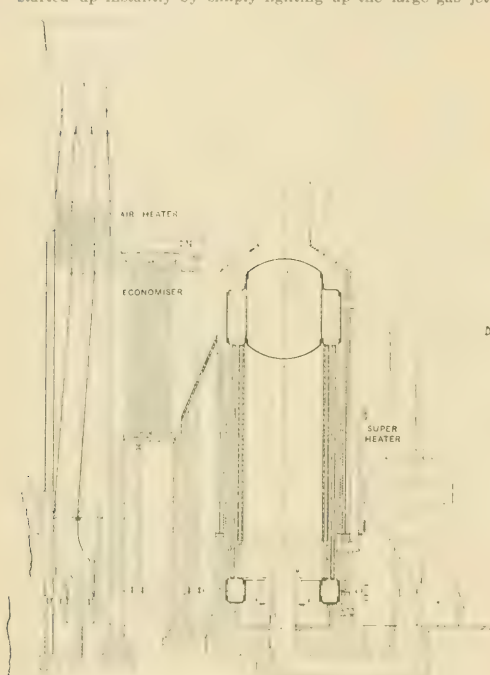


FIG. 3. BETTINGTON BOILER ARRANGEMENT.

The Bettington boiler was installed in 1911, and a thermal efficiency of 85 per cent. was guaranteed. The boiler, as depicted in the figure, had to be somewhat modified. At first it was fitted with a parallel chimney 60 ft. high and 4 ft. 6 in. diameter. It was expected that the pulveriser, which acts as a fan and produces a pressure of 1 in. to 1½ in. in the combustion chamber, would be sufficient to force the hot gases around the boiler tubes, the economiser and air heater tubes, and thence up the chimney. In practice, however, the gases were somewhat choked, and cooled to such an extent that additional draught had to be provided to get the full capacity out of the boiler. It was impossible to modify the air pressure at the pulveriser, as it interfered with the combustion of the coal dust. The economiser and air heater were considerably reduced, and a more direct path for the gases to the chimney was provided, by raising the air heater about 26 ft. In addition, the boiler was fitted with a Schwabach indirect induced-draught plant exactly similar to those installed on the other boilers, and the height of the chimney in the new arrangement is 86 ft., the draught at the bottom of which is about ½ in. In this way the rated capacity of the boiler was obtained, but its efficiency was somewhat lowered. No doubt in the future design of this boiler its efficiency can be somewhat improved by a proper relation between the pulveriser pressure, the boiler tubes, and the magnitude and arrangement of the economiser and air heater system without the necessity of an additional mechanical draught system at the base of the chimney.

After these alterations and certain adjustments at the pul-

verisers were made, the boiler, whilst not attaining the high efficiency of 85 per cent. as guaranteed, was considered thoroughly reliable for the purposes for which it is used at the municipal power station. Practice shows that the water tubes are practically self-cleaning. The inner row of water tubes does not appear to show any unusual evil effects by being close to the combustion chamber. During a period of four years very few tubes have been replaced. The boiler can be, and is, usually put on the steam mains from cold in about 20 minutes to half an hour from lighting it up by gas. The boiler is usually run to take the evening peak load, but has been run regularly day and night on occasions for a period of over a week, during which time it is necessary to take out the pebbles of slag every 12 hours, and there was no particular trouble experienced through slag depositing on the brick lining. This boiler has been of great service when part of the other boiler plant has been suddenly put out of action. Its ability to get up steam quickly is regularly taken advantage of, especially during the rainy season, when sudden large increases of load arise in a very short time. As it is fitted with two pulverisers, each of which can give the full rated output, its overload capacity has at times proved exceptionally useful. Needless to say, the boiler was paid for and taken over, and it forms a valuable portion of the boiler plant, working on conditions of large and sudden power demands.

The last boiler installed is one of the Babcock & Wilcox patent marine type water tube boilers, having 5,780 sq. ft. of heating surface, with an evaporation of 35,000 lb. per hour from and at 212 deg. F. with coal common to the Transvaal. This boiler is fitted with two chain-grate stokers, a patent superheater, and an economiser. The boiler is connected to a mild steel chimney arranged with the Prat system of induced draught.

The following shows the results of some comparative tests that have been carried out on this boiler and the modified Robeson Bettington boiler:

	Bettington tests.	Babcock and Wilcox tests.
Gauge pressure, lb. per sq. in. ...	173.7	161.9
Feed temperature ...	65.5° F.	61.7° F.
Steam temperature ...	510.3° F.	546° F.
Water evaporated per hour ...	31,561 lb.	29,370 lb.
Lb. of water evaporated per lb. coal (as fired) ...	7.050 lb.	7.011 lb.
Net calorific value of coal as received ...	1110	1142
Evaporated equivalent from and at 212° F. (as fired) ...	9049	9140
Evaporative equivalent from and at 212° F. (dry) ...	9461	9868
Percentage auxiliary power ...	3.8	1.0
Efficiency on net calorific value ...	81.1	80.0
Net efficiency on net calorific value ...	78.2	79.1

The make-up water is obtained from two sources:—

(a) Five boreholes, sunk to depths of about 300 ft. in different parts of the works ground, the supply from which during recent years has steadily declined; and

(b) Town supply mains.

Owing to the amount of chlorine which has developed in the borehole water during recent years, it is now almost exclusively used for the make-up for the cooling towers, and town water is treated for the boiler feed make-up.

An approximate analysis of the town water shows:—

Alkalinity ...	3.68 deg.
Total hardness ...	29.6 deg.
Permanent hardness ...	11.4 deg.

The water has been treated for several years by a fluid called "Noxal," which has a very alkaline reaction, and contains about 8.48 grammes of soda in 100 c.c. of the fluid. The town make-up water is about 25,000 gallons per day. Four gallons of Noxal fluid is diluted with about 20 gallons of water, this amount being used every day. The mixture is placed in a cask over the feed tank and allowed to trickle into it continuously. In this way the scaling of boiler tubes and their renewal is kept within reasonable limits, the Noxal having the effect of loosening any scale which may be formed. It is removed from the boiler by the blowing-down arrangement, and takes about 50 gallons of water per boiler per 24 hours.

The condensed water from the three turbines is pumped direct into the feed tank without treatment, as it is practically free from oil.

The condensed water from the reciprocating engines is treated in a Davis-Perrett de-oiling plant, after which it flows into the main feed tank. The amount of water that can be dealt with is 3,000 to 4,000 gallons per hour.

The following are results of analyses showing the amount of oil in the water before and after the above treatment:—

Amount of oil found before entering de-oiler ...	.012 p.c.
Amount of oil after electrical treatment ...	.003 p.c.
Amount of oil after filtering ...	.0004 p.c.

This method of removing oil from water has been most effective, but good results were only obtained after considerable trial and failure. The analysis of the water in the feed tank shows:—

Alkalinity ...	1.44 deg.
Total hardness ...	12.0 deg.
Permanent hardness ...	4.8 deg.

There is the objection to the use of the "Noxal" boiler fluid that its work is done inside the boiler itself, but investigations went to show that this fluid does not act injuriously upon the boiler tubes and plates. The results obtained have been very satisfactory, so far as the replacement and cleaning of boiler tubes are concerned. To further improve the water feed it has been decided to install a Lassen & Hjort water purifying plant.

The electric supply from the Johannesburg power station is led to three distinct sections of the distribution plant: 3,300 volts A.C. for the suburbs, 600 volts D.C. for traction, and 460 volts 3-wire D.C. for the inner area of Johannesburg. In any case it was necessary to install direct-current generating plant. The author came to the conclusion that it was too risky to embark on direct-current turbo-generators, because of the inevitable difficulties connected with commutation, more especially having regard to the exceptional dust experienced in Johannesburg. The circumstances of space, however, and the future demand at the power station, put all plant out of consideration other than turbines, and the scheme ultimately decided upon was that of turbo-alternator generating plant, the direct-current requirements to be obtained by means of converters to transform the alternating to direct current. The scheme appeared to suit the distribution plant from the point of view of future growth of traction and power demand, as it became more and more obvious that the direct-current power supplied from the central station would diminish, whilst the alternating-current requirements would increase. There was also the point that with turbo-alternators and converters it would be possible to obtain all three requirements at times of low load from one steam turbo-alternator unit, this tending to economical running.

The plant installed has been impulse turbines, manufactured by Belliss & Morcom, of Birmingham. The first 3,000-kw. turbo-alternator was installed and put on load on October 5th, 1910, the second on July 7th, 1911, and the third on August 3rd, 1913. Orders for two additional 3,000-kw. sets have just been placed with Messrs. Parsons & Co., for plain reaction turbines running at 3,000 R.P.M.

The power plant installed in the engine room at the present date consists of two 500-kw. and three 1,000-kw. triple-expansion Belliss & Morcom engines, three 250-kw. Allen reciprocating sets, three 3,000-kw. turbo-alternators, all with Belliss & Morcom turbines, two 750-kw., and two 1,250-kw. motor converters of the La Cour type, manufactured by Bruce Peebles & Co.

The absence of large natural ponds and the scarcity of water on the Witwatersrand make the subject of cooling circulating water for turbines one of the greatest importance for the economical production of electric power. Whilst the temperature of the air and the high altitude militate against good cooling, there is no doubt that the low relative humidity of the air and the mean wind velocity of the Rand are factors which tend to good cooling. Numerous investigations were made before a final decision on the cooling arrangements was arrived at. The final choice was to erect "wind cooling towers" for each of the 3,000-kw. turbines. They were designed and made departmentally, and may be described as partly open, natural-draught cooling towers.

The salient features provide for good distribution of the water over the whole section of the tower and the complete breaking-up of the water before falling on the extended surface provided by brushwood, as well as the provision of a clear space at the bottom of the tower enabling the wind to get into the tower and to rise through the brushwood by the natural draught provided by the height of the tower.

The water falls through porcelain tubes (6 in. long by $\frac{5}{8}$ in. diameter, ordinary leading-in tubes used in the distribution branch of the department), which always keep themselves clean. The water emanating from the porcelain tubes is then broken up very effectively by zinc disks placed about 9 in. below the porcelain tubes, and the water thus broken up falls over the brushwood. Experiments were carried out, and it was found that so long as the ray of water impinges on a relatively smooth surface of any shape, it is effectively split up.

A feature of the circulating water piping to the condensing plant of the three turbo-alternators is that instead of the usual iron, it is made of Californian redwood. The pipes are of varying lengths up to 20 ft., the main pipe lines having an internal diameter of 20 in. They are composed of staves $3\frac{1}{2}$ in. wide and $1\frac{1}{2}$ in. thick, the edges having "V" tongues and grooves, the whole being bound together with $3\frac{1}{16}$ -in. diameter steel wire, machine-wound tightly round the outside with a pitch between coils of 1 in.; the wire is further secured at intervals by staples. Before being wire-wound the pipes are accurately turned in the lathe to the proper dimensions both inside and out. The couplings consist of collars of a width of 12 in., built of staves and wired in exactly the same manner as the pipes. The ends of the pipes are slightly tapered for 6 in. back (where the wiring ends), and the joint is made by forcing the tapered portion into the collar after painting with red lead paint. Where bends occur in the pipe line, castings are used with tapered ends similar to those on the pipes, the joints being made in exactly the same manner as on the pipes themselves. They are much cheaper than cast-iron pipes and easy to run. In fact, owing to the presence of the gas plant and the enormous amount of underground piping, it would have been almost impossible to run iron pipes because of the gradual rise and fall in various portions of the ground to avoid cutting through existing pipes.

The pipes take up by swelling after two or three days' working, and leakage entirely ceases. After several years' experience of this type of piping, it is regarded as highly satisfactory.

Owing to the barometer standing at approximately 24.75 in. as compared with 30 in. at sea level, and the relatively high engine-room temperatures experienced in this country, for the same output and the same temperature rise, it is a wise policy to have electrical machinery about 30 per cent. bigger on the Rand than at sea level and in the home country. When working at full load and 8 P.F. in an engine-room temperature of about 100 deg. F. the alternators are sufficiently large to keep the temperature rise between 65 deg. and 70 deg. F.

When all the power required for auxiliaries is taken into account, the steam consumption per unit on full load is from 15.6 to 15.8 lb. at a back pressure of approximately 1.1 lb. per sq. in., and from an analysis of the various losses in the steam turbine the blade efficiency is from 88 to 90 per cent.

The first turbine has been running for nearly five years, and its running has been perfect. Some six months ago, after four years' continuous running, the low-pressure blading showed signs of pitting, and it was decided to replace it, but before carrying out this decision some of the blading stripped and the work had to be done more quickly than anticipated. It can be safely stated that the turbine ran for a period of four years before it became necessary to replace any blades, and all but the low-pressure blading have not been touched and are still satisfactory. Experience has proved that it is best to replace blades when they show pitting rather than wait for their final destruction. The second turbine has been running since July, 1911. Before this machine was finally taken over from the contractors, four rows of the high-pressure blading stripped and did some damage to the drum of the rotor. The Council had to acknowledge lack of foresight and inaction on the part of the driver in attendance on the turbine, and it was decided that the Council and the contractors should each pay half towards the cost of the breakdown. Apart from this the machine has run excellently since its installation four years ago, but, taking the experience on the first turbine into account, the blades at the low pressure end were recently replaced. The third turbine was installed in August, 1913, and has run satisfactorily to date. Taken altogether, the running of the turbines has been satisfactory, and the Council up to the present has been spared the calamities that have befallen some of the turbine plants that have been installed on the Witwatersrand.

The alternators have been remarkably free from electrical faults; in fact, there has not been a single fault during the whole time the three sets of turbo-alternators have been running.

The duty of the converting plant is to transform the two-phase alternating current generated at 3,300 volts, 50 cycles, to three-wire direct current for light and power at 460/520 volts, and direct current with compounding arrangements for traction at 500/600 volts. Two 750-kw. and two 1,250-kw. units were installed.

Motor converters were chosen on account of their established reputation as being reliable machines and occupying a mean position with regard to capital expenditure and efficiencies of the motor generator and rotary converter. Only on two special occasions have the machines been used for the transformation of D.C. to A.C., but worked satisfactorily.

Speed limit devices were called for in the specification in case the machines came out of synchronism and attempted to run up to the full speed of the rotating field of the stator. In practice these have been found unnecessary, as the large current taken on the A.C. side under such circumstances brings out the circuit breaker.

The motor-converters have now been running for about four years. In general it has been found that motor-converters require much more minute adjustment than ordinary D.C. generators, but when once correctly adjusted the attention required is no greater than on any other type of D.C. plant. The doctor's bill has been relatively small. There have been two faults during the whole of their running, covering four years.

The guaranteed efficiencies were exceeded by about 1 per cent. The sizes of the converters are such that it is never necessary to work any of them below half-load, and the efficiency of transformation is thus never below 90 per cent. The power factor varies from .7 to .85 lagging when the converters are on lighting, and from .98 leading to unity power factor when on traction.

The perfect provision for balancing in connection with the motor-converters is a feature of the arrangement. Each of the motor converters installed in the municipal power station is capable of dealing with an out-of-balance current of 15 per cent. with a difference of voltage between the two sides of the machine of 1.5 per cent. of the average voltage per side, the middle wire of the three-wire system being connected to the middle or star point of the rotor windings through a terminal on the starting resistance, which is connected to the short-circuited slip rings.

The use of rotary balancers has been discarded; normally the out-of-balance load can be kept within 200 amperes, the converters are able to deal with it easily, and the difference in voltage is practically nil.

The following figures convey some idea of the growth of the system since 1909, and of the present dimensions of the electric supply undertaking:—

	1909.	1915.
Total number of connections to mains	5,720	16,091
Total number of meters on system	5,755	17,350
Total units generated	12,691,367	26,426,072
Maximum load (kW.)	5,400	10,800
Total number of street lamps	5,340	7,000

The monthly load factor, based on the maximum number of units generated in any one hour (usually on Saturday evenings), is approximately 30 per cent. The works costs are approximately .5d. per unit measured by the actual units delivered to the D.C. traction, the three-wire lighting, and to the A.C. bus-bars. This includes a price of 4s. 6d. per 1,000 gallons at present paid for town water. The capital charges on the total power station equipment are approximately .22d. per unit, making a total cost of approximately .72d. per unit generated. The selling prices vary from 6d. to 3d. per unit.

The department is in a sound financial position; £550,218 has been provided out of profits since 1903-4 (after wiping out losses owing to the gas engine failure during the years 1906-7 and 1907-8). Of this amount £95,227 was utilised for capital moneys, and the remainder went to the relief of rates. The annual amount provided for the above purposes during the last few years has represented some 6 or 7 per cent. of the capital of the whole of the electric supply department, which is approximately £1,000,000 sterling, of which £286,000 belongs to the new steam station plant and buildings, £244,326 is held as an accumulated fund for the redemption of the loans, and there is a net amount of £127,698 still standing to the credit of the renewals fund.

L. & N.W. RAILWAY ELECTRIFICATION.

In our issue of August 11th we briefly outlined the present position of the work in connection with the electrification of the suburban services of the London and North-Western Railway in the London area.

In this connection we are able to illustrate some of the extensive cable work carried out by Messrs. W. T. Henley's Telegraph Works Co., Ltd., in connection with this scheme. Messrs. Henley having been responsible for supplying and laying the whole of the L.T. feeder cables, jumper, sectioning, and cross-bonding cables, including some 20 miles of heavy cable.

In addition they provided 12 double-feed switch pillars containing two single-pole 1,500-ampere switches, 22 section double-feed switch pillars, 76 section cross-bond double-feed switch pillars



FIG. 1.

and four resistance pillars with 1,500-ampere s.p. switches and resistance grids to carry 3,000 amperes, for 20-second periods at 10-minute intervals.

Fig. 1 shows the laying of 1'25 sq. in. paper-insulated V.B. sheathed track feeder cables at West-End Lane sub-station; the cables pass through an iron bend to make connection with Cortez-Leigh patent sealing terminals; figs. 2 and 3 show section-feeder pillars, in the latter case constructed in concrete near Kentish Town Station on a viaduct, where there was no room for the ordinary type of pillar.

The cubicles are of reinforced concrete, with roller-shutters to save space. The cables are 1 sq. in. cross bonding and 1'25 sq. in. section cables, insulated with vulcanised rubber, V.B. sheathed, and laid in shallow trenches, it being impossible to lay the ordinary type of cable in trenches over the viaduct.

Fig. 4 illustrates part of the back of the switchboard in the Willesden sub-station, showing the Henley porcelain sealing ends



FIG. 2.



FIG. 3.

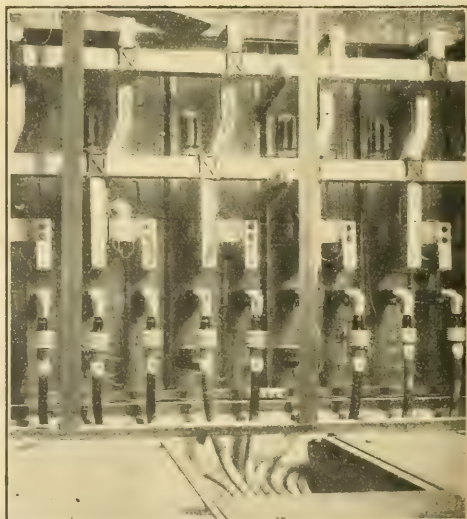


FIG. 4.

with 1'25 sq. in. paper-insulated, lead-sheathed car-shed feeders; the bus-bars are of aluminium.

The cables laid by Messrs. Henley include the sections Willesden to Camden Town, Willesden to Acton Wells Junction, Chalk Farm to Loudoun Road, Chalk Farm to Broad Street, Acton Wells to Kew East Junction—Kew Bridge, and Acton Junction to Gunnersbury.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Raising Steam by Electric Heating.

In many hydro-electric plants there is for some months of the year an excess of energy which is, to a large extent, not utilised. The use of this energy for raising steam in the boilers of a reserve steam plant has naturally suggested itself, and experiments along this line have been made, first, with two steam boilers, by the Electric Supply Co. of Zurich, Switzerland, at its Lötten plant. As a result of these tests, the company has ordered two new sets of electric heating elements, for a third boiler, the section of which is given in fig. 1. This apparatus has been in operation since September, 1915.

The electric-heating sets are arranged as shown in the illustration, and consist of resistance elements A of cast iron, insulated with mica and eternit. The use of any easily-fusible or expensive metal or of any solder has been avoided. Each heating unit consists of six resistor sets, which may be connected at will according to the particular conditions. The connections are made at the binding posts at the end wall, which also has a window through which the interior may be observed. While electric heating is carried on, the heating chamber is hermetically closed. The

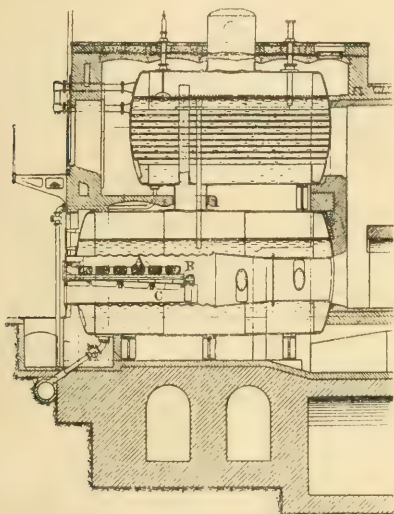


FIG. 1.—CROSS-SECTION OF BOILER EQUIPPED WITH ELECTRIC HEATING GRIDS (A).

maximum temperature of the heating resistors is below 600° C. The boiler has 180 sq. m. heating surface, and contains 17 cu. m. of water. With a maximum consumption of 84 to 86 kw., 1,720 kg. of steam is produced in 24 hours, and the steam is utilised in various ways. The three boilers of the Zurich station, equipped with electric heating sets, furnish, on the whole, 5,630 kg. of steam per day, with a consumption of 7,392 kw.-hours, saving 750 kg. of coal a day. This is a specific consumption of 1.31 kw.-hours per kilogramme of steam (0.6 kw.-hour per lb. of steam).

In order to operate the boiler with coal as fuel, the unit of electric-heating elements is removed from the boiler. This may be easily done in half an hour. The use of electric power for steam raising is proposed only for those periods in which excess power is available which would otherwise be wasted.—*Electrical World*.

Fireproofing Manhole Cables.

According to the *Electrical Review* and *Western Electrician*, the EDISON ELECTRIC ILLUMINATING CO., of Brooklyn, N.Y., uses concrete to fireproof its lead-covered feeder cables in manholes. Two coats of paraffin, separated from each other by cheesecloth, are applied; a $\frac{1}{4}$ -in. lamp rope is then bound round the cable, and, finally, a $\frac{1}{2}$ -in. layer of concrete is spread over all. This also prevents the sheaths from picking up stray currents.

Motograph Signs.

THE FEDERAL SIGN SYSTEM, of Chicago, U.S.A., is responsible for a new development in moving-sign construction, and what is claimed to be one of the largest electric signs in the world, of this type, is located at the corner of Michigan Avenue and Randolph Street, Chicago, showing in both streets.

The display area measures 130 ft. by 50 ft., and is uniformly studded with 10,000 Mazda lamps, the sockets of which are connected with wires running to a terminal board; by passing a perforated paper ribbon between this terminal board and a corresponding brush-board forming part of the apparatus, lamps corresponding to the perforations are caused to light up on the sign—the effect of

moving letters and words being obtained, so that constantly-changing legends can be shown.

The letters in this case are 12 ft. high, and it is estimated that some 200,000 people see the sign each day. At the end of each advertising message, the time of day is flashed upon the sign, with the legend, "Ye Town Clock," and this feature is much appreciated. — *The Central Station*.

A Useful Telephone Attachment.

Fig. 2 shows a new telephone attachment adapted to grip on to the neck of the ordinary desk-pattern telephone. The object of the device is to save the subscriber's time while either waiting for a call or during the delays which so frequently occur when a reference has to be looked up or some other person called to the telephone.

When the receiver is dropped into the two jaws of the "Chatterak" (the name by which this device is known), it lies in a position in which the subscriber, while going on with other work and having both hands free for the same, can hear anyone speaking on the

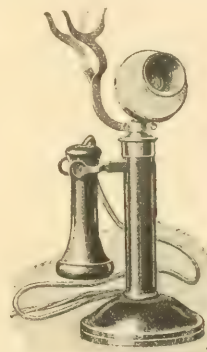


FIG. 2.—"CHATTERAK" TELEPHONE ATTACHMENT.

line. It is not suggested that this is the most convenient position for carrying on a conversation, although this can be done, and the device used in this way is specially useful when it is desired to take down a message and have both hands free to do so.

The device may be obtained wholesale from the CHATTERAK CO., of Queen Anne's Chambers, Westminster. The attachment, which costs but little, is finished in copper bronze, similar to the finish most usual on the desk type of telephone.

LEGAL.

ELECTRICAL METERS AND MACHINERY CONDEMNED BY THE PRIZE COURT.

IN the Prize Court on August 23rd, the President, Sir Samuel Evans, had before him a suit by the Crown, asking for condemnation of a case of "hardware" on the ground that it belonged to enemies of this country.

MR. M. W. SLADE, for the Crown, said that the goods consisted of a case of electrical meters and other machinery, and were shipped on board the British steamship *Michigan*, by Isaria, Ltd., a company incorporated in this country, to customers in Canada, shortly before the war. They were rejected by the customers in Canada and were seized on their return to Liverpool as being enemy property. Isaria, Ltd., had in a letter made a claim to the goods, stating that they were manufactured in Bavaria, the order for them being placed in April, 1914. Accepting their statements, Counsel asked for condemnation on the ground that Isaria, Ltd., was an enemy firm. The facts with regard to Isaria, Ltd., Mr. SLADE continued, were set out in his Lordship's judgment in May of last year, in the case of the *Poonia*. His Lordship had decided that Isaria, Ltd., must be taken to be a British firm, but following upon the decision of the House of Lords in the *Continental Tyre Co.*'s case, the company must be regarded as an enemy firm.

THE PRESIDENT: Your case is that the goods were the property of Isaria, Ltd., who had not a single British shareholder? You may also say that the order was given to Munich, and that Isaria, Ltd., merely shipped the goods to Toronto?

MR. SLADE: Yes, in which case the goods would be the property of the enemy company in Munich. He added that no formal claim had been put forward to the goods. An order had been made for their sale, but they had not yet been sold.

THE PRESIDENT, in giving judgment, said that the company had not put forward any claim to the goods in these proceedings, although they sent a letter to the Procurator-General, alleging that they were the owners, and that as a company registered in this country, they were entitled to have the goods released to them as they were in the case of the *Poonia*. In that case he (the President) said that if the judgment of the Court of Appeal in the

Continental Tyre Co.'s case was "unsound, it must be so pronounced by the House of Lords. It had been pronounced to be unsound by the House of Lords, and following that decision and his own statement as already expressed in the *Pearce* case, he must hold that Isaria, Ltd., for all purposes affecting this case, must be treated as an enemy company, although carrying on business in England, and the goods in question must be condemned as enemy property.

MUNITIONS COURT CASE

BEFORE the Monmouthshire Munitions Tribunal, Reginald Victor Powell complained that the Newport Corporation Tramways Department unreasonably refused to issue a certificate in his favour on July 31st. He alleged that he had been superseded as senior switchman by a man who had only been in the Corporation's employment about three weeks, whereas he was a capable man and had been a servant of the Corporation for about 18 months. His application was based wholly upon the fact that the new man had been described as a "senior switchboard attendant."

MR. A. NICHOLS MOORE, the borough electrical engineer, who represented the Corporation, said that the explanation was that both men were senior switchboard attendants.

The applicant was refused. *Monmouthshire Evening Post.*

THE THERMIT WELDING PROCESS.

ON August 24th, Mr. W. B. Ballantyne, of 1, Dr. Johnson's Buildings, Temple, London, E.C., applied for a licence to use two patents in the name of Dr. Goldschmidt, of Essen, for aluminio-thermic processes.

MR. WHITEHEAD, who appeared for Thermit, Ltd., objected to the jurisdiction of the Board of Trade. By agreement the right to these patents was vested in Thermit, Ltd. In July, the Public Trustee, pursuant to an order of the Board of Trade instructing him to sell the shares of Thermit, Ltd., which had hitherto been held by alien enemies, entered into an agreement to sell them to a company known as the Birmingham Metal and Munitions Co., Ltd., and the consideration for sale appeared in the correspondence as £19,500. That money had actually been paid to the Public Trustee, and the shares had been transferred. The bulk of the shares of Thermit, Ltd., were now held by the Birmingham Metal and Munitions Co., a certain number being held by a Mr. Horatio Ballantyne. The Birmingham Metal and Munitions Co., Ltd., was a British company whose shares were held by Nobel's Explosives Co., Ltd., also a British company. It was a matter of the utmost importance to Nobel's Explosives Co., Ltd., and the Birmingham Munitions Co., Ltd., that they should not be deprived of half what they expected was coming to them. There was no indication in the agreement that they were not getting the patents. His clients might desire to go to the Courts for a judicial construction of the agreement.

The hearing was adjourned to decide whether the Board of Trade should assume jurisdiction or not. *Evening Standard.*

WAR ITEMS.

Employés of Military Age.—A decision was given by the Manchester Stipendiary Magistrate, on August 24th, in a case in which Messrs. Waygood-Otis, Ltd., lift makers, were summoned under the Defence of the Realm Act for failing to post in a conspicuous part of their premises in Manchester a list of their male employés of military age. The defence was raised that the firm was a "controlled" establishment under the Munitions of War Act; that as such they kept at their head office in London a register of all their employés of military age, and that they were accordingly exempt from the obligation to keep a list at the Manchester branch office. The Stipendiary agreed with this view, and dismissed the case.

Separation Allowance Case.—A Bradford, the wife of a soldier, formerly employed in the electricity department, was fined £5 for obtaining money from the Corporation by false pretences. She had applied for relief from the War Fund when her husband enlisted, and stated that he had no allowance from his former employer. On inquiry recently it was found that she had been receiving 14s. a week from the Corporation, as well as the Government separation allowance and 6s. 6d. a week from the War Fund, from which latter she had drawn a total of £20 9s. 6d.

Holborn Tribunal and Electrical Firms.—Mr. Oswald Nettlefold, Chairman of the Advisory Committee of the Holborn Tribunal, has resigned his position in consequence of the Tribunal's decisions in claims made by Messrs. Falk, Stadelmann & Co., and Messrs. J. and W. B. Smith, both engaged in the glass trade in Farringdon Road. The former firm asked for the exemption of 16 men; and the latter for nine. It is alleged that Messrs. Falk, Stadelmann's business has been carried on mainly under the direction of naturalised British subjects of German descent.

The Advisory Committee recommended the dismissal of Messrs. Falk, Stadelmann's appeals, and the granting of Messrs. Smith's, but the Tribunal granted the former firm 13 men of the 16 asked for, and informed Messrs. Smith that six of their men would have two months' exemption, whilst three must join up within three weeks. Mr. Nettlefold accordingly resigned. *Daily Telegraph.*

Munition Workers' Holiday.—In order to correct a misapprehension which appears to have arisen with regard to the date of the rest period for munition workers, which was directed by the Government, the Ministry of Munitions says it should be understood that the period in question will extend from September 28th to October 1st, both dates inclusive.

German Munitions Captured.—Sir Samuel Evans, sitting in the Prize Court, has condemned as absolute contraband a supply of machinery for munitions and trench-drilling intended for the German forces. The machinery was captured on its way from America, and was made up in 300 small postal packages. It was destined for delivery via Copenhagen to the Internationale Pressluft und Elektrizitäts Gesellschaft, Berlin.

Training Disabled Sailors and Soldiers.—The Disablement Section of the War Pensions Statutory Committee at a recent meeting discussed a new regulation enabling maintenance to be paid to disabled men during training for employment, in cases where the pension is insufficient to support the man and his family, when the training necessitates absence from home, and thus increases his expenses.

Power Station Fatality.—In connection with a recent Zeppelin raid, an inquest has been held regarding the death of a switchboard attendant, aged 34, employed at a power station. The evidence showed that a bomb dropped in the neighbourhood of the switchboard at about 1.30 a.m., deceased and another man being injured. Medical evidence showed that the man was in a very collapsed condition, suffering from loss of blood, and that he had wounds on the head, chest, and abdomen. He died the next morning from shock and hemorrhage. The jury returned a verdict of death from shock following the explosion of a bomb from a German Zeppelin.

British Industry: Definite Line of Policy Now and After the War.—Mr. F. Dudley Docker has been appointed President, and Sir William Peat chairman, of the Federation of British Industries Association, which has been established as a central organisation of manufacturing interests. Among the bodies which have been absorbed in the new association are the Institute of Industry and powerful industrial groups in Manchester and Birmingham. The Institute of Industry has accordingly gone into voluntary liquidation, a condition being that the minimum amount of the fund to be raised under the new arrangement should be £100,000, a sum which, as a matter of fact, has been greatly exceeded.

A large number of important firms and companies have already given their adhesion to the new movement, which includes a wide representation of all the more important industrial interests in the country. The main object of the new organisation is the investigation and carrying into effect of a definite line of policy in regard to the various matters affecting British industry both now and after the war.

Proposed Ministry of Commerce.—A memorial of the Associated Chambers of Commerce has been submitted to the Prime Minister urging the Government to take immediate steps to create a Ministry of Commerce and Industry with a Minister of Cabinet rank, aided by a permanent advisory council, consisting of representatives of the Foreign Office, the Colonial Office, the India Office, the self-governing Oversea Dominions, and the leading commercial interests of the Empire. The memorial suggests that the Commercial Department, the Patents, Designs, and Trade Marks Department, and the Companies Department of the Board of Trade should form the nucleus of the new Ministry. It is further suggested that commercial representation in foreign countries should be added to the functions of the Commercial Department, with power to send trade representatives to foreign countries in the same way as they now send representatives to British Possessions. The Government is asked to appoint a special committee to inquire into the proposal and to report on it at the earliest possible date. *The Times.*

British Mannesmann Tube Co., Ltd.—The shares of this company have been sold by the Public Trustee to a British group, including Sir Hugh Bell, Mr. A. J. Dorman, Messrs. Balfour, Williamson & Co., and Messrs. Higginson & Co. All German interest in the company has been eliminated, and it is the intention of the new controlling interests to constitute a representative board to continue the business of the company under the present organisation, which is entirely on a British basis. The company has large weldless-tube works at Swansea, and intends to erect additional tube mills at Newport (Mon.). Other developments are also in contemplation, which will further widen the scope of the company's activity.

The British Mannesmann Tube Co. was registered in July, 1899, as the British Weldless Tube Co., to take over the business of the Mannesmann Tube Co., and four months later the title was altered to its present form. The issued capital is £340,000 in £10 shares, £150,000 being 5 per cent. cumulative preference and £150,000 ordinary shares; in addition £65,500 of 4 per cent. debentures have been issued. The company had a virtual monopoly of the supply of tubes for water-tube boilers, and according to a question by Sir John Lonsdale in the House of Commons, practically the whole of the issued capital was held by persons resident in Germany. Their holdings, in accordance with the provisions of the Trading with the Enemy Act, 1916, were placed in the control of the Public Trustee for disposal, with the result stated above. *Financial Times.*

Exports to China.—The "London Gazette" for August 29th contains a further list of names of persons to whom articles may be exported in China and Siam.

Metal Workers' Wages.—An application by the metal, wire, and tube workers of Birmingham and district was heard in London by Sir George Asquith, of the Board of Trade. The workmen asked for a 5s. war bonus for day workers, and 12½ per cent. increase in pay for piece workers. Sir George heard, too, an application of the engineering and allied trades for a 25 per cent. increase on the present day-work rates. The employers' cases were also presented, and the decisions were deferred.—*Birmingham Daily Post*.

Labour Transfer Scheme.—A scheme for the transfer of skilled labour for accelerating war output has been arranged on the Clyde, and in other Scottish districts, by the Board of Admiralty, the Ministry of Munitions, and the Labour Supply Committee, with the aid of the Boilermakers' Union and the Scottish District and Clyde Committees. It recognises that firms are retaining workmen when their services are not actually required, owing to fear that it would be impossible to secure these men or similar men when their services were most needed. It is thought that if firms were assured that the workmen would be returned to them when required, they would be willing to release the employees to work for other firms urgently needing such men. Therefore a local distributing committee, consisting of representatives of the Admiralty, Ministry of Munitions, and employers' and workers' associations, is to be appointed, with power to ascertain where workmen are available for transfer and where they are needed.

Dilution of Labour.—Dilution has already been established in 150 of the largest of the 300 controlled engineering and shipyard establishments on the Clyde, and some 14,000 women have been introduced by the Commission, the greater proportion of whom are engaged on general engineering work, excluding shells. Agreements have been concluded for dilution in shipbuilding and ship-repairing yards on the Clyde and Tyne with all the principal shipyard trades, and the interchangeability of members of different shipyard trades, and the introduction into the shipyards of unskilled men and women, is proceeding satisfactorily. The work of the Commission on the Clyde and Tyne will be taken over and continued as from September 1st by officers of the Ministry of Munitions and of the Admiralty, as in other parts of the country.

U.S. and Trade After the War.—The New York banking house of Henry Clews & Co., in their weekly financial review, remark: "An interesting feature of our foreign commerce returns for the last fiscal year was that out of total merchandise exports of \$4,353,000, more than half, or \$2,658,000, consisted of manufactures which doubled their amount in the past twelve months. The extraordinary expansion in manufactured exports is mainly due to the war, and must be considered as quite abnormal. Nevertheless, there is no doubt that we shall retain much of this newly-gained foreign trade, provided our costs can be made to meet those of Great Britain and Germany, who will strenuously endeavour to recover all and more than they have lost. Our chief handicap will be high-priced commodities and labour troubles, in both of which there will have to be a readjustment before we can successfully meet foreign competition abroad."

Exemption Applications.—At Newport (Mon.) Tribunal, Mr. A. Nichols Moore, borough electrical engineer, applied for the exemption of nine men in his department. Mr. Moore pointed out that his department was down to its minimum. The men included men from the permanent-way department, night car repairer, brake fitters, coachbuilder, motor tramways inspector, overhead linesman, &c. All these men were absolutely necessary. Three months' exemption in each case was granted.—*Monmouthshire Evening Post*.

The Stalybridge Tribunal has granted temporary exemption until November 30th (conditional on the men joining a Volunteer Regiment) to three men appealed for by the Stalybridge, Hyde, Mossley and Dukinfield Joint Tramways & Electricity Board. It was stated that out of 71 conductors 68 had been allowed to join the Colours, and the Board was contemplating an expenditure of £30,000 on extensions at the generating station. The men appealed for were Mr. S. B. Firth (32, married), cashier, collector and wages clerk; Mr. P. C. Firth (31), chief clerk; and Mr. H. Marsh (33), rent collector and wages clerk. Three members of the office staff had enlisted, and the accountant, who was over military age, had obtained another situation.

Winchcombe Tribunal allowed a month's final exemption to an electrician on a local estate, who also looked after the estate waterworks; he had been passed for garrison duty abroad.

At the York Tribunal, the electricity department applied for exemption for two cleaners and greasers; it was stated that the men were in a certified occupation, and acted as assistant engine drivers. The cases were adjourned for a fortnight. At the same Tribunal, the York Opera House asked for total exemption for its electrician and stage manager, aged 35 and married; after serving seven years in the Army and five years in the Reserve, he was called up for the Expeditionary Force and discharged in February last. Exemption to November 30th allowed.

Before the Bath Tribunal, a further application for exemption in respect of Lawrence Laing, aged 32, electrician at the Palace Theatre, was refused.

On Monday last, at the Westminster Town Hall Tribunal, Mr. H. C. Truman, chief electrical engineer to the Law Accident Insurance Society, was granted exemption for four months as being in a reserved occupation.

The Leeds Tribunal has granted three months' exemption, with leave to renew the appeal, to an electrical and mechanical engineer, who stated that 90 per cent. of his work was in repairing rotary coal-cutting machines.

The Wetherby Tribunal refused to exempt Mr. Edwin Maltby, electrical engineer to Mr. T. G. Mylchreest, of Thorner, who has charge of a private electrical plant supplying a number of residents. He is not to be called up for service before September 15th.

At Hyde, on Wednesday last week, an appeal by George Rutherford, a motorman employed by the Stalybridge, Hyde, Mossley and Dukinfield Joint Board, was disallowed.

At Oldham, temporary exemption was granted until November 1st to an electrician and wireman employed by Mr. Frank Wall; and temporary exemption till December 1st to a pavior in the tramways department, who appealed on domestic grounds.

Watford Tribunal has granted exemption from combatant service to E. Leigh, electric light attendant at Euston Station.

At Blackpool, on August 24th, a firm of electrical engineers, who have lost 17 men out of 21, appealed for an employé, and conditional exemption was granted.

At Cambridge, on August 22nd, an appeal for exemption for Frederick G. Gates (19), electrician, with the Cambridge Electric Supply Co., Ltd., failed. It was stated that the man was "starred," but the Military representative contended that he should be in the Army.

Canterbury Tribunal has given conditional exemption to George Herbert Fowler (28), manager for Mr. E. J. Philpot, electrical engineer.

At Sandwich, on August 23rd, absolute exemption on medical grounds was given to Mr. H. Claringbold (25), electrician.

At Dover, conditional exemption was granted to W. A. King (38), a coal and ash trimmer at the electricity works.

At Deal, Messrs. Stratford & Faulkner appealed for George Ralph (39), electrician, the only workman left, whom they had been unable to replace. Three months were allowed.

At Stoke-on-Trent, on August 24th, the Corporation electricity department appealed for four employés. Mr. C. H. Yeaman, the engineer, said that if the men went he could not be responsible for the supply of current this winter. He had been trusting to the Ministry of Munitions to retain the men, and he had not a single hand who could be spared without jeopardising the supply. It was decided that a list of the employés of the department should be prepared for the Tribunal before the claims were dealt with.

At Caterham, on August 21st, Mr. E. B. Howard, manager of the electricity works, applied for exemption for Mr. A. J. Douglas (40), the only man left to attend to mains, and also acting as shift engineer. The Tribunal, holding that he was in a certified occupation, granted conditional exemption.

Poole Tribunal has given exemption until August 15th to Mr. G. Loveless (35), electrical engineer.

Wallington Tribunal has given conditional exemption to the electrical engineer to a local firm of cement manufacturers.

At Cheltenham, the Military representative asked for the removal of the star against the names of charge engineers at the Corporation electricity works. The electrical engineer (Mr. W. J. Eache) said the works were run in three shifts of eight hours each, and one or other of the three charge engineers was on duty day and night, both week-days and Sundays. The fourth charge engineer was necessary to take the place of any one of the others on leave, &c. He had tried to get men unfit for military service, but had failed. In one case the star was removed, and the other cases were adjourned until two months granted by the Medical Board had expired.

At Wandsworth, Mr. Philpott, of Messrs. Philpott Bros., electrical engineers, of 35, Upper Tooting Road, applied for the conditional exemption of his leading electrician, W. G. Conner. The Tribunal granted three months' exemption on condition that he joined the V.T.C.

Mr. Wild, secretary of the British Incandescent Mantle Co., Ltd., of Ravensbury Road, Earlsfield, S.W., asked for the exemption of a stoker, who, he maintained, was in a certified trade. He had been discharged from the Army after 15 months' service, and applicant did not think he would be called up again. Three months' conditional exemption was granted.

Irish Battery Industry.—According to the *Daily Express*, a factory will shortly be opened in Dublin for the manufacture of dry cells and batteries of all kinds for pocket lamps, telephones, bell and automobile. It is proposed to start with 200 hands, and an output of about 30,000 batteries weekly is anticipated. The yearly consumption of batteries in the United Kingdom before the war was over 60 millions, most of which were imported.

REVIEWS.

Wireless Telegraphy and Telephony. By W. H. ECCLES.
London: The Electrical Printing and Publishing Co.,
Ltd. Price 12s. 6d. net.

This is a handbook of formula, data, and information, and forms an addition to the well-known *Electrician* series of standard electrical works. It is produced in a compact and handy form, well got up and illustrated. There are some 418 pages, with 332 illustrations. In the author's preface the work is described as a classified collection of information, data, formula, and tables likely to be helpful to designers and investigators in radio-telegraphy. The information is given in condensed form while yet attempting to set out the position of modern thought and speculation.

The chief divisions of the work fall under the heads of Tables, 52 pages; Formulae, 63 pages; General Information and Descriptions, 272 pages; Glossary of Terms, 28 pages. In most respects the book is of a comprehensive and informative character, with lucid explanations of the principal features of methods, apparatus, and systems. The tables and formulae appear to be well selected and useful. In themselves, they convey a large amount of information in tabloid form. Care appears to have been taken to include useful short-cut methods of dealing with electrical problems as, for instance, the equivalent circuit method of dealing with transformer problems where the circuits contain capacity as well as resistance and self-induction. Standard works of reference and original papers have been freely drawn upon in this portion of the book.

The widest scope for comment or criticism falls on the part covering general information and descriptions, where, in the present state of knowledge, it may be expected that much controversial matter will be found. A few of the more salient points presenting themselves in this light will be dealt with here.

In a work of this character, exception may fairly be taken to the perpetuation of weak or misleading methods of expressing ideas. On page 161 appears a table of so-called "ranges" of wireless stations, of typical commercial spark type, in which the ranges corresponding to certain sizes of power plant, wave-length, and nature of transmission surface are given. The mileage figures indicate a professed accuracy of about one per cent. The table is not qualified by any statement as to the nature of the receiver, height and kind of antenna, standard of received signals assumed, standard of hearing assumed, climatic conditions under which tests are taken, standard of sensitivity of auxiliary receiving apparatus, whether day or night signals, and a host of other factors concerned in this absurdly elastic term. That the author is alive to the bearing of some, at least, of these factors is evident from qualifying remarks introduced in a similar connection on pages 324, 327, and elsewhere, but he does not give any hint of the very questionable difficulties to be faced in framing an adequate definition of the term. The suggestion is that its use, at least in the popular sense, should be tabooed in a scientific work. Even more serious exception must be taken to the term being applied, as on page 219, to a form of apparatus for generating high-frequency discharges. Its adoption by international institutions in relation to complete installations may be advanced as an excuse for its perpetuation. So long as such institutions are run and controlled by officials with a smattering of technical knowledge and an absence of practical touch with the subject, and so long as Governments will essay to legislate first and investigate afterwards (or not at all), much time and money will continue to be wasted. A number of the assumptions underlying official assays at wireless legislation are similarly erroneous or unsuitable.

In an interesting dissertation on the theory of propagation of signals round the globe, Dr. Eccles continues to support the contentions of himself and others by the assumption of reflection of electric waves from layers of ionised air having lower boundaries which are "fairly sharply defined," whatever that may mean. Now, the obvious basis for this assumption is the optical condition of a sharply-defined surface of discontinuity between two transparent media upon which total reflection of light depends. It has yet to be shown that a corresponding effect can occur with waves of so grossly greater dimensions than those of light. Also, within what limits is the boundary definition to be taken as "sharp," seeing that waves of the order of a mile or two in length may be concerned, and that, in the optical analogy, sharpness of definition in the wave itself is equally necessary? As at present presented, the assumption can only be taken as a highly speculative one, though Dr. Eccles presents it in so matter-of-fact a way.

The enthusiasm for formulae evinced by the author manifests itself throughout. Some of these are of doubtful practical value, as in the case of the formula for wave propagation over mountain ranges, given on page 165. This is based purely on wave diffraction, and will, obviously, not account for the large differences in propagation efficiency over mountains by night as compared with daytime.

On the subject of strays, there appears to be a widely-spread fallacy, which is voiced by the author, that strays are largely due to the so-called "silent discharge" of a receiving antenna into the atmosphere. The microscopic currents pro-

duced in an antenna by silent discharge under normal conditions cannot account for strays of a strength that matter. If a corona or glow discharge is produced, that is another question; but such discharges are quite abnormal, and even rare, at any rate, in these latitudes.

In reference to quenched spark methods, it is stated that quenching ensures singleness of frequency. This is not a precisely accurate statement, for strongly coupled waves are emitted during the transient building-up process which precedes the quenching of the spark, and this period is not, as a rule, negligible. Neither is it correct to say that mechanical quenching by rotary dischargers gives the equivalent of the usual quenched spark transmission.

Exception must also be taken to the inadequate explanation of the action of Pedersen's ticker receiver, which fails to do justice to this very neat and effective contrivance. A similar remark applies to the theory of the slipping contact detector, and it is not clear why this device is ascribed to L. W. Austin. The drawing of the instrument given on page 340 contradicts the text in an important respect. In regard to the system "Onde Unique," the author states: "There is theoretical reason to credit the claim of single waviness." It has been generally thought that Prof. Howe effectively disposed of this claim. Points in relation to the construction of inductance coils and condensers would bear comment, as also numerous other matters of practical significance.

In the matter of omissions, it may reasonably be urged that the practical working defects and weaknesses of the various appliances and systems are not sufficiently indicated. The trend of developments in Continental practice, especially that of Germany, is not treated nearly as fully as English developments. The important subject of the selection of sites for land stations and the numerous factors involved, as affecting efficiency of operating, running costs, and housing, is not treated. Very little information is given as to mode of emission, propagation, and arrest of waves, such as would lead to good working conceptions of the functions of antennæ both in transmission and reception. Principles of theoretical and practical importance in reference to the effects of varying the proportions of capacity and inductance in high-frequency circuits and antennæ are another matter on which little information will be found. The reader will not gather much knowledge of the organisation of wireless services, or learn that international understandings have been arrived at in regard to the manner and conditions of use of wireless apparatus.

Though a certain amount of criticism has been made, it may be taken that the book contains many desirable features, and will doubtless be much appreciated by engineers and investigators. It fairly presents the prevailing standard of knowledge in wireless telegraphy. That standard cannot be regarded as an eminently satisfactory one, as a great deal of careful investigation and careful weighing of results is necessary to put it upon a satisfactory basis. It will probably be found, in the light of later knowledge, that far too much credence has been given to mis-statements and misinterpretation of results, and that our real knowledge is a great deal less than we are apt to imagine.—J. E. T.

Handbook of Electrical Methods; compiled from the *Electrical World*. London: Hill Publishing Co. Price 12s. 6d. net.

The book before us is divided into ten chapters, surveying the whole of the practical side of what may be called applied electrical engineering. By this we mean that it does not go into questions of manufacture, but of the installation and use of machinery, transformers, switchgear, meters, wiring and apparatus in general.

Though the divisions of the book are called chapters, they are not chapters in the sense that they have been connectedly and consecutively written around the same thread of thought by the same hand. Many hands have written this book, for it consists, as the title tells us, of a compilation of articles from the *Electrical World*, of New York.

As the preface tells us, there is so much of permanent value published in the technical Press, which must, if it is to be of real use, be accessible in some other form. Methodical and probably fussy people mutilate their papers every week, and clip up articles of interest to them in a form of no use whatever to anyone else, and then proceed to hide them where they are of no use whatever to themselves. The orderly carrying-out of this process involves the absence of serious occupation, and its inevitable consequence is that the compiler becomes a serious nuisance to those about him.

The object aimed at, but seldom attained, by such people, is carried out in a proper way with regard to one technical journal in this book. The articles are classified by being repeated under the chapter heading describing the subject to which they refer.

The subjects dealt with range from thawing frozen water-pipes electrically to replacing insulators on a "hot" 50,000-volt overhead line; from testing electrical instruments to the danger of broken lamps near inflammable material; from an advertising novelty and the method of influencing the curio-seeker's choice to the soldering of "aluminum" and the operation of the "Edison," known here as the three-wire, system.

There are numerous illustrations; we have not counted the number, since nearly all of them appear to be marked Fig. 1. This, of course, arises from the fact that each reprinted article has a Fig. 1 of its own, and the numbering has not been changed.

As a book of reference, the book is useful. It has a good index, and is well printed. It forms an example which might well be followed by papers of similar eminence on this side. The price of 12s. 6d. strikes us as being rather high.

BUSINESS NOTES.

Pumping Machinery in Chile.—U.S. Consul Voetter, at Antofagasta, says that the market for pumps in the district is almost exclusively confined to the requirements of the nitrate plants. In this, the arid region of Chile, there are some 170 plants for the elaboration of nitrate of soda, and each has a pumping installation complete. A nitrate plant uses from 300 to 900 tons of water per day, obtained usually at dug wells located several miles away from the plant. The classes of pumps and pumping machinery used by the nitrate plants are as follows:—

Wells.—Power-driven deep well pumps, usually single-acting, triplex, of bucket type. The depth of well varies from 60 to 500 ft.

Surface force pumps, power driven, for delivery of water from well to nitrate plants. Power is usually furnished from a central electric power station at the plant some miles distant.

Plant.—Boiler feed pumps, almost exclusively steam driven, as also the oil pumps for supplying fuel to the furnaces.

Steam or power driven pumps for transferring liquors (agua vieja) from crystallisation tanks to elevated storage tanks.

From 2 to 10 centrifugal pumps, usually 6-in. suction and 6-in. discharge, for circulating hot liquors (relave) between the boiling tanks. The average centrifugal pump handles from 200 to 400 gallons per minute against a head of 30 ft.

Miscellaneous fire pumps, internal-combustion engine cooling water pumps, fuel-oil pumps, &c.

The general terms of credit given by American manufacturers to importers are cash against shipping documents on arrival of shipment in Antofagasta. European manufacturers extend credit of 60 to 90 days after acceptance of draft against bill of lading on arrival of goods, and in exceptional cases 120 days. Prices should be c.i.f. Antofagasta, and not f.o.b.

Pulley and Belt-Calculating Scale.—We have received a sample of a new calculating scale which has been devised by Mr. H. W. Durham, to assist millwrights, engineers and others to calculate the sizes of pulleys and belts for given powers and speeds, and so on. The scale is published by Messrs. Alfred Haworth & Co., Ltd., price 1s. 8d. post free, and provides for calculations relating to cotton ropes, leather and balata belting, and the sizes of pulleys and gear wheels. It is a useful and handy time-saver.

For Sale.—The Public Trustee invites tenders by September 14th, for the purchase of the whole or any part of the 13,993 £1 fully-paid ordinary shares in the Concordia Electric Wire Co., Ltd., vested in him as custodian by the B. of T., under the Trading with the Enemy Act. Particulars appear in our advertisement pages to-day.

Fire.—A small fire occurred on August 21st at premises at the rear of the establishment of Mr. Edward Pincott, electrician, Alington Street, Exeter, and damage estimated at between £80 and £100 was done.

Dissolutions and Liquidations.—HEAP & DIGBY.—The partnership between Messrs. A. C. Heap and W. Pollard Digby terminated on the 31st ult. Mr. A. C. Heap has accepted an important appointment which compels him to relinquish all private consulting and inspecting work. Mr. W. P. Digby will continue to carry on the professional work hitherto entrusted to Messrs. Heap & Digby, and will be joined by Mr. Walter Ryley, who has been with them for several years. The title of the new firm will be DIGBY & RYLEY.

RESISTO-ELECTRICAL MANUFACTURING CO.—A meeting of creditors will be held at Thorner's Chambers, Ingram Court, 167, Fenchurch Street, E.C., on September 6th.

PHENIX ELECTRIC HEATING CO., LTD.—A meeting will be held at 8, Staple Inn, Holborn, on October 2nd, to hear an account of the winding-up from the liquidator, Mr. A. E. Tilley.

BALDUR ENGINEERING AND SUPPLY CO., LTD.—The first annual meeting of creditors will be held at 39, Victoria Street, S.W., on September 1st. Liquidator, Mr. J. W. Buck.

Plant for Sale.—The sale of plant and machinery announced in our last issue to take place at Millwall on September 5th, has been postponed to September 13th and 14th.

Catalogues and Lists.—SPRAY ENGINEERING CO., 93, Federal Street, Boston, U.S.A.—Sixteen-page pamphlet describing and illustrating their "Spraco" system for cooling condensing water, also a folder relating to the Vaughan flow meter.

BRITISH L. M. ERICSSON MFG. CO., Ltd., 5, Chancery Lane, W.C.—Leaflets describing a motor-driven telephone generator, and a storage battery hand lamp.

Blacklisted Firms.—A new list of additions to the statutory list of firms of enemy nationality or enemy association with whom persons in the United Kingdom are forbidden to trade has been published. Copies can be obtained from the official publishers.

Australian Postal Contracts.—A discussion is proceeding with reference to the contracts of the Australian Postal department. In October, 1915, the secretary of the Australian Electrical and Allied Contractors' Committee addressed the Postmaster-General, giving reasons why an arbitration clause or its equivalent should be inserted in those contracts. After three months' interval the Postmaster-General intimated that he had decided not to vary the conditions of contract in regard to the rejection of material by making provision for the appointment of a survey board.

Trade Announcements.—THE ELECTRIC AND GENERAL WORKS, LTD., notify that from September 1st their address will be 128, Stamford Street, S.E. Telephone number: HOP 5223.

MESSRS. WOOLLETT, AIREY & CO., brokers and shipping agents, have removed their offices to 15, Leadenhall Street, E.C.

"A Question of Origin."—Under this title the BENJAMIN ELECTRIC, LTD., have just issued a booklet with the object of disproving the supposition existing in some quarters that their products are of foreign manufacture. As we have inspected their workshops, and recently described them in our pages, there is for us no "question of origin"; those who are still sceptical, and are unable to visit the works themselves, will surely be convinced also by a perusal of the contents of this interesting and well-produced brochure.

Change of Name.—With a view to more clearly identifying the company with the place where its works are situated and the nature of the business carried on, Messrs. Thomas Kesor & Co., Ltd., have, with the approval of the B. of T., adopted the name WATFORD ELECTRIC AND MANUFACTURING CO., LTD., by which they will be known in future.

Bankruptcy Proceedings.—W. D. BIRKETT, factor of electrical goods, Whitley Bay. A first and final dividend of 2s. 8d. in the £ is payable on September 4th, at the Official Receiver's office, 30, Mosley Street, Newcastle-on-Tyne.

Book Notices.—"Polyglot Rubber Trade Directory, 1916." Third edition. New York: *India-Rubber World*. This publication gives a great deal of information regarding American rubber manufacturers and their products. The opening preface, printed in English, French, German, Italian, Spanish, and Portuguese, gives key letters for rubber goods and imitation rubber products respectively, which are used throughout the several sections to indicate the class of manufactures made by the firms named. The first section is an alphabetical list of rubber manufacturers; the second deals with their products in classified form; others following deal with rubber machinery, tools, and appliances, rubber factory supplies, rubber goods dealers, reclaimers of waste rubber and waste rubber dealers, recent incorporations, and rubber trade marks.

"Canada, the Country of the Twentieth Century." By Watson Griffin. Published by authority of Sir George E. Foster, K.C.M.G., Minister of Trade and Commerce, by the Department of Trade and Commerce, Ottawa. Issued from the Trade Commissioner's Office: 73, Basinghall Street, London, E.C.—The purpose for which this fine volume of between 280 and 290 pages has been produced is to give business men who have never visited the Dominion a comprehensive, but epitomised, review of its agricultural, forest, and mineral resources, its industrial and commercial development, and its geographical relation to the markets of the world. The book is very fully illustrated, with useful maps and with photographic views taken in all parts of the Dominions, contains a record which is both fascinating and impressive to the industrial and engineering mind, and really makes us wonder—the while we study it—why we are here and not there. It is well that we should get to know all we can about this wonderful part of the British Empire, which in these days is contributing so magnificently, by blood and treasure, to the cause of universal freedom. After the war, when Canada resumes those leaps forward which marked her development a few years ago, this record should be of greater interest and value even than it is now.

Proceedings of the American Institute of Electrical Engineers. Vol. XXXV. No. 8. August, 1916. New York: The Institute. Price \$1.

"Circular of the Bureau of Standards." No. 56: "Standards for Electrical Service." "Scientific Papers of the Bureau of Standards." No. 281: "A Study of the Inductance of Four-terminal Resistance Standards." No. 283: "Volume Effect in the Silver Voltmeter." Department of Commerce: Washington.

"Welfare Work." By E. D. Proud, B.A. With a fore-word by the Right Hon. D. Lloyd George. London: G. Bell & Sons, Ltd. Price 7s. 6d. net.

Les Echanges Franco-Américains. By V. Cambon. Paris: La Lumière Electrique.—In this lecture, delivered to L'Union pour la Belgique et les Pays Alliés, the author discusses the natural resources of the United States, the character of the people, and the business methods which they employ. He then deals with the American products which are destined to replace German imports into France, the artifices adopted in the past by German firms, and the future course of business between France and the United States.

"Electric Switch and Controlling Gear." By C. C. Garrard. London: *Electrician* Printing and Publishing Co., Ltd. Price 13s. net.

LIGHTING AND POWER NOTES.

Australia.—**NORTH SHORE ELECTRIC SUPPLY.**—The Sydney City Council has now completed arrangements to connect private consumers in the northern suburbs of North Sydney, Lane Cove and Willoughby across the harbour. The delay in completing the supply scheme was due to war conditions which caused difficulties in securing the necessary material. The supply is 240 volts A.C. 50 cycles for lighting, fans, motors, radiators, and cookers, and 415 volts, three-phase, for motors.

The cable for the supply to Mosmans is expected to arrive at any time.

A hydro-electric scheme is proposed for Warragul (Vic.) from the Tanjil River, 36 miles from the town. It is estimated that it will be possible to supply electricity at about 1d. per unit, and a company is being promoted to carry out the proposal.

The Dimboola (Vic.) Shire Council's electric lighting plant, which has been installed at a cost of £3,750 was formally opened last month: the plant consists of a Hornsby suction gas engine and producer, with generators, and a battery of the D.P. type. The distribution is on the three-wire system at 230 and 460 volts.

In our issue of April 21st, particulars were given regarding the financial position of the Melbourne (V.) City Council's electrical undertaking for the year ended December, 1915. The report of Mr. Harper, the city electrical engineer, which is now available, gives the total units generated as 26,361,637, against 22,806,968 units in the previous year. Of the total units sold, 39 per cent. were for lighting and 60.97 per cent. for power purposes. The number of consumers increased by 717. The total connections for the year amounted to 26,603 k.w., as against 24,029 k.w. in 1914. Motor connections numbered 3,016, representing 14,668 H.P., as against 2,764 and 13,255 H.P. in 1914. The engineer reports that amongst the inquiries recently dealt with has been one for an electric furnace, which would require a supply of 600,000 units per annum: the maximum demand for 1915 was 8,364 k.w., as against 7,751 k.w. in 1914; the load factor was 35.7 per cent., as against 30.26 per cent. in 1914. The total working cost for 1915 was 796d. per unit, as against 907d. for the previous year, and the total costs, including capital charges, were 1,532d. per unit, as against 1,581. for 1914, a reduction of 4.8 per cent. (*Commonwealth Engineer*).

Aylesbury.—The U.D.C. has reduced the price of energy supplied to the Royal Bucks Hospital to 2d. per unit.

Baildon.—**E.L. SUPPLY.**—Application has been made to the Shipley District Council by a number of residents in the adjoining township of Baildon for a supply of electricity, and a reply has been sent that the Shipley Council would be willing to supply under agreement with the Baildon Council, to whom the applicants should apply.

Canada.—A large military camp has been constructed by the Canadian Government at Pine Plains, Simcoe County, Ontario. The camp is 20,000 acres in extent, and has electric power in use for pumping and lighting, the supply being obtained from the hydro-electric line, which runs between Barrie and Waukegan, Ontario. A transformer station has been erected at the camp, and the voltage is stepped down from 22,000 volts to 2,000 volts. A number of 150 c.p. gas-filled lamps about 200 ft. apart are placed on the main thoroughfares of the camp, where 300 H.P. is now being taken. (*Canadian Engineer*).

Colombia.—The Municipal Council of Urroa, Department of Antioquia, has been authorised to raise a loan of £8,000 for electric lighting purposes and aqueduct works in the district; the municipal authorities of Amagá, in the same province, are borrowing £1,200 for the installation of an electric-power plant. (*Boletín de Trade Journal*).

Coniston.—**E.L. SCHEME INAUGURATED.**—An electric supply scheme for this parish has been completed, and the light was switched on on August 21st. The supply is by overhead wires to the centre of the area, but it is to be extended to the lower end, and probably to Waterhead. The power station is by the side of a stream, the water of which drives the dynamo. The engineer in charge is Mr. F. Turnbull.

Erith.—**YEAR'S WORKING.**—The report of Mr. J. C. Williams, manager of the Council's electrical undertaking, for the year ended March 31st, shows a gross revenue amounting to £32,691, an increase of £8,371; and after deducting working expenses, £22,360, loan charges, £7,139, and other expenditure, there remained a net profit of £1,736, or £250 more than in the previous year. During the year, 5,357,515 units were sold, as against 3,606,336 units in the previous year; the total connections amounted to 3,374 k.w. and the load factor to 39.4 per cent. The works and management costs were 97d. per unit, as against 9d. in 1914-15; coal cost 74d., as against 56d. per unit, but economies in other directions largely counterbalanced this. Mr. Williams remarks that practically the whole of the output was obtained from one turbine set running continuously, a performance which tends to establish confidence in this type of plant. Increased charges (4d. per unit for lighting and 10 p. cent. for power supply) were in force for six months, and brought in an extra £2,279; Mr. Williams hopes that any further increase will be unnecessary.

Glasgow.—**COAL SUPPLY.**—The question of coal purchases by the Electricity Committee was considered at last week's meeting of the Corporation. A member said that as supplies could

not be got from coal owners the Committee had to make purchases from middlemen whose charges were above the rates fixed by the Prices of Coal (Limitation) Act. It had been discovered that the middlemen were exempt from the Act, and an agreement, he alleged, had been come to between owners and merchants whereby a portion of the Corporation's supplies had to come through the latter. Bailie Hannay said that the increased cost was entirely due to the longer distance some of the coal had to be transported.

Kingswintord.—**PUBLIC LIGHTING.**—The R.D.C. has accepted an offer from the Midland Electric Corporation of a rebate of £151 on the public lighting account, owing to the restricted use of lamps.

London. A Committee has been formed, consisting of representatives of all the London Borough Councils, 15 companies, and eight municipalities outside the London area, with a view to co-ordinating the existing supply of electricity.

Ormskirk.—Considerable discussion took place at a meeting of the B. of G. on the offer of the Ormskirk Electric Supply Co. for lighting and power. Councillor Richardson moved that the matter be referred back, as they should know exactly what their own machinery could do before it was scrapped. The amendment was defeated, and a recommendation to accept the offer was approved.

Reigate.—At a meeting of the Guardians, last week, a report was considered from a L.G.B. inspector on the question of a proposed laundry extension. The inspector does not regard the installation of electricity as an economical system, seeing that steam power is already in service, notwithstanding that the steam pressure is stated to be insufficient for driving laundry machinery. The views of the Guardians' architects differ on this matter from those of the L.G.B. inspector: they think electricity should be the motive power. The cost of installation would be far less, and with motors, shafting need not be run except when the attached machines are actually in use. The whole matter was referred to the Works Committee.

Sevenoaks.—**FIXED-PRICE LIGHTING.**—The U.D.C. has generally approved the adoption by the local supply company of the fixed-priced lighting scheme (as employed in the Wimbledon area), providing that each case of external wiring is separately approved.

Shipley.—**LINKING-UP PROPOSAL.**—The Electricity Committee has come to the conclusion that it agrees with the Bradford Electricity Committee that the benefits to be obtained by linking up the systems of the two authorities are not sufficient to justify the proposal being proceeded with.

Stirling.—The T.C. has decided to install an electric elevator in the new municipal buildings in course of erection in Corn Exchange Road, at a cost of £427.

Worsborough.—The U.D.C. has decided to call the attention of the Yorkshire E.P. Co. to the fact that residents in Mount Vernon Road desire to have the electric light installed in their houses, via the cable of the Barnsley T.C. to Mount Vernon Sanatorium. The company has hitherto refused consent to the supply being taken from the cable.

Workshop.—At the meeting of the U.D.C., on Monday, the Lighting Committee recommended the appointment of Mr. T. R. Skinner as general assistant electrical engineer; Councillor Saxton said that when the Council allowed Mr. J. P. Crowther to join H.M. forces, and agreed to pay him half his salary, it was given to understand that the acting engineer (Mr. Fletcher), whose salary was increased at the time, would be able to manage without extra assistance. Despite considerable opposition, the recommendation of the Lighting Committee was eventually agreed to.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—**YEAR'S WORKING.**—The report of the year's working of the Corporation tramways to May 31st last shows that the total revenue was £94,328, an increase of £6,326 on the previous year. Working expenses amounted to £58,197, an increase of £6,472, and after payment of £26,432 for interest and sinking fund and other charges, there was a net profit of £9,697, as against £11,000 in 1915. Of this, £3,239 has been allocated to the relief of rates and £6,464 carried to reserve account. During the year, £2,436 was expended out of capital, making a total capital expenditure of £368,769. The depreciation and renewal funds stand at £166,796, the sinking fund at £57,500, and the reserve account at £43,271, making a total of £267,567. Mileage run, 1,968,615, an increase of 59,605 miles. Electricity used, 2,481,384 units, an increase of 164,180 units, at an average cost per unit of 841d., as against 845d. in the previous year. During the year 26,593,730 passengers were carried, as compared with 24,048,916 in the previous year.

Argentina.—According to the *Times*, the Central Argentine Co.'s electrified route from Buenos Aires to Tigre was inaugurated on August 25th, by President Plaza. A short description of this scheme appeared in our pages on May 19th last.

Blackburn.—The continual drainage of male employees will probably necessitate a reduction in the tramway service. Before the group system, 115 employees had enlisted; 35 have been

taken under the group system; and there are still 25 liable. Over 20 women are now engaged as conductors and others for the "collecting" duty and for driving are being trained. The allowances to dependents of men with the Colours amount to £45 per week and this will shortly be augmented to £60 a week, or £3,000 per annum.

Blackpool.—**HOLIDAY TRAFFICS.** It is reported that the tramway receipts during the first fortnight of August were much in excess of those of the same period in 1915, but not up to the record established in 1913; the third week, ending on August 23rd, is reported to have beaten all records.

ELECTRIC VEHICLES.—The cleansing department has received delivery of a second electric water-sprinkler, purchased at a cost of about £1,000. The two machines will be sufficient to deal with the sprinkling of the streets, and the horsed carts will be withdrawn. One of the water-sprinklers will be used in winter for the conveyance of coke, the Cleansing Committee having decided to have a wagon body built to take the place of the water tank when desired.

Continental.—**ITALY.**—It is announced that a Milan syndicate has submitted a scheme to the Italian Government for the electrification of the railways in Sicily. The necessary energy would be supplied from the power station of the Società Elettrica dell'Isola Orientale, the three-phase current being converted to single-phase current at 50,000 volts at a converter station to be established at Nicosia. The project includes the erection of 14 transformer and distributing stations, where the pressure would be reduced to 11,000 volts.

SPAIN.—The Sociedad de Tranvías de la Coruña has applied for a concession to construct and work an electric tramway between Coruña and Sada.

Erith.—**YEAR'S WORKING.**—The annual report on the Council's tramways shows a total revenue amounting to £21,422; after deducting operating expenses amounting to £15,510, war bonus £2,991, and loan charges £5,206, a net profit of £706 remained. During the year 4,900,811 passengers were carried, an increase of 31½ per cent., with an additional mileage of 18,471. Mr. Williams, the manager, refers to the exceptionally favourable workmen's fares, and mentions that although 37 per cent. of the total passengers are workmen, only 25 per cent. of the total receipts are derived from them. Fifteen women conductors were employed at the date of the report. The surplus has been placed to reserve.

London Vehicle Charging Stations.—According to the *Motor*, the General Vehicle Co., Ltd., is arranging for a zone of charging stations round London, and other cities.

Manchester.—Up to date, 2,308 employees of the tramway department have joined the Colours.

Oldham.—At a meeting of the Tramways Committee, the manager reported that over 300 miles were lost during the busiest period on the previous Saturday owing to the local horse parade. They had also lost 110 miles during the past fortnight, mainly due to falling guard wires. The guard wires were in a very poor condition, and they were being renewed as quickly as possible.

South Africa.—The Johannesburg T.C. is considering the advisability of adopting a system of workmen's fares on the municipal tramways.

Spanish North Africa.—A concession has been granted to Don Ramon Prendes Rodriguez, for the construction and working of an electric tramway in Melilla.—*Board of Trade Journal*.

Tasmania.—The Minister for Public Works stated recently that the construction of the Huon Railway would be carried out, and he presumed that electricity would be the motive power. Owing to shortage of men the construction could not be proceeded with at once. The route would be via Kingston, Longley Road, and Crabtree Junction to Huonville.

U.S.A.—**ELECTRIC TAXICABS.**—For some time past electric cabs have been used in Detroit with success. The Detroit Taxicab and Transfer Co. now operates a fleet of 75 electric cabs. The American Motor Livery Co., of Chicago, has recently placed an order with the Milburn Vehicle Co. for 12 electric town cars to be delivered November 1st. The new cab will be of the limousine type, and will accommodate five passengers.—*Electrical Review and Western Electrician*.

Canadian Telephone Statistics.—The following table shows the capitalisation, cost, revenue, operating expenses, and other data connected with the telephone interests of Canada for 1913, 1914, and 1915:—

	1913.	1914.	1915.
Capitalisation	\$59,847,004	\$70,291,884	\$74,284,991
Cost	\$69,214,971	\$80,258,356	\$83,792,583
Revenue	\$14,879,278	\$17,297,268	\$17,601,672
Operating expenses	\$11,175,689	\$12,882,402	\$12,836,715
Remuneration	\$6,839,308	\$8,250,253	\$8,357,029
Number of telephone companies	1,075	1,136	1,396
Wire mileage	1,092,586	1,343,090	1,452,360
Telephones	463,671	521,114	533,090
Employees	12,867	16,799	15,072
Persons per telephone	16.2	15.5	15.1
Persons per mile of wire	6.8	6.0	5.6

Telephone companies' net earnings in 1915, as represented by the difference between total receipts and operating cost, were \$4,764,557. This was better by \$350,091 than the result for 1914.

The following are the different classes of organisation:—Government, 4; municipal, 62; stock, 584; co-operative, 601; partnership, 28; private, 117; total, 1,396.

In Manitoba and Alberta practically all telephone interests are in the hands of the local governments. In Saskatchewan, the Provincial Government operates in all the large centres, but has not taken over the 520 small units that spread their wires over the rural sections of the province. In all the provinces there is a growing tendency towards consolidation.—*Electrical Review and Western Electrician*.

Infringement Suit.—The Marconi Wireless Telegraph Co. of America, on July 19th, filed in the Court of Claims a petition against the United States, charging that since June 25th, 1910, the United States, through the Navy and Army Departments and the Department of Commerce, had constructed and used apparatus embodying the inventions covered by four patents, in violation of the rights of the Marconi Co. The Marconi Co. claims damages in the sum of \$1,000,000. The patents in question are the following:—

Re-issue No. 11,913 (original No. 586,193, July 13th, 1897), granted to G. Marconi on June 4th, 1901, for transmitting electrical impulses and signals and apparatus therefor.

No. 609,154, granted to O. J. Lodge on August 16th, 1898, for inventions in electric telegraphy.

No. 763,772, granted to G. Marconi on June 28th, 1904, for apparatus for wireless telegraphy.

No. 803,864, granted to J. A. Fleming on November 7th, 1905, for instruments for converting alternating electrical currents into continuous currents.—*T. and T. Age*.

New Zealand's Postal Growth.—Sir Joseph Ward, Postmaster-General for New Zealand, at a recent meeting, gave particulars of the enormous growth of the New Zealand Post Office during the last 25 years; he instanced the fact that in 1891 the number of letters received and dispatched was 75,600; while last year these had risen to 351,000,000. After the war he hoped, he said, that the Post Offices of Australia and New Zealand would direct their combined energies to secure the ideal of sixpence per word cables to Great Britain.

Sweden.—The Swedish Press is urging the Government to take steps to prevent the misuse of the Swedish wireless stations by foreign ships trading in the Swedish waters. It is reported that the telegraph authorities have now taken such measures as will make the use of the Swedish wireless system for trade espionage impossible.

Tesla v. Marconi Co.—The answer of the Marconi Wireless Telegraph Co. to a suit of the Nikola Tesla Co. for an alleged infringement of its patents, was filed recently in the U.S. Federal District Court. The Marconi Co. denied that Mr. Tesla was at any time the original or first inventor of the alleged new and useful method of signalling set forth in the complaint. The answer also denied that the patents issued on March 17th and April 14th, 1903, were duly or lawfully granted to Mr. Tesla, because he had not complied in all respects with the conditions and requirements of the patent laws. The defendant company asks that the complaint be dismissed.—*T. and T. Age*.

West Indies.—A radio station has been installed at Navassa Island lighting station, now under construction; it is operated at present by the contractors for the erection of the lighting station, and will be operated by the United States light-house service when the station is completed.—*T. and T. Age*.

Wireless on Ships.—A new regulation under the Defence of the Realm Act specifies that every British ship of 3,000 tons gross tonnage or upwards, in respect of which a licence to install wireless telegraph apparatus has been granted by the Postmaster-General, and which puts to sea from a port in the United Kingdom after a date to be specified in such licence, shall be provided with a wireless telegraph installation, and shall maintain a wireless telegraph service, and shall be provided with a certified operator, together with suitable accommodation for the apparatus and operator. The Postmaster-General will, as and when wireless telegraph apparatus and the services of operators become available for the purpose, cause licences to be issued in respect of such ships as in the opinion of the Admiralty should in the national interests be fitted with such apparatus, and the licences will specify the date as from which the carrying of such apparatus under this regulation is to be compulsory, the character of the apparatus, and the qualifications of the operator.

TELEGRAPH AND TELEPHONE NOTES.

Australian Wireless Service Changes.—Some time ago the Commonwealth Government decided to transfer all the work of the wireless branch of the Post Office to the control of the naval authorities. Recently representatives of the Government wireless service waited on the Minister of the Navy to protest against the proposal, which it is contended will result, in some cases, in a loss of social status, less salary, overtime without pay, &c. They also objected to other conditions pertaining to naval control. Wireless employees are to rank in the naval radio service as lieutenants, commissioned warrant officers, warrant officers, or chief petty officers, and will wear the naval uniform of their rank and work under general naval discipline and conditions.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—September 6th. Powell-Duffryn Steam Coal Co. Electrical goods. Forms from Stores Manager, Aberdare Office, near Aberdare.

Australia.—SYDNEY.—September 20th. N.S.W. Government Railways. One 30-ton electrically-operated overhead travelling crane for Zara Street power house, Newcastle. October 11th. One motor-driven air compressor for Zara Street power house. Electrical Engineer, 61, Hunter Street.

ADELAIDE.—September 27th. Deputy P.M.G. Telephones, telephone material, instruments and parts. Schedule Nos. 429 to 437.*

PERTH.—October 4th. Deputy P.M.G. Telegraph and telephone measuring instruments and parts. Schedule 501 W.A.*

MELBOURNE.—November 1st. Victorian Railways. 50,000 flame arc carbons. Chief Storekeeper, Railway Offices, Spencer Street.

October 18th. Victorian Government Railways. Electric time releasing mechanisms for automatic signalling. Cont. No. 30,343.*

Brighouse.—Electric friction crane complete, to lift about 6 cwt. J. P. Bakeries, Brighouse.

Dublin.—September 6th. G.N. Railway Co. of Ireland. Supply of electric battery material. Specifications from Mr. T. Morrison, Secretary, Amiens Street Terminus.

Edmonton.—September 20th. Electric lamps for six months. Mr. F. Shelton, Clerk, Lower Tottenham.

London.—Supply of electric light fittings for Australia House, Kingsway, W.C. Particulars from Mr. H. H. Turner, 48, Broadway, Westminster, S.W.

Manchester.—September 12th. Tramways Committee. (a) Permanent-way special trackwork, and (b) permanent-way point tongues and crossings. Specifications, &c. (£1 ls., returnable), Mr. J. M. McElroy, General Manager.

New Zealand.—INVERCARGILL.—September 28th. Borough Council. Steam turbo-alternator, condensing plant, and switchgear. Specifications from the Tramway Office. Contract No. 40.*

GISBORNE.—October 2nd. B.C. Cooling tower at the power station. Specifications from the Town Clerk.—*N.Z. Shipping and Commerce.*

Rochdale.—No date. Electricity Committee. 500-K.V.A. static transformer. Mr. C. C. Atchison, Borough Electrical Engineer.

Sheffield.—Water Department. Electrically-driven pump and D.C. motor, &c. General Manager, Water Department, Town Hall.

South Africa.—JOHANNESBURG.—September 4th. Municipal Council. 10,000 drawn-wire metallic-filament traction lamps; 10 miles of 19/14 "Underwriters' wire" (lightly insulated wire for outdoor use). Contract No. 151.*

September 21st. Municipal Council. Tramcar spares. Contract No. 153.*

Spain.—September 25th. Departamento de Fomento de la Mancomunidad de Cataluña, Barcelona, for the installation of a telephone system connecting the towns of Balaguer, Artesa, Pons, and Calaf, at an estimated cost of about £2,850.—*Board of Trade Journal.*

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Aberdeen.—The Tramways Committee has accepted the tender of the British Thomson-Houston Co. for two traction motors, at £115 each.

Australia.—The Nunawading Council has accepted the tender of the Edison Swan Electric Co., at £319, for the supply of consumers' meters in connection with the shire electric lighting scheme.—*McDonough Age.*

Bury.—The B. of G. has accepted a quotation of the Century Electric Co. for a motor starter for the laundry, and one for a chain drive from Messrs. Hans Renold, Ltd.

Meter Contracts.—Messrs. Chamberlain & Hookham, Ltd., have secured contracts for the supply of electricity meters to Cardiff and Manchester for the ensuing 12 months.

Walthamstow.—The U.D.C. has accepted the following tenders for new plant for the electricity works:—

British Thomson-Houston Co.—Extra-high-tension switchgear, £984.
General Electric Co.—Low-tension switchgear, £135.
Bruce Peebles & Co.—Motor converter, £1,925.

FORTHCOMING EVENTS.

British Association for the Advancement of Science.—Tuesday, September 5th, to Saturday, September 9th. Annual meeting at Newcastle-upon-Tyne. Inaugural meeting at the Town Hall, September 5th, at 8.30 p.m.; address by the President, Sir Arthur Evans, F.R.S.

NOTES.

Education Committees.—In pursuance of the arrangements which the Government has made for reviewing the system of education as a whole, the Prime Minister has appointed two Committees to inquire into the position of science and modern languages respectively in the system of education in Great Britain.

The terms of reference of the Science Committee are:—

To inquire into the position occupied by Natural Science in the educational system of Great Britain, especially in secondary schools and universities; and to advise what measures are needed to promote its study, regard being had to the requirements of a liberal education, to the advancement of pure science, and to the interests of the trades, industries, and professions which particularly depend upon applied science.

Sir J. J. Thomson will be the chairman, as, owing to unforeseen circumstances, Lord Crewe finds that it will not be possible for him to act as chairman of the Committee, as previously announced.

The terms of reference of the Modern Languages Committee are on similar lines.

Communications intended for the committees should be addressed to the secretaries, at the Office of the Board of Education, Whitehall, London, S.W.

London Lights.—A new Lighting Order, more on the lines of the order now existing in the provinces, comes into force in the Metropolitan Police District to-day.

All external lights, whether public or private, must be extinguished with the exception of such public lamps as the Commissioner directs to be kept in use for public safety. All lights not extinguished must be reduced to a minimum intensity, and so obscured that no more than a diffused light is cast on the ground.

Internal lighting must be so reduced or shaded that no more than a dull subdued light is visible from any direction outside, and no part of the pavement or roadway or any building or object is illuminated.

The order will apply to the City of London and the whole of the Metropolitan Police District, and will take effect from 8.0 p.m. from September 1st to 15th; 7.30 p.m. from September 16th to 30th; 6.0 p.m. from October 1st to 15th; 5.30 p.m. from October 16th to 31st; 5.0 p.m. from November 1st until the issue of a further order, till one hour before sunrise in each case.

Electrically-driven U.S. Battle-cruisers.—According to the *Scientific American*, the U.S. Navy Department has decided on the construction of *super battle-cruisers* having a displacement of 40,000 tons and a speed of 35 knots, or 40 miles an hour. These ships are to be fitted with the turbo-electric drive, the 175,000 H.P. required being furnished by four 35,000-kw. turbo-generator sets, which will supply propeller motors, apparently on the lines of equipment fitted to the naval collier *Juniper* by the General Electric Co. (U.S.A.). The 35,000-kw. sets are 50 ft. 7 in. long, 22 ft. wide, and 15 ft. high, and by placing them on two decks they would occupy a space of only, say, 55 ft. wide by 35 ft. high, by 55 ft. long; if the ships are 850 ft. long by 97 ft. broad, ample space will remain for water-tube boilers and fuel—the latter oil, which can be stored in the double bottom. The engine and boiler plant of the *Lusitania* occupied three-fourths of the ship's length.

Educational Notes.—UNIVERSITY OF LONDON.—UNIVERSITY COLLEGE.—The new session of the Faculty of Engineering commences on October 2nd. In addition to the degree and diploma courses, special courses can be arranged, and postgraduate and research work is provided for. A Goldsmid entrance scholarship (£90) will be competed for at the end of this month. See our advertisement pages for particulars.

We have received a copy of the prospectus of the Faculty of Engineering for the new session, giving full particulars of the various courses, &c. Prof. E. G. Coker (Dean) is at the head of the department of Civil and Mechanical Engineering, and Prof. J. A. Fleming (Vice-Dean), of the department of Electrical Engineering.

KING'S COLLEGE, UNIVERSITY OF LONDON.—Faculty of Engineering. Next term begins on October 4th. Particulars are given in our advertisement pages to-day.

LEEDS UNIVERSITY.—Two further gifts of £1,000 each—both anonymous—have increased the Leeds University's special fund for the study of the Russian language and literature for the promotion of British trade to £13,000, and an ambitious scheme is being formulated. It is proposed to have a Russian house arranged and furnished in every detail in the Russian style as the headquarters of the movement in Leeds. The University, having also received a gift of £1,000 to start a fund for a new school of Spanish and Portuguese language and literature, is preparing a scheme for that development also. The idea of promoting British export trade by novel courses of preparatory study is arousing great enthusiasm throughout the West Riding.

On the suggestion of the Ministry of Munitions and the Home Office, two courses of preparation for welfare supervisors in factories have been arranged by Leeds University under the direction of the acting head of the Department of Economics. Under the Police (Miscellaneous Provisions) Act, which came into force on August 3rd, the Home Secretary is empowered to continue in industrial works the welfare supervision now exercised in national munition factories and many controlled establishments. The object of the new University courses is to provide a supply of trained supervisors.

Patents and Alien Enemies.—Application has been made to the Board of Trade to avoid or suspend Patents Nos. 788/06 and 926/06, granted to Goldschmidt for an aluminio-thermic process, by W. B. Ballantine. The application of the Suffolk Electricity Supply Co., Ltd., with respect to patent No. 4,908/09 granted to Anst. has been dropped.

Licences have been granted to the Refractory Zinc Ore Treatment Co. in respect of Patents Nos. 605/09 and 15,128/11, granted to Siemens Bros. & Co. and Siemens & Halske, A.-G.

Application has been made to the Board of Trade to avoid or suspend Patents Nos. 19,282/05, granted to Claassen, and 26,322/07, granted to Centralstelle für Wissenschaftliche Technische Untersuchungen Ges. for aluminium alloys, by Messrs. Vickers Ltd.

Parliamentary.—The Shropshire, Worcestershire and Staffordshire Electric Power Bill was read a third time in the House of Commons last week.

Scientific and Industrial Research.—The first annual report of the Committee of the Privy Council for Scientific and Industrial Research for the year 1915-16 states that since the establishment of the Committee by Order in Council on July 28th, 1915, it has considered and approved recommendations from its Advisory Council in respect of aid to 20 scientific investigations of industrial importance. It has, in addition, approved grants to a number of individual research workers, both students and others, which will amount at the close of the academic year 1916-17 to a sum not exceeding £6,000. The amount placed by Parliament at its disposal for the initiation of the scheme in the financial year 1915-16 was £25,000, of which £12,241, including a special grant of £4,250 to the Royal Society, was expended in the last months of that year. For the current financial year the vote was £40,000.

A memorandum embodying certain suggestions for promoting co-operation between different parts of the Empire in the organisation of scientific and industrial research was circulated to the Governments of the Dominions overseas, and has been communicated to the Overseas Universities.

The report of the Advisory Council is printed *in extenso*, with five appendices.

Preservation of Trade Union Customs.—Lists of all departures from Trade Union customs under the Munitions Act are being prepared by the Amalgamated Society of Engineers, and similar records are in the possession of the National Advisory Committee and the Ministry of Munitions. The society urges that all such changes should be recorded, because when the time comes for restoration the chief evidence will be the record of departures made by employers and accepted by the Trade Unions as correct. In the instructions to district Committees, it is stated that a complete record of all departures will constitute the most powerful weapon of the society after the war, when grave perils will menace the conditions which have been built up by years of struggle.—*Times*.

Fatalities.—An inquest was held at Newcastle-on-Tyne, on Friday, in connection with the death of Robert Blackburn from injuries received in an electric warehouse lift. It appeared that deceased and another youth went up in the lift to the third story, when the former, who remained in the lift, in some way started it and got jammed between the lift and the side of the well. Deceased was unacquainted with the use of the lift, which in normal times was worked by men. Verdict: Accidental death.

An inquest was held on Saturday last on the body of T. D. Hoskin, aged 23, a gunner in the R.G.A., who was killed by falling from an electric train just before it entered Edgware Road station. The evidence showed that the train was full, and the door of the car was open when it left Paddington, and that Hoskin was pitched out of the car by a sudden jerk. Railway officials stated that the doors were always closed before the train started. The jury returned a verdict of "Accidental death," and expressed the opinion that there had been neglect on the part of the railway officials.

Institution and Lecture Notes.—Institution of Mining Engineers.—The annual general meeting will be held at the Royal Technical College, Glasgow, on Thursday, September 14th, at 11 a.m. A reception by the Lord Provost and Magistrates will take place in the afternoon, and on Friday there will be an excursion down the River Clyde. On account of the war, the usual dinner will not be held.

The Electrical Association of Australia (N.S.W. Section).—The monthly meeting was held at Sydney, on June 2nd. The president, Mr. T. P. Strickland, read a short paper on "Current Rushes in Transformers," and an illustrated lecture was given by Mr. J. J. Richardson, entitled "The Experimental Electrical Investigations of the late Lord Armstrong on the Characteristics of Positive and Negative Electricity."—*Commercial Engineer*.

Iron and Steel Institute.—The autumn meeting of the Institute will be held at the Institution of Civil Engineers, Great George Street, Westminster, on Thursday and Friday, September 21st and 22nd, 1916, commencing at 10.30 a.m. on the 21st and at 10 a.m. on the 22nd.

Amongst the papers that are expected to be submitted for reading and discussion, the only one that appears to be of electrical interest is one by Prof. E. D. Campbell: "Influence of Heat-Treatment on the Thermo-Electric Properties and Specific Resistance of Carbon Steels."

The Council announces that the Privy Council has sanctioned the new by-law providing for the expulsion from the Institute of members who are subjects of a country at war with the United Kingdom.

New Collieries.—It is reported that nearly £1,000,000 is being spent on opening out new coal mines in the Manchester, Leigh, and Bolton districts.

America's Electrical Week.—Information received from the Society for Electrical Development shows that in anticipation of the "electrical week" (December 2nd-9th next) local Committees have been formed in 286 cities; various booklets are to be issued and 25,000 copies of a "Facts" booklet will be distributed, the cover of which will contain a reproduction of the \$1,000 prize winning poster, which is to be the official design for the campaign. Nearly 800 designs were submitted for this poster. Amongst other features four weekly magazines, viz., "Collier's," "Scientific American," "Scribner's," and "Leslie's" are to issue special electrical numbers or sections on December 2nd; these publications with nearly 2 million circulation do not overlap to any extent.

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place, S.W.—Orders for September, 1916, by Lieut.-Col. C. B. Clay, V.D., Commanding.

A General Parade will be held on Saturday, September 30th, at 2.45, at Headquarters. Uniform.

W. Eyles, Esq. (late R.E.), has kindly consented to give four lectures, as follows:—

Wednesday, September 6th and 13th, "Bridging."

20th and 27th, "Demolitions."

Members are requested to take special note that during this month the lectures will be on Wednesdays, in place of Tuesdays.

Drills will be held under the Sergeant-Major on Tuesday evenings, as during August.

The range will be open on Thursday evenings, as during August. Instruction Classes at Regency Street will be held as usual for Platoons Nos. 9 and 10.

Entrenching.—Every Sunday at Victoria Station (S.E. & C. Railway). Booking-office, 8.45 a.m. The importance of a steady continuance of this work cannot be overestimated.

The Commandant desires to draw attention to the Report on Work Done on South London Defences in July, 1916, in which the paragraph referring to the Corps says:—"The work has been very well done and the task completed," and to express his gratification at the support he has received.

Special Note.—Ordinary Drills will be resumed on and after September 18th. Supplementary Orders will be issued later.

Corps Meeting.—A General Meeting will, if possible, be held at the end of September.

MACLEOD YEARSLEY, Adjutant.

3RD BATT. (OLD BOYS) CENTRAL LONDON VOLUNTEER REGIMENT.—Battalion Orders by Capt. R. J. C. Eastwood (Commandant). Thursday, August 31st, 1916:—

Week-End Parade.—Saturday.—The Battalion will Parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 8.40 a.m., and proceed by train for Entrenching duties. Those who cannot take the early train will parade at 1.20 p.m.

Sunday.—The Battalion will parade at 9.30 a.m. for Entrenching duties.

Recruits. The O.I.C. will be at Headquarters, Lord's, on Mondays, Wednesdays, and Fridays, to enrol recruits, from 6 to 7 p.m., and to see any members who may wish for an interview.

Recruits will Parade at Lord's Cricket Ground on Saturday, at 3 p.m., and on Sunday at 11 a.m. and 2.30 p.m., for Recruit Drill.

Musketry.—Members who have sent in their names to shoot at Bisley on Saturday, 2nd inst., will report in uniform either to Sergeant J. W. S. Burmester, at 9.20 a.m. at No. 8 Platform, Waterloo Station, or to Corporal W. P. Gibson, at 12.45 p.m., at the same Platform.

Map-reading Class. Mr. W. Page will commence a new class at Headquarters, at 6 p.m., September 5th. Those who wish to attend should send, in their names to the Adjutant as soon as possible.

G. H. F. DUNCAN, Acting Adjutant.

Inquiries.—Makers of Davis-Perrett oil eliminating plant, and suppliers of machinery for making paper tubes and troughs, and for pasting paper on iron sheets, are asked for.

Appointments Vacant.—Electrical engineer to take charge of electric lighting and pumping machinery at Roffey Camp, Horsham, Sussex (£3); shift engineer (50s.) and wireman (38s. to 45s.), for the War Department; shift engineers, for Morley Electricity Works; shift engineer (£2), for Reigate. See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editor of the Electrical Engineer, who has connected with the technical and commercial side of the profession and industry, also writes a column and advertisements, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—Mr. E. C. GORMING, who enlisted as a soldier in the London Electrical Engineers whilst engaged in the Edinburg district sales department of the local electric light company, has received a commission in the Mechanical Transport.

The Aylesbury U.D.C. has appointed Mr. W. J. RABY, of Horsham, as assistant engineer at the electricity works at a salary of £2 10s. per week, provided he is exempted from military service.

A presentation was made on August 18th, at the offices of the Guernsey Electric Light & Power Co., to Mr. A. C. THORN, on the occasion of his approaching marriage.

The *Commonwealth Engineer* mentions that Mr. H. A. WILCOX, manager of the Melbourne Tramways & Omnibus Co., has been appointed manager of the Melbourne Tramway Board at the increased salary of £2,500 per annum. Mr. W. O. STRANGWARD, formerly secretary of the Prahran and Malvern Tramway Trust, has been appointed secretary to the Board at a salary of £1,300 per annum.

General.—Mr. F. J. BORLAND, of "Scissors" arc lamp fame, and formerly of Leeds, has joined the Italian Red Cross as a motor engineer, and is now on the Italian frontier.

Mr. C. J. BOWEN COOKE, chief mechanical engineer of the L. & N.-W. Rly. Co., has just been appointed a Magistrate for the Borough of Crewe.

On the occasion of his marriage, Mr. W. B. RICHARDSON, formerly of the electrical engineering department, G.C. Rly., was presented by the staff of Messrs. Vickers, Ltd. (machine gun shop) with a dining-room clock.

Roll of Honour.—The Distinguished Service Order has been conferred upon Second-Lieutenant (temp. Captain) HUBERT CONRAD SPARKS, London Regiment, for conspicuous gallantry in action. During an assault on the enemy's trenches he took command when his senior officer was killed, and rallied his men, who were under heavy fire, and had expended nearly all their ammunition. With a handful of men he made a most determined stand, although nearly surrounded, and thus enabled the remainder to withdraw. He was the last to leave. Captain Sparks is the brother and partner of Mr. C. P. Sparks, President, I.E.E., whose three sons have also distinguished themselves in the war.

Private W. BALL, Loyal North Lancashire Regiment, who was employed on the Blackpool and Fleetwood Tramways, has been killed in action.

Private LEONARD SMITH, of the King's Own Royal Lancasters, aged 21, formerly employed on the Blackpool Corporation tramway system, lost his life while attempting to rescue a wounded comrade.

Gunner HERBERT WOLSTENHOLME, aged 21, has been killed in action; he was employed at the Accrington Corporation electricity works.

Private H. C. DARBYSHIRE, Royal Fusiliers (Sportsmen's Battalion), killed by a sniper, was formerly employed in the Salford Corporation tramway offices.

Private HAROLD PETERS, South Lancs. Regiment, who is posted as missing, was employed at the British Westinghouse Works, Trafford Park.

Private ERNEST WARD, of the Seaforth Highlanders, who has been wounded, was employed by Messrs. T. Harding Churton & Co., Ltd., Leeds.

Private FRANCIS ALBERT PASKEY, of the Royal Fusiliers, who was a partner in an electrical business in London when he enlisted, six months ago, was killed in action on August 6th. He was 28 years of age.

Private H. A. PICKESS, Machine Gun Corps, who was with the Southend-on-Sea Corporation tramways, has fallen in action in France. He was 26 years of age.

Sergeant L. RATCLIFFE, of the Cheshire Regiment, formerly on the staff of the Mersey Power Co., of Runcorn, has been awarded the Military Medal for bravery at the Front.

Corporal J. CHADWICK, of the Lancashire Fusiliers, who served in the South African war, and has seen a good deal of fighting in France recently, has been killed. He was an electrician at Messrs. Bibby & Baron's mill.

Private HERBERT HOYLE, of the Lancashire Fusiliers, formerly a motorman employed by the Bury Corporation, has been wounded.

Gunner VINCENT HARRISON, Royal Field Artillery, formerly in the electrical department of Messrs. Eyre & Sons, Ltd., of Chesterfield, has been killed in action.

Private JOHN RUSSELL, of the Cheshire Regiment, formerly with the Urban Electric Supply Co., Ltd., at Glossop, and the Glossop and Hadfield Tramways, is in hospital.

Private CHAS. EDWARD FIRTH, of the Yorkshire and Lancashire Regiment, formerly on the staff of the Carlisle electric tramways, has been wounded.

Private HARRY FEAR, who has fallen in action in France, belonged to Weston-super-Mare, and served his apprenticeship as an electrical engineer at Clifton, Bristol.

Private FRED BEAUMONT, Gordon Highlanders, who has died of wounds received in action, was on the Halifax Corporation tramway staff.

Corporal J. H. HULL, formerly with the Liverpool Corporation tramways, has fallen in action in France.

Private F. L. BAILEY, Barnsley Battalion, formerly with the Barnsley Traction Co., is reported wounded and missing.

Private OWEN ALIAS JONES, Royal Welsh Fusiliers, formerly at the Bangor electricity works, has been killed in action.

Lieutenant HERBERT WILLIAMSON, who was an electrical engineer at Denaby and Cadeby Collieries, has been promoted to the captaincy, and placed in charge of a machine gun company of the King's Own Yorkshire Light Infantry. At the outbreak of the war he was a lieutenant in the Territorial Forces.

Lance-Corporal WILLIAM WILLIAMS, of the Royal Engineers, formerly electrician at Messrs. Lewis's, Manchester, has been wounded by the accidental explosion of a bomb.

Private CORSER, of the Manchester Regiment, an employee of the British Westinghouse Co., has been taken prisoner by the Germans.

Corporal LESLIE S. ANDERSON, of the Manchester Regiment, formerly employed by the Lancashire Electric Power Co., is reported missing.

Gunner EDWIN MCCULLOUGH (38), of the Royal Artillery Experiments Department, has been accidentally killed while carrying out experiments. He was formerly in the Manchester Corporation tramways department.

Private JAMES WILKINSON, Royal Scots, aged 20, prior to the war an apprentice at the British Westinghouse Works, has been killed in action.

Signaller T. PARKER (19), Machine Gun Corps, has been awarded the Military Medal for gallantry in the field. He was formerly employed at the Manchester electricity works.

Captain J. M. DONALDSON, of the King's Royal Rifles, whose winning of the Military Cross has just been announced, was educated at the Whitgift Grammar School, Croydon, and won an electrical engineering exhibition of the Fishmongers' Company. He held responsible positions with the British Thomson-Houston Co., and subsequently spent about two years in Canada and the United States gaining experience. Ultimately he became assistant chief engineer to the North Metropolitan Electric Power Co. An old C.I.B. officer, he joined the C.I.B. Battalion of the K.E.R., and went to the Front at the end of November, 1915, being twice slightly wounded ere winning the M.C. for bravery in action.

Private HAROLD BREWSTER, of the Lancashire Fusiliers, formerly employed by the British Westinghouse Co., Trafford Park, has been killed in action.

Captain H. G. FRASER, who has been awarded the Military Cross, was an engineer at the Wakefield Corporation's electricity works.

Sergeant WILLIAM CONYERS, killed in action, was an electrical engineer on his own account in Leeds; he was a son of the late Coun. J. D. Conyers.

Private JOHN WRIGHT, of the Loyal North Lancashire Regiment, who was an employee of Messrs. Dick, Kerr & Co., Ltd., at Preston, is reported from France to be missing.

Private GEORGE LEWIS, of the Lancashire Fusiliers, posted as missing, was employed at the Salford electricity works.

Captain G. Z. PINDER, of the Canadian Infantry, who, prior to going out to Canada some years ago, was with the General Electric Co., Ltd., Salford, has just been awarded the Military Cross for conspicuous gallantry and ability when leading his Company in a counter-attack, and in subsequently controlling his men when severely wounded.

Acting-Captain FRASER BRYANT, of the Manchester Regiment, awarded the Military Cross for conspicuous gallantry and ability, was formerly with Messrs. Mather & Platt, of Manchester. He took command when the Commanding Officer became a casualty during operations, and led with great skill and courage.

Lance-Corporal JOSEPH HULME, formerly employed by the British Insulated & Helsby Cables, Ltd., has been awarded the Military Medal for conspicuous bravery. His company officer was wounded, and Hulme went to his aid, and succeeded in getting him to hospital, although under machine-gun fire most of the time. According to a doctor, the officer's life was saved through the prompt treatment he received.

Private ALFRED CORNTHWAITE, Black Watch, has been killed in action; he was formerly employed in the Manchester Corporation tramways department.

Private HARRY HUGHES, of the Lancashire Fusiliers, formerly employed at the power station at Radcliffe, has been killed in action.

Private FREDERICK IRELAND, of the Royal Scots, wounded by shrapnel and bullets, and now in hospital at Ashton, is only 17 years of age, and enlisted when 16, being then employed at the British Westinghouse Works.

Obituary.—MR. WALTER STEVENS.—Mr. Walter Stevens, assistant superintendent of the Western Union Cable Co., at Penzance, has died under distressing circumstances. Deceased was found drowned in the sea at Lamorna.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

STOCKS AND SHARES.

TUESDAY EVENING.

Resisto Electric Manufacturing Co., Ltd.—Issue on August 4th, 1916, of £1,900 debts., part of a series of which particulars have already been filed.

Holworthy Gas & Electric Supply Co., Ltd.—Particulars of £750 debts., created July 22nd, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £300. Property charged: The company's undertaking and property, subject to certain prior mortgages and debentures. No trustees.

Brilliant Arc Lamp & Engineering Co., Ltd.—A memorandum of satisfaction to the extent of £40 on August 12th, 1916, of deb. dated June 22nd, 1915, securing £30, has been filed.

New Peto & Radford Accumulator Co., Ltd.—Mortgage on Victoria Works and Greville Works, Ashstead, to secure £2,000. Holders: C. G. Howard, 16, Tokenhouse Yard, E.C., and C. R. Mayo, 10, Drapers' Gardens, E.C.

CITY NOTES.

West India Electric Co., Ltd. The report of the president and directors for the year ending December 31st, 1915, submitted at the annual meeting of shareholders held on March 9th, 1916, states that the falling-off in railway receipts which commenced in August, 1914, continued throughout 1915, and showed a total decrease for the year of \$22,653.10. The lighting and power receipts, on the contrary, show an increase for the year of \$7,886.94. The total receipts from all sources were \$274,317.88, as against \$288,924.97 for 1914, a decrease of \$14,607.09. Fortunately, there was a well-distributed rainfall throughout the year, consequently the consumption of coal was light, and this, in conjunction with other economies, effected a reduction in operating expenses to \$143,368.43—a decrease of \$11,860.27—the result showing a profit of \$130,949.45. There was paid out of this sum interest on bonds, \$30,000—payment to the Government of the 4 per cent. tax on railway receipts, \$7,409.35—and rental to the Jamaica Light & Power Co., Ltd., \$12,000, the total of fixed charges being \$49,409.35, leaving a net income of \$81,540.10, which has been disposed of as follows: Four quarterly dividends paid amounting to \$40,000, transferred to contingent account \$17,471.57, and added to surplus account \$24,068.53. The contingent fund now amounts to \$100,000, and the surplus account to \$426,274. Property and plant account has been increased by \$25,233.87, made up principally by cost of storage battery and extension of lighting lines. The sale of electric current for lighting and power in Spanish Town has grown slowly but steadily.

Bombay Tramways Co., Ltd. At the annual meeting, held in Bombay, Sir SASSOON DAVID, the chairman, stated that after meeting all fixed charges, and defraying all the operating expenses and maintenance charges of the business, and making the appropriations to various funds, the balance of net profit justified the declaration of a dividend at the rate of 7 per cent. per annum on the ordinary shares. This left £9,602 to be carried forward, as against a sum of £8,326 brought into last year's revenue. The creation of the Indian board was the result of the action recently taken by a very large majority of the company's shareholders to free it from liability to pay the English income-tax in addition to the Indian income-tax. Not only had the price of materials used in their business in many cases doubled or trebled, but there were great difficulties in obtaining supplies of many articles on any terms whatever. They were anxious as early as possible to place an additional 20 two-car trains on their lines, in order to provide additional accommodation for passengers, but it was quite impossible to say when they would obtain material for the construction of this rolling stock which was on order. The directors' report was adopted, and Sir Sassoon David and Mr. A. H. From were re-elected directors, and the election of Mr. F. C. Rimington as a director, during the period he remains in India, was confirmed.—*Indian Engineering.*

Brompton & Kensington Electricity Supply Co., Ltd.—An interim dividend at the rate of 8 per cent. per annum, less tax, on the ordinary shares, payable September 6th, is announced.

Kalgoorlie Electric Tramways, Ltd.—The accounts for 1915, after including the debit balance of £12,520 brought forward and charging £4,000 for depreciation and £9,206 for debenture service, show a debit balance of £18,520 to be carried forward.—*Financial Times.*

South Metropolitan Electric Light & Power Co., Ltd.—Warrants for dividends payable the 31st inst., for the half-year ended June 30th, 1916, of the company's 7 per cent. cumulative first preference shares and 6 per cent. cumulative second preference shares, have been posted.

Most of the markets round the Stock Exchange are good in tendency, the immediate cause of the firm tone being the news that Roumania had declared war upon Austria. Upon this, the gilt-edged stocks hardened, and the Home Railway market improved in sympathy. At the end of last week, the latter stocks were decidedly depressed; and the result of this weakness is still seen in some of the Underground issues. Electric lighting shares are steady, and the foreign groups are firm, with the exception of Anglo-Argentine Tramways. Iron, steel, chemical, and rubber shares are mostly better.

London Electric shares, it will be noticed with interest, are unchanged at 1½ for the ordinary and 4½ for the preference. County of London have risen to 11. The company is doing well, and there are several buyers about of small amounts. Present holders are not disposed to sell, and the limited supply is being easily absorbed. Metropolitans advanced to 2½, showing a rise of ½; and St. James's at 6½ are 5s. to the good. The Brompton & Kensington Electric Co. has declared an interim dividend at the rate of 8 per cent. on the ordinary shares, payable next week, this comparing with 9 per cent. for the corresponding period last year.

No other quotable changes have occurred, but the market is strong throughout. In explanation, the market offers the well-worn truism that there are more buyers than sellers, but what happens, of course, is that with new issues reduced to something like a minimum, and with so much money being made in the provinces by reason of the war, investors are obliged to confine their attentions to the existing securities and to utilise their money to the best advantage.

The Mexican situation has reached a highly interesting point, but the rise in the various stocks, carried out so sharply last week, suffered something of a check as more cautious views began to take the place of the previous optimism. Previous would-be buyers are reckoning up what it is likely to cost the companies to set their affairs in order; and a little stock has been offered on behalf of those who picked it up more cheaply what time nobody would look at Mexicans. The lighting and power group is very steady, but no further changes have occurred.

In the American-Canadian division, Pennsylvania Water and Power shares are better at 80½, Shawinigan common has risen several points to 136, while Canadian General Electric common fell 1 to 121, the preference being about 119. Vera Cruz Electric Light, Power & Traction fives have been changing hands on the basis of 60. The ordinary shares of the Cordoba Light & Power Co., which are of the nominal value of £1 each, stand about 5s., and are being advised for an advance in price. These shares might be useful by way of a speculative lock-up, but those who buy them should recognise the possibility, to say the least of it, that they may have to keep their holding for several years before the money grows into a profit.

Melbourne Electric ordinary stock has been negotiated during the past few days at about 155½, which is 37 points lower than the price current at the end of July, 1914. Calcutta Electric Supply shares stand at 64, or £1 less than their pre-war figure. Anglo-Argentine Tramway issues are dull, the first preference again receding 1/16 to 3½, while the first debenture stock at 75 is a point lower and returns now 46 13s. 4d. per cent. on the money. Brazil Tractions keep steady at 62½, although the report is said to be somewhat disappointing. The preferred shares remain at 93. A feature in this section is the continued strength of British Columbia stocks, further rises occurring of 2 in the preferred and 4 in the deferred, the last-named now being raised to 50.

Metropolitan Consolidated and Districts fell back in sympathy with the weakness of the railway market, to which reference has already been made, but there was a partial recovery, and on balance the falls are trifling. Underground Electric shares are the turn lower, but the 3 per cent. income bonds at 92 gained a small fraction. The bonds will be quoted ex dividend on the Thursday in this week, and at 89 ex, the return will work out to 6½ per cent., which is equal to 9 per cent. on the money, if income-tax at 5s. in the £ is taken into account.

Telegraphs have developed a certain amount of irregularity. Eastern ordinary shed a point, and Westerns eased off to 15, while Anglo-American preferred at 103½ is a shade lower. On the other hand, Cuba Submarines are good at 8½, and Great Northern rose £2 to 42½. The rise in the latter is associated with the fall in the Petrograd exchange. Telephones are firm, United River Plates gaining ¼ at 6½, and Chiles being better at 7. There is not much going on in Globes.

Animation is shown by the Marconi market; and although the parent shares have not moved after their rise of last week,

Americans shot up to 19s. 9d. on buying which was declared to be inspired from the other side. Marconis themselves are being picked up by people who disregard the present paltry yield of 3 per cent. on the money, but who argue that after the war the company will expand its profits and its energies by loans and bonds.

This, of course, is already discounted to some extent in the price, and it may well be, as we have mentioned on previous occasions, that there will be disappointment when the award of the Government to the company is announced. Some of the people who are following the market rather look for a disappointment of this sort and a consequent drop in price, upon which they expect to get in on a more modest level than 34. But as to an ultimate advance in the shares, there are few who have any particular doubt.

The industrial market is keeping up its end with considerable strength. General Electrics are good at 13½. The preference are up to their par value of £10. British Westinghouse preference, on the other hand, are a dull market, and at 49s. again show a loss of 1s. Babcock & Wilcox rose 3/16 to 34, and nearly all the shares in this section are as nearly buoyant as they can be in the present restricted condition of business, as carried on under the Treasury regulations.

Similar conditions apply to the chemical shares, Castner-Kellners being a leading example at 34, at which they are ½ up on the week. The rubber market is once more showing noteworthy strength, to which the price of the raw material contributes little or nothing, because after an improvement to 2s. 4½d. per lb., the price went back 1d. per lb. This, however, failed to dissuade the buyers of shares; and once more the familiar complaint is heard that there are not sufficient shares to go round.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.						
	Dividend	Price	Rise or fall	Yield		
	1914. 1915.	Aug. 39. 1916.	this week.	p.c.		
Brompton Ordinary	10	10	62	—	£7 18 9	
Charing Cross Ordinary ..	6	6	31ad	—	7 2 10	
do. do. do. ½ Pref. ..	6	6	34½d	—	8 8 7	
Chelsea	4	4	8	—	6 18 4	
City of London	9	8	12½	—	6 8 0	
do. do. 6 per cent. Pref. ..	6	6	10½	—	6 14 8	
County of London	8	7	7 7	—	6 13 0	
do. do. 8 per cent. Pref. ..	6	6	10½	—	6 7 3	
Kensington Ordinary	9	9	6ad	—	6 10 5	
London Electric	4	4	13	—	6 18 4	
do. do. 6 per cent. Pref. ..	6	6	24½d	—	6 0 0	
Metropolitan	34	34	6ad	—	7 4 0	
do. do. 4½ per cent. Pref. ..	4	4	6ad	—	6 10 8	
St. James' and Pall Mall ..	10	8	2½	—	8 19 10	
South London	5	5	—	—	6 4 5	
South Metropolitan Pref. ..	7	7	1½	—	6 14 8	
Westminster Ordinary	9	7	—	—		

TELEGRAPHS AND TELEPHONS.

Anglo-Am. Tel. Pref.	6	6	109½	—	5 16 0	
do. do. Def.	30/	33/6	29½	—	7 8 9	
Chile Telephone	8	8	7	—	6 14 5	
Cuba Sub. Ord.	6	6	8½	—	6 8 6	
Eastern Extension	7	7	14½	—	5 7 6	
Eastern Tel. Ord.	7	7	148	—	5 8 1	
Globe Tel. and T. Ord. ..	6	6	124	—	5 8 8	
do. do. Pref.	6	6	10½	—	5 10 4	
Great Northern Tel.	22	22	42½	+2	5 8 6	
Indo-European	13	13	48	—	6 12 8	
Marconi	10	10	84	—	3 1 6	
New York Tel. 4½	4½	4½	90½	—	4 10 9	
Orlando Telephone Ord. ..	10	10	6½	—	5 0 0	
United R. Plate Tel.	8	8	6½	—	5 0 5	
West India and Pan.	1	1	1½	—	5 6 8	
Western Telegraph	7	7	16	—		

HOME RAILS.

Central London, Ord. Assented	4	4	74	—	5 8 1	
Metropolitan	1½	1	20½	—	4 1 8	
do. do. District	Nil	Nil	12½	—	Nil	
Underground Electric Ordinary	Nil	Nil	11½	—	Nil	
do. do. "A"	Nil	Nil	6½	—	Nil	
do. do. Income	6	6	9½	—	5 10 5	

FOREIGN TRAMS, &c.

Adelaide Sup. 6 per cent. Pref.	6	6	82	—	8 0 0	
Anglo-Arg. Trams, First Pref. ..	5½	5½	8½	—	7 5 8	
do. do. 2nd Pref.	5½	5½	8	—	6 18 4	
do. do. 6 Deb.	6	6	76	—	8 8 0	
Brazil Traction	4	4	62½	—	6 14 3	
Bombay Electric Pref.	6	6	10½d	—	7 7 1	
British Columbia Elec. Ry. Price.	6	6	68	—	Nil	
do. do. Preferred	Nil	Nil	51	+2	Nil	
do. do. Deferred	Nil	Nil	60	+4	Nil	
do. do. Deb.	4½	4½	68	—	5 5 0	
Mexico Trams 6 per cent. Bonds	Nil	Nil	42	—	Nil	
do. do. 6 per cent. Bonds ..	Nil	Nil	85	—	Nil	
Mexican Light Common	Nil	Nil	90	—	Nil	
do. do. Pref.	Nil	Nil	84	—	Nil	
do. do. 1st Bonds	Nil	Nil	42	—	Nil	

MANUFACTURING COMPANIES.

Babcock & Wilcox	14	15	26½	—	4 16 0	
British Aluminium Ord. ..	5	7	28½	—	6 7 8	
British Insulated Ord. ..	15	17½	12½	—	7 2 10	
British Westinghouse Pref. ..	7½	7½	49½	—	6 2 5	
Calenders	15	20	12½	—	8 8 4	
do. do. Pref.	6	6	4½	—	6 17 8	
Castner-Kellner	20	—	82	—	5 9 3	
Edison & Swan, £3 paid ..	Nil	Nil	10½	—	Nil	
do. do. fully paid	Nil	Nil	11	—	Nil	
do. do. 5 per cent. Deb. ..	6	6	60	—	6 8 8	
Electric Construction	6	6	17½	—	8 11 6	
Gen. Elec. Pref.	6	6	10	—	6 0 0	
Henley	20	25	18½	—	7 11 6	
do. do. Pref.	4½	4½	4	—	6 12 6	
India-Rubber	10	10	12½	—	5 6 0	
Telegraph Con.	30	30	89	—	5 4 0	

* Dividends paid last of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, August 30th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/8	..
a Ammoniac Sal	per ton	475	..
a Ammonia, Murate (large crystals)	..	454	..
a Bisulphide of Carbon .. ..	..	428	..
a Borax .. ..	..	234	..
a Copper Sulphate .. ..	..	451	..
a Potash, Chlorate	per lb.	2/6	..
a " Perchlorate .. ..	..	3/	..
a Shellac	per cwt.	124½	30 inc.
a Sulphate of Magnesia	per ton	428	..
a Sulphur, Sublimed Flowers ..	..	415	..
a Lump .. ..	..	£12 10	..
a Soda, Chlorate	per lb.	1/1	..
a " Crystals	per ton	130½	..
a Sodium Bichromate, casks ..	..	..	..
METALS, &c.			
c Brass (rolled metal 2 to 12 basis)	per lb.	1/2½ to 1/3	..
c " Tubes (solid drawn) ..	..	1/3½ to 1/34	..
c " Wire, basis .. ..	..	1/8 to 1/8½	..
c Copper Tubes (solid drawn) ..	..	1/6½ to 1/6	..
d " Bars (best selected) ..	per ton	£150	£4 inc.
d " Sheet .. ..	..	£150	£4 inc.
d " Rod .. ..	..	£150	£4 inc.
d " (Electrolytic) Bars .. ..	..	£129	£4 inc.
d " " Sheets .. ..	..	£147	£4 inc.
d " " Rods .. ..	..	£135	£4 inc.
d " " H.C. Wire	per lb.	1/4½	1½d inc.
f Ebonite Rod .. ..	..	3/	..
f " Sheet .. ..	..	2/6	..
n German Silver Wire .. ..	..	2/3	..
h Gutta-percha, fine .. ..	..	6/10	..
h India-rubber, Para fine .. ..	..	3/3	3½d inc.
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	..	£32 10	30½ inc.
l Lead, English fine .. ..	..	£17 12 6 to £17 15	..
g Mercury	per bot.	6d. to 8/.	..
e Mica (in original cases) small ..	per lb.	8/6 to 8/.	..
e " " medium .. ..	..	7/6 to 14/.	4 up.
e " " large .. ..	..	1/8	4d. dec.
d Silicium Bronze Wire	per lb.	£85	..
r Steel, Magnet, in bars	per ton	£175 to £173	..
g Tin, Block (English) .. ..	..	2/10	..
n " Wire, Nos. 1 to 16	per lb.	..	..

Quotations supplied by—

a G. Boor & Co.	g James & Shakespear,
c Thos. Bolton & Sons, Ltd.	g Edward Tilt & Co.
d Frederick Smith & Co.	g Bolling & Lowe.
e F. Wiggins & Sons.	g Richard Johnson & Nephew, Ltd.
h India Rubber, Gutta-Percha, and	g P. Ormiston & Sons.
Telegraph Works Co., Ltd.	g W. F. Dennis & Co.

Karachi Electric Supply Corporation, Ltd.—At the third annual general meeting of the shareholders it was stated that the demands for the corporation's energy had exceeded all expectations, so much so that the revenue earned in the first year exceeded that which the directors anticipated would be secured during the second year of the corporation's supply to the public. During the twelve months ending March 31st, 1916, 611 consumers were connected with the corporation's mains. The length of mains in the compulsory area, provided for in the licence granted to the corporation by Government, was a little over 12 miles. The one lakh of rupees of capital which the board called up in August last was expended on the extension of the corporation's mains for a further five miles. Many demands for further extensions had been received. The Karachi Municipality had contracted with the corporation for the illumination of a little over six miles of public streets, whilst the Karachi Cantonment Committee had just given the corporation an order to illuminate a little under two miles of streets in cantonments. The directors recommended a dividend at the rate of 5 per cent. per annum.

—Indian Industries and Power.

Mexico Tramways and Power Bonds.—It is announced that the various meetings of the bondholders of the Mexican Light and Power, Mexico Tramways, Mexican Electric Light, and Pachuca Light and Power Companies will be held on October 4th and 5th in order to consider the past and proposed policy of the Bondholders' Committee and the Trustee.

—Morning Post.

Davis & Timmins, Ltd.—Interim dividend at the rate of 6 per cent. per annum, free of tax, on ordinary shares, payable September 13th.

Clyde Valley Electrical Power Co.—The directors have declared a dividend of 1½ per cent. (actual), free of income-tax.

Oxford Electric Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum, less tax, on ordinary shares, payable September 14th.

PETRI PEREGRINI MARICURTENSIS.

Author of "De Magnete" Epistle, A.D. 1269. Originator of the Floating and of the Pivoted Compass.

By P. F. MOTTELAY.

MARICOURT, a small village on the right bank of the river Somme, in Picardy, about 8 km. distant from Combles, and 40 km. from Amiens, has of late been in almost daily mention by the general Press,* yet how few readers know it as the birthplace of Petrus Peregrinus, the first-known practical magnetist, author of what is in truth the very earliest work of experimental science that has come down to us.

We are told by Roger Bacon ("Opus Tertium," Cap. XI) that Magister Petrus, doubtless a Crusader, was at that time the only one, besides Master John, of London, who could be deemed a thoroughly accomplished, perfect, mathematician, and was one who understood the business of experimenting in natural philosophy, alchemy and medicine better than anyone else in Western Europe. In Chapter XIII of this work, speaking of *scientia experimentalis*, Bacon says:—"I show in the sixth part of my 'Opus Majus' the supreme power of this science over all others that have to be made certain. Students of natural philosophy, commenting upon Aristotle's Meteorology, and students of perspective, busy themselves with making these things certain, but in vain: for experience alone here makes certain, and not argument. Accordingly, I require abundance of experiments about those things; and the business of experimenting no one in Western Europe understands, save only Master Peter."

As the work that has made Peregrinus immortal is now of such excessive rarity as to be within the reach of but few, it is thought well to give here some particulars of its very quaint character as well as of its astonishing scope, and to point out briefly the fruitful results of the author's original investigations. These are detailed in a letter, or epistle, "Written in camp, at the siege of Lucera (delle Puglie-Nucerrae), in the year of our Lord 1269, on the 8th of August," addressed to his *amicorum intimi*, a soldier, by the name of Sigerus de Foucaucourt.

A translation of the introductory prologue to the work was thus given by the late Prof. Silvannus P. Thompson, in his address before the British Academy, November 28th, 1906:—

Inmost of friends: being solicited by you, I will disclose to you in rude narration a certain occult nature of the magnet stone. For nothing indeed is pleasurable to philosophers apart from the sharing of the knowledge of it: because the nature of good things wanders and is obscured in darkness until it is brought into the radiance of public recognition. For love of you, therefore, I will write down in plain language things which to the bulk of students are utterly unknown. Nevertheless, we shall not communicate in this epistle any information save about the manifest properties of the stone, on the ground that this teaching will form part of a tract in which we shall show how to construct physical instruments. To treat of the occult properties of the stone leads us to the art of engraving upon stones. And, although I call those actions manifest concerning which you have inquired, yet they will be of no esteem; and in the eyes of the vulgar will be as illusions and phantasms. And, therefore, because they are secrets to the common people, but will be manifest to astrologers and naturalists, they will also be a solace to them, just as they will likewise be of no slight assistance to travellers who have gone far away.

There are of Peregrinus's work but few reliable manuscript copies, all which have been fully described by Timeteo Bertelli Barnabita, as well as by the late Prof. Silvannus P. Thompson, and there has been of it but one printed issue in book form, that of the Lindau physician, A. P. Gasser, which appeared at Augsburg during 1558.

Much has been said at different times regarding the contents of the above-named epistle, the full title of which is "Epistola Petri Peregrini de Maricourt, ad Sygerum de Foucaucourt, militem, de magnete," and I cannot do better than to give a much abbreviated *résumé* of what will hereafter appear concerning it in my "Bibliography of Electri-

city and Magnetism." The first part of the work shows, in turn:—

Chapter I.—The occult properties of the loadstone, also the art of making scientific instruments.

Chapter II.—The natures of things and likewise the motions of the heavenly bodies.

Chapter III.—The different requisite qualities of the loadstone, and how loadstones are to be selected and tested.

Chapter IV.—How to find in the loadstone the two poles, using preferably a globular magnet.

Chapter V.—How to distinguish the poles readily:—" . . . the stone in the first vessel will be like a sailor in a ship . . . if this pole were turned away a thousand times, a thousand times would it return to its place by the will of God."

Chapter VI.—In precisely what manner a magnet attracts a magnet:—"As a rule, the northern part of one stone attracts the southern part of another stone, and the southern the northern."

Chapter VII.—How iron, whenever touched with the magnet, immediately turns towards the poles of the globe.

Chapter VIII.—In what manner a magnet attracts iron. "If violence is used towards the ends . . . the power in the iron will easily be changed, and that will become southern which was previously northern, and the converse."

Chapter IX.—Why the northern part attracts the southern part and the converse. "The attraction of the south by the south, and of the north by the north, is not according to nature."

Chapter X.—Whence the magnet derives the natural power which it possesses. "It is manifest that the parts of the magnet receive their power from the world's poles . . . the whole magnet from the entire heavens."

The second part of Peregrinus's epistle shows, in turn:—

Chapter I.—The original construction of the floating compass, by which the azimuth of the sun and moon and of any star above the horizon, can be ascertained.

Chapter II.—The original construction of "a better instrument and of more effects," the pivoted compass. "By means of this, you may be enabled to direct your footsteps to States and to Islands, and to any places on the globe . . . whether on land or on sea, so long as their latitudes or longitudes are known to you."

Chapter III.—The construction of a wheel for perpetual motion. "By making a very thin concave silver case, after the manner of a circular mirror, suitably perforated and around the rim of which are inserted small iron nails, or teeth, bent closely toward each other . . . a magnet being set within . . . so that each tooth of the wheel shall arrive at the North pole; and, owing to the impetus, shall pass by and approach the Southern quarter . . . thus every tooth will be in a perpetual state of attraction and avoidance . . ."

It may be added that to Peregrinus is due the first inception of the *terrella*. He makes the magnet round, and he says: "You must know that this stone bears in itself a likeness of the heavens and contains two points, one north and the other south, thus resembling the poles of the sky." The *terrella* was afterwards constructed in much the same way by Wm. Gilbert, only Peregrinus, as has been said, considered it "a likeness of the heavens," whilst Gilbert regarded it as the earth itself.

In his lecture before the British Academy, Prof. Thompson noted the fact that the pivoted compass of Peregrinus antedates by more than 30 years the date usually given as that of the invention of the mariners' compass by the mythical Flavio Gioja, of Amalfi, in 1302.

THE NIAGARA POWER SITUATION.

For some weeks past our American and Canadian contemporaries have devoted considerable attention to the hydro-electric power situation at Niagara Falls, where there is abundant evidence that the legislative concessions for power development are proving quite inadequate to meet the growing industrial requirements of Canadian and United States users. Indeed, so insistent are the economic demands for extended development of this particular source of power that it would not be surprising were utilitarian considerations to prevail over æsthetic ones in the near future, thus leading to the release of a huge amount of water which has up to the present been reserved with a view to preserving the scenic attractions of the Falls. After all, it needs no great stretch of the imagination to picture a time when, in the absence of cheaper sources of power, the ever-growing demands of human existence will compel the complete utilisation of such a power

* Maricourt lies upon the present south-eastern British Front, and, as we learn from Reports of General Headquarters, it has, during the past six weeks, sustained four very serious German attacks; as many as 300 shells having fallen in one day throughout the village.

source as Niagara. The same thing on a lesser scale occurs almost daily; our cherished hills and woods are surrendered to bricks and mortar, our mountain sides are given up to slate quarries, our fields to coal tips, and our lakes for waterworks reservoirs, and many other instances could be quoted of a similar kind.

At the present time, however, under existing international legislation, it would appear that something like an impasse has arisen. We may remind our readers that by an International Treaty of 1909 between Canada and the United States, the contracting parties agreed that each on its own side of the boundary should have equal and similar rights in the waters defined as boundary waters. If for economic reasons more than half the power is developed on one side, the increment over the half may be regarded as the possession of, and given free entry into, the other country. Under the United States 1906 (Burton) Bill for the control and regulation of the waters of Niagara river and preservation of the Falls, 15,600 cu. ft. per sec. could be diverted from Niagara River on the United States side, exclusive of 10,000 cu. ft. per sec. diverted for the Chicago Drainage Canal. The Boundary Waters Treaty, however, allowed the United States to divert up to 20,000 cu. ft., while Canada can take 36,000 cu. ft. per sec. The Burton Bill allowed an aggregate of 160,000 h.p. to be imported from Canada into the States, under the jurisdiction of the United States Secretary of War, and he, in 1907, allowed "fixed" permits for the International Railway Co. to export 1,500 h.p.; the Ontario Power Co., 60,000 h.p.; Canadian Niagara Falls Power Co., 52,500 h.p.; and the Electrical Development Co., 46,000 h.p. The Act further provided for "revocable" permits for the transmission of additional energy from Canada, the total of all permits, including the 160,000 h.p. mentioned above, and the amount generated and used in Canada, not to exceed 350,000 h.p. A Canadian Act was also passed providing for the exportation of energy to the United States under a duty not exceeding \$10 per h.p.-year.

The treaty allowance to Canada of 36,000 cu. ft. per sec. still remains, although the actual power developed has increased. According to the *Canadian Engineer*, certain agreements entered into with the Ontario authorities allow the three large companies operating on the Canadian side to generate an aggregate of 405,000 h.p., which, it is understood, will require the eventual diversion of 29,500 cu. ft. from Niagara River, leaving only the small residue of 6,500 cu. ft. available for further use, or, as our contemporary puts it, for the logical and inevitable expansion of the Ontario Hydro-Electric Power Commission, for it is due to the exceptional growth in the demands of the Commission that the question has been brought into such prominence at the moment.

Quoting our contemporary: "In September, 1910, the Hydro-Electric Power Commission's Niagara system began operations with a load of 600 h.p. That system is now carrying a load of 110,000 h.p. When the Commission executed a contract with the Ontario Power Co. for the supply of 100,000 h.p., it was confidently expected that this amount of power would meet all the requirements of the Niagara system for at least 30 years. The Commission has actually more than exhausted this contract in less than six years' operation, hence the urgent necessity of negotiating the 50,000 h.p. contract with the Canadian Niagara Power Co., concerning which much discussion has recently appeared in the daily newspapers.

"Even upon the basis of the past rate of increase and demand, the Commission will certainly require 200,000 h.p. or more to supply the Niagara system alone in 1918. If this estimate is correct, the extra 50,000 h.p. will be absorbed within a year, and at least two years more will probably elapse before the

Commission's Queenston plant will be in shape to deliver power."

The Canadian Niagara Co. exports practically all its power, and is reported to have asked such a high price that the Commission threatened to call in the Dominion Government's aid with a view, if necessary, of curtailing its export of power.

Our contemporary asks whether the contract obligations of the companies are really of such a nature as to make it impossible for them to meet Ontario's demands. The Dominion Government licences are renewable annually, and revocable at will; as recently as 1915 licences in force permitted the power companies at the Falls to export 210,000 h.p. to the States, and it is understood that the companies were specifically cautioned against making binding contracts for the permanent supply of exported power to their American customers in view of the revocable nature of their licences and the possibility of the power being later required in Canada. Moreover, the American users were officially warned by their own Government of the position taken up by the Canadian authorities. In view of this, it is argued that the Canadian-Government could not be accused of an unfriendly act if it saw fit to exercise its rights in reclaiming power now being exported.

Such a policy, however, might cause injury to present users of imported power in New York State, where, despite the clearly-defined limitation as to exports, a large vested interest has been created, apparently based on the assumed permanent nature of the supply; actually the New York State Public Service Commission, in a recent discussion, assumed that international relations in regard to the conditions of supply and use of this power had become "fixed," and subject only to changes which would fully protect the interests and rights involved, although the incorrectness of this interpretation of Canadian laws was subsequently pointed out by the Canadian Government.

The position as regards power, light, and heat in Ontario is accentuated because the province is practically dependent on the adjacent coalfields of the United States for its supply of coal, especially of hard coal, which may not always be available in view of the expansion of American industry, and because hydro-electric power is a partial substitute.

Our Canadian contemporary points out that the curtailment or absolute prohibition of export would place New York State in a very similar position to that in which Ontario finds herself at the present time as regards inadequate supply, also that New York State has available a similar remedy to the projected Queenston development by Ontario.

The United States Government still holds in reserve 4,400 cu. ft. per sec. of the treaty water at Niagara. Between 7,000 and 8,000 cu. ft. per sec. of Niagara water is being diverted through the Chicago drainage canal, of which more than 3,000 cu. ft. per sec. is being taken in direct defiance of the Federal authorities at Washington, and is being wasted to all intents and purpose in a low-head development at Lockport, Ill.

New York State should have 7,400 cu. ft. available, and with a practicable head of 300 ft., nearly 225,000 h.p. could be obtained, which would more than off-set the withdrawal of Canadian power.

As regards the proposed Canadian development, the mean difference in level between Lake Erie and Lake Ontario is 327 ft., and the Hydro-Electric Power Commission reports that at least 300 ft. of this head can be effectively used for the development of power through the agency of its projected Chippewa-Queenston scheme. This is more than double the general average of effective head now being used by the power companies at Niagara Falls. It means that with the unallotted surplus of treaty water, the Hydro-Commission can develop nearly 200,000 h.p. at Queenston, or 30 h.p. per

cu. ft. of water as against 14 H.P. which the private companies at Niagara Falls can produce. Moreover, so long as the existing private companies continue to operate on present lines, nearly half a million H.P. will be sacrificed which could be developed for use in Canada.

It may be pointed out that there is no connection between the above scheme (referred to in our "Lighting Notes" on August 20th, 1915) and the Thomson scheme for developing 2,000,000 H.P. by damming the lower Niagara River just above Queenston, which has been much discussed and criticised lately.

On the American side, the representatives of electrochemical industries located at Niagara recently presented their side of the question to members of the Committee on Foreign Relations of the House of Representatives.

One speaker, Mr. F. A. Liddbury, of the Oldbury Electrochemical Co. (says the *Electrical World*), pointed out that ever since power restriction measures came into effect there had been a tendency to shortage of power on the American side and increasing prices, and that this had resulted in the migration of industries to other countries.

The American Cyanamid Co. placed the first fixed nitrogen plant in America on the Canadian side, and was followed by two well-known abrasive industries, which moved the greater part of their furnace operations to Canada, and in one case to France; recently the Union Carbide Co. has been erecting a 100,000-H.P. plant in Norway; and the market for the products of these concerns is principally the United States. It has been suggested that the electrochemical industries could move further west, where there is abundant water power, but Mr. Liddbury pointed out that the market is in the manufacturing districts of the east, and additional transport charges would be prohibitive, calculations showing that in the case of the majority of the processes, they would on the Western Coast require not merely free power, but a bonus equal to what was being paid for power at Niagara.

The power situation was bad, but likely to be worse, as the Canadian Government had reduced the amount of power for which permits were given, and notified its intention to reduce the exported quantities yearly at a rate which would bring exportation to a stop in the course of six or seven years; as at least one-third of the Niagara power used in the States was imported from Canada, they were faced with further restrictions of operations. The speaker went on to urge the complete utilisation of their power resources, and pointed to the enormous industrial developments which had arisen as a result of the alleged spoilage and destruction of the scenic beauty of Niagara.

THE INDUSTRIAL CONDITIONS IN GERMANY IN WAR TIME.

AN interesting survey of the labour and industrial conditions prevailing in Germany in 1915 and early in the present year is contained in a series of Consular reports which have recently been transmitted to the Government of the United States from official representatives in Germany. Under existing conditions official statistics and reports by the German Chambers of Commerce are not being issued, and the information available concerning trade and commerce is therefore fragmentary, and reflects the abnormal period through which German industries are now passing. Consul-General Julius G. Lay, of Berlin, first shows the enormous reduction in the interchange of trade as contrasted with the last year of peace. He states that, as declared at the American Consulates and agencies, the value of the exports from Germany in 1915 amounted to \$39,967,000, as compared with \$156,406,000 in 1914 and \$186,035,000 in 1913. The trade with neutral countries in Europe has materially decreased, largely owing to the embargo, blockade, and contraband restrictions, but that with Germany's allies may be regarded as approaching the normal level.

The large stock of American goods at the free port of Hamburg on the outbreak of war has been absorbed. After the war, Consul-General Henry H. Morgan, of Hamburg, states, a large demand will arise for copper, steel, rubber, &c., in order again to build up the internal industries, and the United States will undoubtedly be called upon to meet these needs. At present, however, there is no possibility of doing business, and the time is not opportune to make any propaganda for the future.

The Consular district of Frankfurt-on-Main, which is reported upon by Consul-General Heaton W. Harris, ranks as one of the three principal centres of American trade in Germany. This trade has been for the most part well organised, and formerly covered a wide and increasing range of products, including copper, oils, machinery, leather, rubber tires, calculating machines, &c. Under war conditions, however, this trade has suffered severely. It has been impossible to replenish stocks on account of trans-Atlantic shipping conditions, and several of the agencies have been closed, although the business premises in most cases have been retained for resumption of operations when circumstances permit.

Banking Changes and Company Dividends.

A remarkable feature of 1915, as reported by the Consul-General at Berlin, was the gradual development of the German banks into deposit institutions and the gradual elimination of their stock exchange and commercial characteristics. This alteration was brought about largely by the closing of the Stock Exchange and the limitation of the usual industrial banking activities. The tasks and obstacles confronting the various Berlin banks were essentially the same; the most important task was assisting in the subscription and collection of the war loans. The punctual and creditable operation of these loans is a result which has largely to be credited to the banks. A large increase in investments was also noteworthy during the year, bank depositors becoming to a large extent bank creditors, since the capital that was formerly tied up in commercial pursuits became available. Although the financing of industrial operations almost ceased during the year, it was possible to extend credits in a few cases, as, for instance, in the manufacture of artificial saltpetre, yeast, &c.

The annual statements of the most prominent German companies for 1915 show that the number which announced no dividends for the year was relatively small as compared with the total number reviewed. It also appears that a large decrease in dividends was shown only in a minority of cases, and only by undertakings which were either inadequately financed originally or were manufacturing articles of luxury and products intended for exportation. The porcelain and glass industries as well as the potash industry, which generally exported more than half of their production, were naturally compelled to pay lower dividends because the loss of exports could not be compensated in any other way. The cement mills, which were not in the best of positions in times of peace, have suffered greatly.

In general, reduced rates of dividends were reported by the industries not actively engaged in the production of war requirements. The limitation of the output has not only been caused by a decreased demand, but also by a lack of producing facilities. The lines in which relatively high dividends were announced are principally mill products, chemicals, paper, coal, iron and steel, and the textile industries, and the railways and banks also have not materially suffered from the war.

Labour Questions and Increases in Wages.

Since the disturbance in labour conditions which occurred at the beginning of the war, matters have so far improved that the Consul-General at Berlin is able to announce that conditions have now settled down to a degree of regularity. A large amount of female labour has been introduced into various trades where male labour was formerly employed. In a number of industries imported foreign labour, particularly Scandinavian and Dutch, has been substituted for native workers, whilst 650,000 prisoners of war are stated to have already been employed in farming and industrial occupations at the commencement of May, 1916. The authorities in charge of the funds for insurance against sickness continue to report a more favourable situation than in times of peace, and as a result of the employment of men partially incapacitated for military service, and of women, the statistics of the unemployed in the empire have materially improved.

The preliminary figures issued in relation to the number of strikes in the empire in 1915 show a great reduction both in number and duration. As compared with 1914, when 1,115 strikes occurred, there were only 137 last year, and these were generally limited to several factories or firms, but did not extend over a whole branch of industry. Over one half of the strikes were settled by compromise. On the other hand, the number of lock-outs receded from 108 in 1914 to four last year.

Dealing with the state of employment in the province of Rhineland, a report issued for last December by the official Labour Exchanges shows that there were 61 male applicants to every 100 vacancies. Vacancies for 15,453 men arose, but only 9,474 men made applications, and 6,015 of these found occupation. The chief demand came from the agricultural, coal mining, and iron and steel industries. On the outbreak

of the war, 56,890 men out of the total population of 160,750 at Aix-la-Chapelle were engaged in industrial work, but at the end of 1915 only 23,800 were so occupied, indicating a decrease of 13,000 wage-earners.

The manufacturing industries in the Breslau district of Upper Silesia were all affected more or less by the general scarcity of labour, particularly the textile and porcelain trades. On the other hand, the iron and steel branches found means of increasing the number of their employes, first by requisitioning large numbers of Russian prisoners of war, and secondly, by importing labour from the occupied portions of Russian Poland. In addition, large numbers of men were withdrawn from various manufacturing establishments, and their places filled by women and girls, whilst the men themselves were transferred to the iron and steel branches and the machine shops. The entire equipment of manufacturing plants was sometimes changed in order to meet the change of conditions; in other cases extensions were made to accommodate a new branch of the industry, and in other instances it was simply a matter of small details in the construction of machinery and parts. It is possible that the inventions resulting from the war may play an important part in the markets of the world after peace has been restored.

A steady increase in the rates of wages paid since the opening of the war is reported by Consul-General Heaton W. Harris, of Frankfort-on-Main. It amounts to from 20 to 40 per cent., although the actual cost of labour in many industries is said to have been from 40 to 50 per cent. more than previous to the war, in consequence of the employment of many inexperienced workers and the operation of the existing conditions, under which all classes have been more or less affected. Consul William P. Kent, of the Leipzig district of Saxony, adds that it is not expected that the termination of the war will be followed by a reduction in wages to the levels which formerly prevailed, and the prospect of a continued higher cost of labour cannot be disregarded in forming an estimate of German competition in the world's markets. According to Consul Milo A. Jewitt, of the district of Kehl, there is little apparent destitution among the working classes, owing to the adaptation of industries, and the transfer and regulation of labour, together with the national, State, and municipal aid to the needy, especially to the families of soldiers.

The Iron and Steel Branches.

The production of steel throughout Germany and Luxemburg (the Zoll Verein) amounted to 13,187,616 metric tons in 1915, as compared with 14,946,212 tons in the preceding year, the reduction being ascribed to the labour difficulties. One of the most important events in connection with the industry was the effort made by the Thyssen group to withdraw from the Steel Syndicate (Stahlwerks Verband). A compromise, however, was arranged, and a reorganisation of the syndicate was rendered unnecessary.

According to the United States Consul at Cologne, the great Rhenish-Westphalian iron and steel region extends into this Consular district, where 19 blast furnaces and several steel plants are situated, most of them in the locality of Coblenz. On the whole, the iron and steel industry of Germany was adversely affected by the war on account of the loss of the foreign market, and the labour shortage due to men having to join the Army. As a consequence, the production of pig iron, which amounted to 19,309,000 tons in 1913, decreased to 14,389,000 tons in 1914, and to 11,790,000 tons last year. A marked revival, however, took place in the production of steel in the second half of 1915, and this has continued, it should be noted, down to July of the present year. The market for iron and steel has been described as active since the latter part of 1915, but no advance in prices occurred until March, 1916. Since then quotations, both for pig iron, semi-finished steel, and sections, have been increased by sums up to 20s. per ton.

Some branches in the district of Aix-la-Chapelle are fully occupied on the production of Army requirements. The gross profits of one of the largest local companies in 1915 were two and a half times as large as in 1914, and a dividend of 25 per cent. has been paid, as compared with 12 per cent. in the previous year. This company succeeded in acquiring large quantities of raw materials before prices reached their present level, and its plant was adjusted from the first day of mobilisation to the production of Army supplies. The plant has been extended, and large Government contracts are on hand. One iron and steel foundry which employs many thousands of workers is operating day and night; whilst another, which paid no dividend for 1914, earned 10 per cent. last year, and smaller foundries and machine shops are also fully occupied.

The adaptation to war production has likewise been carried out in Upper Silesia in such important works as those represented by the Königs and Laura Hütte, the Bismarck Hütte, the Friedens Hütte, the Borsig Works, the Oberschles. Eisen Industrie, and the Hohenlohe Works, whilst several of the smaller concerns were amalgamated in order to strengthen their interests. All these works are constituents of the Steel Syndicate for semi-finished steel, heavy railway material, and sections.

The Machine and Machine Tool Industry.

It we now turn to the machinery industry, it is found from the report of the Consul-General for Berlin that the conditions in 1915 improved as compared with the previous year, as is shown by an increase in the dividends declared by many prominent companies. The machine tool industry has been

able easily to adapt itself to Army requirements; the output has consisted principally of war products, and in a few cases tool-makers have taken up the production of projectiles. Despite the generally satisfactory state of the machine tool industry, complaints were made of the limited supplies of raw metal. In order to remedy this difficulty an office was organised in Berlin to effect the release of the necessary quantities of raw materials, all of which were placed under Government control. Makers' prices of machine tools were raised by 30 per cent., while those of merchants and dealers were increased by 50 to 100 per cent. Since the imports of machine tools from the United States have ceased, makers in the Berlin district report an improvement in the home market, and state that this has afforded partial compensation for their losses in exports. It is added that the scientific training of the leading engineers has been of assistance in facilitating the adaptation to war conditions. The manufacturers of precision machinery have been more affected by the cutting off of the export trade than other branches of the industry.

The great activity of the machinery makers in connection with Army contracts in the district of Aix-la-Chapelle has rendered it impossible for private concerns and the civilian trade to obtain adequate supplies, such as machinery and parts and hardware. In the region of Cologne, the machines made in 1915 were mostly lathes and other tools used in the production of war munitions, and the machine shops are now occupied mainly with the output of munitions. The makers of machinery in Saxony are doing well, and it has been found necessary to work overtime and night shifts, and on Sundays in some cases. The district of Frankfort-on-Main presents similar features, inasmuch as the machine industries in most cases have changed over wholly, or in part, to the manufacture of munitions or other supplies needed by the Army. One well-known company has made material additions to its plant, has operated from two to three shifts, and has paid a dividend of 20 per cent. In the Duchy of Brunswick the large orders from the military and naval authorities have compensated machinery makers for the lack of contracts from foreign countries, and the workmen are kept busy under the changed conditions. The purchase of raw materials was attended with difficulties which delayed the delivery of manufactures, and the advance in the prices of the former and the rise in wages caused the quotations for manufactures to increase. Money conditions were easy, owing to the punctual payment and to war orders. Besides the latter, orders were executed for a number of grain mills, oil mills, storehouses, transport and pneumatic plants and elevators, cement mills, hydraulic presses, and other machinery, whilst potash-nitrogen plants were erected specially for military purposes.

The Electrical Trades.

Dealing with the dividends of German companies, the Consul-General at Berlin mentions that the A.E.G. and the Siemens and Halske Co. have declared rates of 12 per cent. for the business year 1915; the latter reported that its production in that year was about the same as that which obtained in the last few years before the war. The value of the exports invoiced at the American Consulate in Berlin for the United States was only 1,190 dollars in the case of electrical lamps and bulbs in 1915, as compared with 26,265 dollars in 1914, whilst that of all other electrical goods amounted to 35,224 dollars and 18,194 dollars in the two years respectively.

The manufacture of electrical machinery and appliances in the district of Frankfort-on-Main was fairly active in 1915. The electric lighting of villages and of cities has been increasing, partly in consequence of the inadequate supplies of petroleum, and great quantities of small storage battery lamps have been manufactured for the Army. An addition to its works has been made by a large cable and copper working company, with increased earnings, and the dividend paid has been advanced from 7 per cent. in 1914 to 10 per cent. last year.

The industries concerned with porcelain, glassware and pottery in the Breslau district of Upper Silesia suffered more inconveniences owing to the difficulties of export than any other branch of Silesian industries.

The manufactures in the district of Frankfort-on-Main cover a wide range, including dyestuffs and other chemicals, several kinds of machinery and tools, electrical appliances, explosives, copper cable and other copper goods, rubber tires, &c.

The Chemical Industry and New Processes.

The large German chemical companies have been able to declare higher dividends for 1915 on account of their adaptability to war conditions. But the diminution in exports, which formerly represented from one-third to one-half of the total value of the production, is felt throughout the industry. The provision of substitutes for raw materials which were formerly imported has been of great assistance to chemical manufacturers. This has been particularly the case in regard to artificial rubber, albumen, fertilisers, and oil. Military reasons, however, prevent the publication until after the war of reviews of the help rendered by the chemical industry in the production of war materials and pharmaceutical supplies, but it is confidently asserted that the industry has accomplished a great task in these directions. Indeed, it is said that the great home demand has compensated to some extent for the loss of the transmarine export trade. One of the most

surprising changes reported from Upper Silesia is the substitution of cellulose and wood-pulp products for cotton goods.

A further development is announced from the district of Cologne, where several works are stated to have been erected for the extraction of nitrogen from the atmosphere, and the manufacture of fertilisers in place of Chilean nitrates. It is predicted that these works will be able to compete with imported fertilisers after the war.

Apart from synthetic nitrates, substitutes have been needed for cotton in the making of explosives, of artificial camphor and of various other articles. It is possible to read of at least partially satisfactory substitutes for rubber, of the utilisation of the fibre of nettle as a substitute for cotton, of cellulose in the production of string and twine for wrapping and other purposes, and of the food value of certain plants not hitherto used for this purpose. In conclusion, it is mentioned that the general situation has been in part relieved by the large employment of war prisoners in agriculture, together with the more general use of traction engines in ploughing and cutting corn.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Cab Whistles and Lamp Calls.

In your current issue sign-makers and others are invited to "wake up" to the possibility of providing a sign call for taxis, &c. Such a sign, however, has been made and listed by us for some years, the catalogue description of the sign illustrated being:—

"Hotel day and night sign for calling taxi, hansom or four-wheeler. The letter corresponding to the vehicle required is illustrated by a coloured lamp. The letters T. H. F. are shown on three sides."

As the most popular size is fitted with 12-in. opal letters, the sign is visible to drivers of vehicles at a considerable distance. After all, there is nothing new under the "Sun."

The Sun Electrical Co., Ltd.

E. R. MORTON, Works Manager.

London. W.C., August 26th, 1916.

The Deficiencies of Government Departments.

I read with a considerable amount of interest your leading article, and I must endorse fully all you say as to the difficulty of getting the Government department to work with any serious idea that their department needs to take any business considerations into account.

The following is a short history of an experience with my company:—

We have two lines for telephones to the exchange and a private exchange, from which we have five connections, one of which is to our superintendent of the power-house. In January, 1916, the telephone needed to be moved from the house of the superintendent to another house in a different part of the town. In February the telephone authorities were advised where to have this telephone fixed; they were also informed that we were certified under the Ministry of Munitions, and owing to the restrictions of light and other regulations, it was essential that the superintendent should be in telephonic communication with the power-house. After interviews and various correspondence, the company offered temporarily the use of telephone wires on their own trolley wire poles; this proposal was made by the company with a view of meeting the difficulty alleged as being a reason for not being able to fix this telephone—that they had not sufficient labour. I was told by the local representative that they had a regulation that no telephone wires were to be fixed within a certain distance of a tramway trolley wire unless insulated, but as we are working under conditions of "war," it occurred to me that there might be enough commonsense in the subordinates or the chiefs to see that such a ridiculous regulation should be (at least during these times of stress) non-effective; but after nine months of entreaty I have received the following letter:—

"In reply to your letter of the 4th inst. (W.J.S./E.R.M.), I am directed to inform you that the General Post Office have again been communicated with, and a reply to the following effect has been received:—

"It is reported that the offer in question of the electric light company was considered by the Post Office Engineering Department, but that it could not be accepted as the offer involved the use of a pair of wires running on tramway standards which were not properly guarded or protected from the power conductors. The work will be carried out as soon as men are available."

I might for your information inform you that the company's telephone wires are fixed on the tail of the brackets, and, therefore, have the pole in between the trolley wire and these telephone wires, and, furthermore, I don't think there

is any place where the trolley wire is within 6 or 8 ft. of the telephone wires.

I think this is a very perfect illustration of the principal objection you raise to Government control.

It apparently does not seem to worry the Post Office authorities that they are under any obligation as a business concern, and that we are put to loss on account of the telephone not being in use, or damage owing to the excessive delay in making this connection.

J. E. Stewart,

Engineer and Manager.

[The article referred to by our correspondent was that entitled "The Centralisation of Electricity Supply" (p. 191), and was written by an engineering contributor.—EDS. ELEC. REV.]

The Electrical Heating of Factories.

In a recent issue of the *Engineering Magazine*, New York we notice an article by Mr. O. M. Becker on "Factory Efficiency and Heating."

Mr. Becker very rightly contends that the physical environment of the workman directly influences his efficiency, and, consequently, the efficiency of the factory, and then proceeds to argue that to obtain the necessary physical efficiency it is advisable to provide heating for the factory staff by means of exhaust steam.

We are unable to reconcile with his views of efficiency a system which from an engineering point of view, is equivalent to exhausting into the atmosphere, with the attendant losses, too obvious to need dwelling on. A system which makes the workman efficient to the detriment of the economical running of the steam plant is, surely, no system at all.

However, the point which interests us principally is Mr. Becker's light-hearted condemnation of electrical heating. After casually touching upon one or two extremely antiquated methods of works heating, as still practised extensively, and pointing out their disadvantages, he states that "electrical heating presents the same disadvantages, and, besides, is usually too costly, except under special conditions."

His statement as to electrical disadvantages would require considerable substantiation before convincing anyone who knew anything of modern electric heating, but his article is evidently written with the primary object of boosting that branch of heating in which he is himself interested.

As to the question of cost, Mr. Becker, if he wishes, can easily convince himself that, under modern conditions of generation, electricity can be, and is, supplied in all large industrial centres at rates which render electrical heating a sound commercial and engineering proposition.

The Bastian Electric Co., Ltd.

JAS. BASTIAN, Sales Manager.

London. W., August 25th, 1916.

To Go—or Not to Go?

I am in an unsettled state of mind as to the course I should now adopt with regard to my future, and accordingly beg to invite your views.

I am an all-round man, i.e., I have had experience in machine shops, power, lighting, telephones, &c., and at present hold the position of foreman of the testing department with a large firm of electrical manufacturers.

I am fair technically, with a good commercial experience, of good personality, and a capable interviewer; of sober habits, cool and level-headed; well accustomed to the handling of labour. I have a fair command of the French language.

Summarised: Would it be better to decide to settle in this country or prepare to "get out"?

Wishing your valuable paper the success it deserves, and thanking you, &c.

Unsettled.

[To advise a man on a matter of so tremendous an importance—to him—is difficult and dangerous. Who can tell what the future may bring forth? For ourselves, we have infinite confidence in the ability of the Old Country to weather any storm, and we believe that a period of prosperity lies ahead. We should be very sorry to hear that our correspondent was leaving this country; he is the sort of man who will be indispensable to us when peace returns. Perhaps other correspondents will favour us with their views upon this subject.—EDS. ELEC. REV.]

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

ARGENTINA.—The valuations for the purpose of assessing the duties on articles imported into the Argentine Republic are fixed by a Valuation Tariff established in 1906, taken to represent the value of each class of merchandise imported. The Tariff of 1906 classified some 3,700 articles, but it has since been found necessary to value, by analogy, 1,500 other items; and owing to the very considerable changes which have taken place in costs and freights, the present tariff

valuations do not correspond in the majority of cases to actual c.i.f. values.

The question of revising these valuations has been under consideration on several occasions, and a Bill has passed the Senate and been favourably recommended to Congress for the establishment of a permanent Board of Appraisers. Anticipating action by Congress, however, reports H.M. Commercial Attaché at Buenos Aires, the Argentine Government have appointed a Commission, composed of representatives of the Departments of Foreign Affairs, Finance, Agriculture, and Customs, to draw up a revised schedule of valuations for all imports, including those which figure in the Tariff of 1906 and also subsequent additions. Representatives of local industrial, agricultural and commercial interests will also be appointed to the Commission, but will not have the right to vote.

The Commission will collect all data necessary as to the cost and freight of each article, and will obtain expert technical opinions when necessary.

Fifteen days' notice is to be given of the intention to consider the valuation of specific articles, and after a rate has been provisionally adopted a period of 30 days will be allowed for the presentation of objections, which the Commission will take under consideration before proceeding to make their recommendations.

The Commission will only consider representations which are confined to proving the real c.i.f. value of goods at Argentine ports.

British exporters of merchandise to the Argentine Republic who take exception to the present valuation of their goods for import duty should instruct their representatives in the Republic to bring their views before the Commission.

SOUTHERN RHODESIA.—A Customs Decision has been issued recently to the effect that incandescent bulbs for pocket electric torches are classed under Tariff heading 1145, and accordingly are dutiable at the rate of 3 per cent. *ad val.* under the General Tariff. Goods manufactured within the Empire are, however, admitted free under the Preferential Tariff.

RUSSIA.—A Decree dated June 22nd/July 5th has been published in the official *Bulletin of Laws*, of Petrograd, giving a list of the machines, apparatus, appliances, &c., which are to be admitted, for a period of ten years, free of Customs duties, for the requirements of the Siberian and Ural gold mining industries, in accordance with the Imperial Decree of May 13th/26th last—see the REVIEW of July 14th. The following are included in the list:—

1. Dredges complete.
2. In dredges driven by electricity: dynamos, electric motors with cables and distributing arrangements; protecting and measuring appliances; transformers; electric stations, to be placed on the river bank or in barges and developing power for the engines on the dredge: all steam engines, boilers, motors at the station, electric generators, power conducting apparatus, and in general everything necessary for the fitting up of the station.
3. Parts of dredges, viz. (f): parts of electrical equipment for electrical dredges: electric stations on the bank or on a special barge for serving the dredge (engines, dynamos, switchboards, protecting and measuring appliances, transformers, cables, electro-motors).
4. Excavators complete.
5. Parts of excavators, including electric locomotives and parts of same.
6. Apparatus and mechanism for prospecting dredging areas: including all kinds of drilling apparatus (including those worked by electrical power) with all accessories.
7. Parts of the above-mentioned apparatuses (clause 6), including electro-motors, rheostats, and dynamos.
8. Apparatus, appliances, machines, &c., for crushing gold ores and for extracting from them gold by chemical processes.
9. Parts of above-mentioned apparatus (clause 8).

It is officially announced that the Council of Ministers has approved a proposal submitted by the Minister of Commerce to prohibit the transit through Russia of goods the exportation of which from the Empire is prohibited.

FRENCH INDO-CHINA.—The French Government have notified H.M. Ambassador in Paris that for the period of the duration of hostilities, British goods exported from the United Kingdom to Indo-China, on *British, French or Japanese* vessels, will, in the under-mentioned circumstances, be accorded the Tariff treatment to which they would be entitled if they were transported direct (*i.e.*, they will obtain the benefit of the "Minimum" Tariff rates of duty):—

(a) If the goods are dispatched from Great Britain direct or with transshipment in a French port, without subsequent transshipment;

(b) If the goods are dispatched from a French port, without subsequent transshipment;

(c) If the goods are dispatched from a port in Great Britain, with or without transshipment at Marseilles, but with transshipment at Singapore or at Hong-Kong, subject to the necessary "authorisation" being given by the French Consul-General in London, and provided that the goods are transhipped at Singapore on vessels of the subsidiary line of the Messageries Maritimes, and at Hong-Kong on French vessels. A Consular certificate establishing the regularity of the transshipment must be produced.

(d) If the goods are dispatched from a French port with transshipment at Singapore or at Hong-Kong, under the same conditions of transport as are specified in the preceding paragraph, from the port of transshipment to the port in Indo-China.

The Note from the French Government in which this information is conveyed adds that, as the concession is based on the frequent impossibility (under present conditions) of loading British goods on French vessels (for direct transport to Indo-China), the "authorisation" of the French Consul-General in London cannot be dispensed with, and British exporters must, accordingly, obtain such "authorisation" for each consignment of goods.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 11,439 "Adjustable rest for telephone receiver." J. B. BAILLIE. August 14th.
- 11,453 "Clips or gripping appliances for moving traction cables, endless rope systems, &c." A. PARRY. August 14th.
- 11,465 "Telegraphy." E. S. HEURTELEY. August 14th.
- 11,503 "Electric cable connecting boxes, fuse switch boxes, dividing boxes, &c." R. W. BROWN AND BRITISH INSULATED & HELSBY CABLES, LTD. August 15th.
- 11,520 "Apparatus for closing and locking gates, &c., by electrical means." J. P. SNEY. August 15th.
- 11,533 "Selenium cell." ECONOMIC CAR LIGHT, LTD., & W. W. LEWIS. August 15th.
- 11,537 "Apparatus for signalling or telegraphing." T. McLEOD. August 15th.
- 11,548 "Spark plugs." G. J. KNUTSON. August 15th.
- 11,554 "Electro-magnetic pneumatic furnace." A. TURNER. August 16th.
- 11,565 "Fluid containers or holders, and fabrics for same." BRITISH INSULATED & HELSBY CABLES, LTD. August 16th.
- 11,569 "Contact breakers for magnetos, &c." H. KERN. August 16th.
- 11,581 "Electric lamps." F. WESTWOOD. August 16th.
- 11,604 "Automatic and semi-automatic telephone systems." W. AITKEN AND THE RELAY AUTOMATIC TELEPHONE CO. August 16th.
- 11,605 "Automatic and semi-automatic telephone systems." W. AITKEN AND THE RELAY AUTOMATIC TELEPHONE CO. August 16th.
- 11,617 "Electrically-operated indicator mechanism." W. R. SYKES INTER-LOCKING SIGNAL CO. & R. W. TARRANT. August 16th.
- 11,623 "Electric furnaces." SOC. ELECTRO-METALLURGIQUE FRANCAISE AND D. F. CAMPBELL. August 16th.
- 11,643 "Sparkling plug for internal-combustion engines." J. KNIGHT. August 17th.
- 11,658 "Means for telephonic communication to and from moving railway trains, &c." K. H. WARFINGE & V. G. WERNER. August 17th. (Sweden, August 27th, 1915.)
- 11,683 "Ships', &c., electric telegraphic apparatus." C. H. WOODWARD AND W. CHADBURN. August 17th.
- 11,684 "Submarine electric leakage telegraphy." SIGNAL GES. August 17th.
- 11,691 "Magneto-ignition systems." SOC. DE PARIS ET DU RHONE. August 17th. (France, December 6th, 1915.)
- 11,707 "Ships' pneumatic telegraphic apparatus." W. CHADBURN. August 18th.
- 11,713 "Electric lamp holders." BIRMINGHAM ELECTRICAL ACCESSORIES MANUFACTURING CO. & C. E. GARRETT. August 18th.
- 11,730 "Pocket or portable electric lamp." W. KING & B. THEODOR. August 18th.
- 11,740 "Prepayment electricity meters." LANDIS & GYR SOC. ANON. August 18th. (Switzerland, September 18th, 1915.)
- 11,743 "Ignition systems for internal-combustion engines." F. HOLDEN. August 18th.
- 11,752 "Electric motor gyroscopes." CRUCIBLE STEEL CO. OF AMERICA. August 18th. (U.S.A., April 3rd, 1915.)
- 11,759 "Electric motor gyroscopes." CRUCIBLE STEEL CO. OF AMERICA. August 19th. (U.S.A., November 3rd, 1915.)
- 11,787 "Sparkling plugs for internal-combustion engines." W. A. CLARK, H. C. LONGFORD, W. W. LONGFORD & THE SPINX MANUFACTURING CO. August 19th.
- 11,789 "Electric transformers." BRITISH ELECTRIC TRANSFORMER CO. AND S. C. MOUNT. August 19th.
- 11,804 "Varying frequency of alternating electric currents." A. ROLFE. August 19th.
- 11,807 "Producing electric oscillations." R. E. GILLMOR (Sperry Gyroscope Co.). August 19th.
- 11,812 "Electric lifting magnets." A. WEST AND A. WEST & CO. August 19th.

PUBLISHED SPECIFICATIONS.

1914.

- 15,690. ELECTRO-MAGNETIC FRICTION CLUTCHES. J. Bing. June 30th.

1915.

- 6,408. DRIVING AND REGULATING OF TALKING MACHINES. British Thomson-Houston Co. (General Electric Co., U.S.A.). April 29th.
- 8,537. ELECTRICAL HEATER. W. J. Kerr. June 9th. (December 7th, 1915.)
- 11,321. STARTING AND SYNCHRONISING OF DYAMO-ELECTRIC MACHINES. British Thomson-Houston Co. & F. P. Whitaker. August 5th.
- 11,976. TELEPHONE TRANSMITTERS. J. Liddle (Universal High-power Telephone Co., U.S.A.). August 19th.
- 12,075. SEALING MEANS, MORE PARTICULARLY FOR USE IN CONNECTION WITH ACCUMULATOR CASES. C. A. Vandervell. August 21st.
- 13,334. OPERATING ROTARY CONVERTERS AND OTHER ALTERNATING-CURRENT MACHINERY. A. H. Railing & C. C. Garrard. October 1st. (Patent of addition not permitted.)
- 14,993. MAGNETO-ELECTRIC MACHINES FOR IGNITION IN INTERNAL-COMBUSTION ENGINES. M. S. Conner. October 23rd.
- 15,873. SPARKING ARRANGEMENTS FOR ELECTRIC IGNITION DEVICES. H. W. F. Ireland. November 10th.
- 17,910. CONSTRUCTION OF SPARKING PLUG FOR INTERNAL-COMBUSTION ENGINES. A. E. Heath. December 22nd.

1916.

- 3,707. SYSTEMS FOR THE PROTECTION OF ELECTRIC CABLES IN THE EVENT OF EXTERNAL DAMAGE. C. J. Beaver & E. A. Claremont. March 13th. (Addition to 8,574.) (100,978.)
- 5,061. TELEPHONE INSTRUMENTS. E. A. Petithory. April 6th, 1916. (100,987.)

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LABOUR PROBLEMS.

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1916 EDITION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE Trade Union Congress, which opened at Birmingham on Monday last, has had to consider problems which render the meeting perhaps the most important of its kind that has ever been held. The industrial organisation of this country, the relations between Capital and Labour, the very constitution of Labour itself, are in the melting-pot, and into what forms they will be moulded when peace returns we cannot tell. That there will be fundamental changes in all these factors of the industrial situation is so obvious as to have become a platitude; we earnestly hope that they will be so ordered as to establish our industries on new and firmer foundations, having for a basis the cordial co-operation of all parties for the promotion of the national welfare.

Before the war the attitude of the Trade Unions towards society in general gave many the impression that Labour looked, and in time of emergency would look, solely to its own interests, and would seek peace at any price. But, happily for the nation and the Empire, the workers proved true to their race, and manfully shouldered the burdens which press so heavily upon them; the charges brought against them of want of patriotism have been gloriously refuted on the field of battle and in the workshops at home. With their support assured, the outcome of the war is not open to question.

But the war must come to an end, and the new conditions which will then obtain demand the most careful attention and the utmost foresight on the part of the Government, the employers, and the Labour leaders. We are glad to note that in his presidential address to the Congress Mr. H. Gosling emphasises the importance of immediate preparation to meet the needs of the situation, in order to avoid the catastrophe which would result from the discharge of millions of men from both military and civil employment without adequate provision for the resumption of their normal occupations. That the process will be made as smooth and gradual as possible goes without saying, but nevertheless the strain will be severe—and it may come sooner than we expect. It will make the heaviest demands upon the patience and forbearance of the men and women thus set free, and we welcome the spirit in which Mr. Gosling invites the Trade Unions to grapple with the problems that will arise. He strikes the right note when he appeals for the cessation of industrial strife, and the cultivation of a new spirit of conciliation and harmony between employers and employed. There have been faults on both sides in the past; the eyes of the nation have been opened as never before to the folly and wastefulness of antagonism between Capital and Labour, which are mutually indispensable and inseparable, and the two parties have been brought into the most intimate contact, and have learnt to appreciate each the good points in the other. The time is favourable to a real and lasting *rapprochement* between them, and the policy which has been adopted by the Government of allying the forces of the State with the efforts of industry, to shut out unfair competition and to increase production, will go far to enable the crisis to be safely passed and our industries re-established on a durable foundation. Employers will realise that high wages and a high standard of living are not incompatible with commercial success; workers will have learnt, as their leaders have

already done, that restriction of output is contrary to their own and the public welfare, and they will give a fair day's work for a fair day's pay. Great strides have been made towards the realisation of a higher standard of comfort in the workshops, and more salutary conditions of working, which result in improved efficiency, and the spirit of enterprise and progress has been revived. We look forward to the future with confidence renewed, trusting in the maintenance of the new ideas and feelings which have been called into being by the fierce discipline of war.

The Financing of Russian Industries.

A DEVELOPMENT of the German practice in the matter of investment or financial trusts is reported as being projected in Russia for the electrical and mechanical engineering industries in that country. Although emanating from a German source, the report is nevertheless of interest in Great Britain, and is of too circumstantial a character to be entirely ignored. We learn, for instance, that the International Commercial Bank, of Petrograd, the Russo-Asiatic Bank, and the Russian Bank for Foreign Trade, together with the banking firms of Rjabuschinski and Meyer & Co., and certain Belgian financial interests, have formed a syndicate and approached the Ministry of Finance for sanction to establish a joint stock bank for the creation and advancement of electricity supply undertakings and mechanical enterprises. The special objects of the bank, which is to have an initial capital of £500,000, soon to be increased to £1,000,000, are stated to relate to the acquisition and utilisation of waterfalls for the production of electrical energy, the grant of short-term credits to electrical and mechanical undertakings, the erection of works for the construction of engines, motor-cars, and aeroplanes, and the conversion into limited companies of undertakings belonging to private individuals. It would seem that although the report refers to erection and construction, the underlying principle is that of financially promoting these objects. The bank also intends to enter into arrangements with the Russian Copper Syndicate Medj for the purpose of ensuring deliveries of copper to the electrical works with which the institution is to be associated. The promotion of works for the manufacture of telephone apparatus and glow lamps is also held in prospect, together with the amalgamation of existing private factories of limited size, and their transformation into companies.

It is well to bear in mind that different Government departments in Russia as a general rule have to express opinions on applications made with a view to securing Government sanction to the formation of joint stock companies. It is asserted that the scheme has met with the disapproval of the Minister of Commerce, who informed the promoters that it was feared that the drawing upon large financial resources for electrical undertakings might easily become a hindrance to the municipalisation of these undertakings, which was authorised by law. In any case, the procuring of private capital for the working of generating stations and tramways must be hindered. It was very much to be regretted, the Minister continued, that the Russian commercial banks were so reserved in the granting of loans of short duration to cities, even in cases where the Government guarantee was given; and it must almost be assumed that this attitude represented the endeavour to oppose the municipalisation of large electrical undertakings. The Minister is, further, reported to have stated that the proposed participation of foreign (Belgian) capital in financial enterprise did not correspond with the repeatedly ex-

pressed view of the Government, who wished to reserve to native capital the work of utilising the national resources—in this case, water power.

The Ministry of Finance, on the other hand, is declared to have adopted a non-antagonistic attitude towards the scheme. In any case, a matter of so great moment will be left to the decision of the Ministerial Council, a decision which should be of great international importance.

Rubber.

THE outlook in crude rubber is still very disappointing, although the time of year has already been reached when signs of an improving demand usually become perceptible in connection with autumn trade requirements. Preparations in that direction are not unlikely to be put off this year, at least for a time, while the manufacturing trades on both sides of the Atlantic are confronted with so many uncertainties, which must necessarily induce much more caution on the part of consumers. As it is, the latter in many cases appear to hold good stocks due to the fact that their operations have been somewhat checked by apprehensions as to a curtailment of the outlet for their products. The nursing of excessive supplies acquired at higher prices is rather a costly matter under the present stringent monetary conditions, and this feature constitutes an additional disturbing factor, although it is premature to infer that anything like important quantities will come on re-sale. For the present, all indications point to a restriction of the outlet for manufactured rubber, and the policy of buyers of raw rubber is to go slow until the outlook becomes clearer. There is no mistaking the fact that conditions in the United States have grown worse, so that the falling-off in the demand from that quarter is not to be wondered at. Industrial enterprise there, at any rate, has become seriously threatened by the Labour unrest which has lately spread to one of the chief rubber manufacturing districts. In addition to this, there is the railway trouble, although the latest advices suggest that a strike will be averted. America, of course, is by far the biggest rubber consumer, hence, until the Labour difficulties have been straightened out, the outlook is viewed with a certain amount of anxiety by rubber holders. The demand recently was not really bad, in fact considerable quantities of the product were taken care of, while the squaring-up on contracts by dealers in the course of August had a temporary steadying effect.

The statistical position is now impaired by accumulations, and this is no doubt calculated to encourage buyers in their reserve, arrivals having assumed rather larger proportions, and it is probable that spot delivery will remain at a discount, while the estates are still reluctant to make concessions for forward contracts, an attitude which is rather puzzling having regard to the changed conditions, inasmuch as there is not much chance of improvement for some time, at any rate. Much, of course, depends on the turn of events in the trans-Atlantic trade, and in the meantime the market must be expected to be put to a somewhat severe test, since unsold supplies coming to this side will have to be financed, which tends to aggravate the want of confidence. The Straits shipments for July were particularly heavy, representing well over 5,000 tons, this making the aggregate from that source over the seven months 28,718 tons, compared with 17,933 tons in 1915, and 10,090 tons in 1914. At this time last year the prices of both plantation No. 1 latex and fine hard Para were practically on the same level, near 2s. 5d. per lb., but whereas the former now stands at well under that figure, the value of hard Para is not much under 3s. per lb., though the quantities of the latter at present dealt in are of no special importance.

INQUIRIES FOR CABLE ACCESSORIES.

By "S. G."

THE above subject is one on which, up to the present, very little, if anything, has appeared in the electrical Press.

During the past ten years or so, this particular branch of electrical work has developed very considerably, and as each year goes by, the users of cable accessories are more particular regarding the design of them.

In view of this, it is but reasonable that engineers should be expected to make their inquiries as clear and as concise as possible.

At present a great number of inquiries are sent to manufacturers, giving insufficient information for them to quote upon.

Very often exceptionally low prices are quoted, "without

If some of the following suggestions were embodied in inquiries, I feel sure many manufacturers would appreciate them very much indeed:—

The voltage should always be stated, especially if for H.T. or E.H.T. work.

The name of the cable manufacturer should be stated, especially if the boxes are required for existing cable.

Full particulars of the cable should be given.

State if the boxes are ordinary "joint" boxes, or if disconnecting; in the latter case, state if fuses or links are required; also state which cables are to be disconnected.

Show links thus $\frac{1}{2}$, and fuses thus $\frac{3}{4}$.

The "lid joint" of disconnecting-boxes is a very important thing, and if any special joint is required, such as "packed joint," "diving bell," or "machine joint," &c., it should be stated.

If the boxes are required for fixing to the wall (and if they are not ordinary "terminal boxes"), it is necessary to

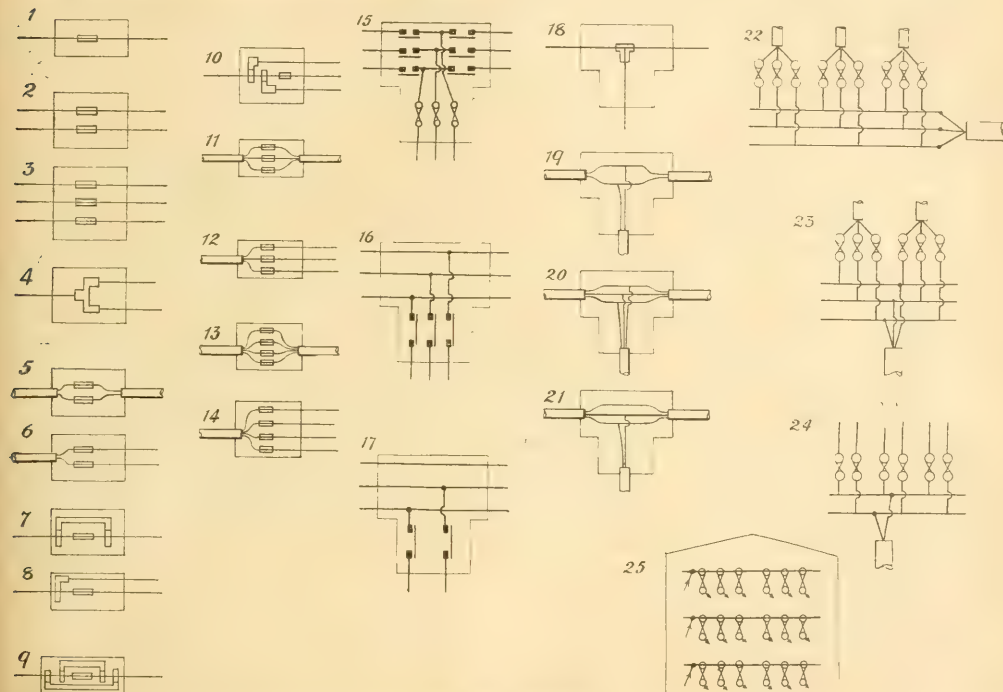


TABLE OF DIAGRAMS.

No. 1. Straight-through non-disconnecting "single." No. 2. Straight-through non-disconnecting "2 singles." No. 3. Straight-through non-disconnecting "3 singles." No. 4.—Straight-through non-disconnecting "two singles off single." No. 5.—Straight-through non-disconnecting "twin." No. 6.—Straight-through non-disconnecting "2 singles off twin." No. 7.—Straight-through non-disconnecting "concentric." No. 8.—Straight-through non-disconnecting "two singles off concentric." No. 9.—Straight-through non-disconnecting "triple-concentric." No. 10.—Straight-through non-disconnecting "3 singles off triple-concentric." No. 11.—Straight-through non-disconnecting "3-core." No. 12.—Straight-through non-disconnecting "3 singles off 3-core." No. 13.—Straight-through non-disconnecting "4-core." No. 14. Straight-through non-disconnecting "4 singles off 4-core." No. 15.—Three-way disconnecting "3 singles all ways, links on main, fuses on branch." No. 16.—Three-way disconnecting "three singles all ways, links on branch only." No. 17.—Three-way disconnecting "3 singles main (3-wire work) links on positive and neutral." No. 18.—Three-way non-disconnecting "single all ways." No. 19.—Three-way non-disconnecting "twin all ways." No. 20.—Three-way non-disconnecting "3-core all ways." No. 21.—Three-way non-disconnecting "3-core main, twin branch." No. 22.—Distribution box "3-way 3-phase" (fused). No. 23.—Distribution box "2-way 3-phase" (fused). No. 24. Distribution box "3-way 2-wire" (fused). No. 25. Three-phase pillar "six-way" (fused).

going into the matter very far," merely to get the order "which may be pending" for cable.

When low prices are quoted in this manner, it is only natural that repeat orders will be given to the same firm. Of course, if there is no cable ordered at the same time, the boxes have to be supplied at a loss.

In order to prevent delay in answering inquiries, due to their not being clear, small sketches or diagrams of connections (as here illustrated) should accompany them, together with a few notes stating definitely what is required, and under what conditions (if special) the boxes are required to work. Not only will the manufacturer thus be treated fairly, but the client will stand a better chance of getting the quotation promptly and correctly.

give a sketch showing the various cables in each gland; that is, supposing the cables are different in size or type. If the box is "three-way," it is necessary to know if the cable on the "tee" leaves at the top or at the bottom; if a "straight through," it is necessary to know if it is to be fixed vertically or horizontally. Inquiries should always state whether compound is required or not.

Sometimes cables are required to be taken out of boxes through pipes, in which case the inquiry should state definitely the size, and whether "conduit" or "ordinary gas pipe."

In connection with "wall terminal boxes," very often bare leads are taken off; this point should be specially mentioned.

When boxes are required to be fitted with troughing sockets, all dimensions of the troughing in use should be given.

If wiring glands are specially required, this point should be specified.

If boxes are required to be "watertight," special mention should be made, and if the customer has any preference, he should state what particular joint he prefers, e.g., "machined joint," "pocket joint," &c.

In the case of "distribution-boxes," it is necessary in almost all instances to send a sketch or diagram of connections.

Customers should bear in mind that manufacturers are not always in a position to supply exactly what is required, and they should give them an opportunity of quoting for standard material or for boxes the patterns of which are already made.

When boxes are required for "mining work," it should be specially stated whether they are required for "underground" use or otherwise. This is very important, as unless it is specially stated, quotations are sent in for boxes suitable for "underground use."

Cable manufacturers, as a rule, manufacture several "classes" or "ranges" of boxes to meet all requirements, and inquiries should state whether a cheap, medium, or very good and serviceable box is required. Some boxes are only required for temporary use, and it cannot be expected that the customer would wish to pay, say, £10 for a box when one at, say, £5 would meet his requirements.

It should be stated whether the cable is armoured, and if "tape," or "single," or "double-wire" armoured (even in the inquiry stage it occurs that full dimensions of the cable are necessary).

Drawings sent for approval are not always treated properly. Instances have occurred where material has been made to approved drawings, but when received has been complained about or rejected every unfair to the manufacturer.

ELECTRIC TRAVELLING CRANES FOR N.S.W. GOVERNMENT.

THANKS to the courtesy of Messrs. Cowans, Sheldon & Co., Ltd., of Carlisle, we are enabled to illustrate one of six large electric travelling cranes recently made by them for the New South Wales Government, all of which have been constructed according to the complete design provided by the purchasers.

The cranes are capable of dealing with loads up to 15 tons at a fixed radius of 55 ft., and the height to the centre of the jib head pulley is 84 ft. above rail. The revolving superstructure is mounted on a high carriage, so as to give a clearance under the jib of 47 ft. at 14 ft. 11 in. from the centre of the crane.

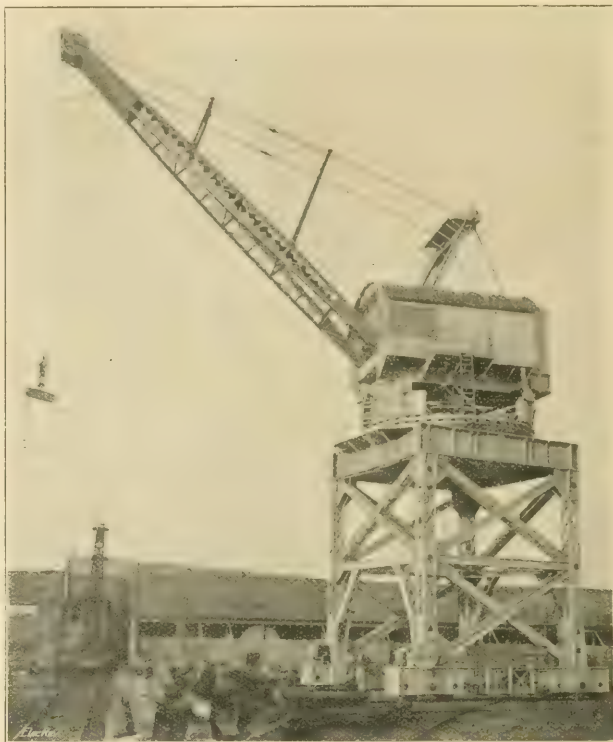
The carriage is arranged to travel on rails laid at 22 ft. 6 in. centres, and has an opening between the rails to allow railway traffic to pass under the crane. The lifting barrels, of which there are two, are driven through two double reductions of spur gearing by two 100-B.H.P. motors, giving a lifting speed with full load of 100 ft. per minute, or, if driven by one motor only, of 50 ft. per minute.

Automatic mechanical brakes of the Weston type and automatic solenoid brakes are fitted on the second motion and armature extension shafts.

The slinging motion is driven by a 25-B.H.P. motor, which gives a speed of 300 ft. per minute at the hook.

The crane is mounted on four pairs of cast-steel rail wheels, one pair of which on each track is driven by a 25-B.H.P. motor through spur gearing arranged to give a speed of 100 ft. per minute.

Each set of control gear is of the contactor type, the



ELECTRIC TRAVELLING CRANE FOR COAL SHIPPING. COWAN & CO.

contactors being mounted on iron frames suitably fixed at the back of the machinery house, and operated by master controllers situated at the driver's position in front of the house.

The whole of the switchgear, including the circuit breakers, ammeter, voltmeter, and connections, is of the ironclad type, mounted on a steel frame, and the complete equipment is arranged to work on direct current at 600 volts. Ample provision has also been made for lighting the crane throughout.

These cranes are for use on the new wharf at Newcastle, N.S.W., for coal-shipping purposes: Australian papers report that tests on the spot showed the anticipated speeds to have been considerably exceeded.

THE SPERRY SEARCHLIGHT.

(Abstract of article by CAPT. ADELNO GIBSON.)

THE one important essential of the projector searchlight lies in the arc source of light, and it has only been recently that any great advancement has been made in this direction. This improvement in the output of the searchlight of a given size lies in the increase of the specific brightness of the light source, which is the brightness per unit area of the light source. It is this tremendous increase of the light source brightness that makes the Sperry lamps so much more powerful than any of the lamps used in the present standard Army and Navy searchlights.

The pure carbon crater has a fairly constant brilliancy of

* Journal of the U.S. Artillery.

approximately 150 c.p. per sq. mm., and it has been considered that this was the highest attainable brilliancy. It is true that this old standard searchlight arc gives the highest brilliancy obtainable from a heat radiating solid, since carbon has the highest melting point of any known element, but this brilliancy has been surpassed in the Sperry arc by making use, in addition to this heated crater surface, of a superheated vapour or gas produced in the arc. This superheated gas is

the vapour into a crater having a much smaller mouth area than in the case of a carbon arc of similar amperage, and this results in a reduced angle spread of the beam which is much more nearly parallel throughout its length. For the standard 150-amp. arc the positive carbon is only $\frac{1}{2}$ in. dia., and the crater diameter somewhat less. The negative carbon diameter is only $\frac{7}{16}$ in., and with its small holder casts very much less shadow on the centre of the mirror, thus adding more reflected light to the beam.

The principle upon which satisfactory operation of this high intensity arc depends is entirely different from what had been previously supposed. It was first believed that current density was the principal factor for the operation of such arcs, but we have found out experimentally by current densities ranging from 100 to 1,000 amp. per sq. mm. that current density is not the controlling factor, but that current value is the important factor.

It is evident that to obtain this highly concentrated light source and at the same time produce constantly a sufficient supply of bright vapour to fill the positive crater, a rapid consumption of the positive electrode is necessary. It is for this reason that the positive carbons are so much longer than those previously used, being 44 in. for the standard 150-amp. arc. In the old type searchlight arc rapid consumption of the positive was not necessary since the gaseous products were not used at all in the production of light, but in the Sperry type of arc this rapid burning of the positive is necessary to provide the light emitting gaseous materials.

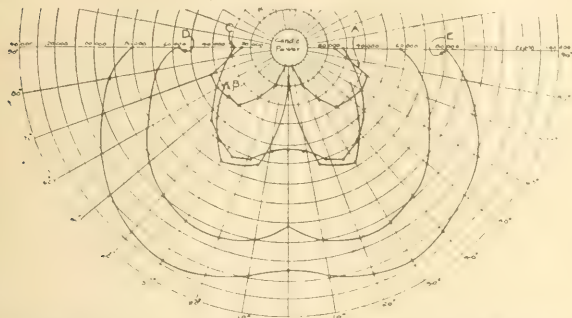


FIG. 1.—CANDLE-POWER DISTRIBUTION CURVES.

formed from certain special materials that are powerful light producers and with which the positive carbon is impregnated.

For the successful use of this bright vapour as a searchlight source, it is necessary that it be concentrated in a very small area. This is accomplished in the Sperry arc by maintaining a very deep crater in the positive carbon and into which crater this bright vapour is kept pressed. This vapour causes the mouth of the crater to emit a very intense illumination running even as high as 500 c.p. per sq. mm. or 320,000 c.p. per sq. in. The force used to keep the vapour pressed back into the crater of the positive is the arc flame from the negative carbon, and is similar to the arc flame used in the old standard searchlight lamps. The arc flame appears as a flame of considerable velocity emanating from the negative carbon, and gives but very little light in either the old or Sperry type of arc as compared with the positive crater.

The following tabulation of the specific brilliancies in c.p. per sq. mm., which is rightly taken as the basis of efficiency-comparison for all arc work, shows the tremendous light intensity of the Sperry arc:—

	c.p. per sq. mm.
1. Ordinary tungsten filament	2.4 to 5.4
2. Ordinary tungsten filament, nitrogen filled ...	10.0 to 20.0
3. Tungsten at the melting point (3,500 deg. C.) ...	72.0
4. Arc flame, ordinary white flame arc	7.0 to 20.0
5. Surface of crater "spot," flame arc positive	50.0 to 90.0
6. Crater surface pure carbon average	150.0
7. The Sperry arc being the the c.p. of dense positive vapour in deep crater of a two-flame arc, special projector electrode	500.0
8. Sun at 30 deg. elevation	775.0

The very high light intensity of the Sperry arc is also indicated by the curves shown in fig. 1. Curve A shows the c.p. distribution of the old type 36-in. searchlight lamp with a maximum of 42,000 c.p. throughout a comparatively small zonal angle, and curve D shows the c.p. distribution of the present Sperry 36-in. searchlight lamp indicating a maximum of 105,000 c.p. with a very wide angle of high intensity.

Another great advantage which the Sperry arc has over the older form lies in the very great reduction in area of the light-giving source or crater.

It is possible by using this new type of arc to concentrate

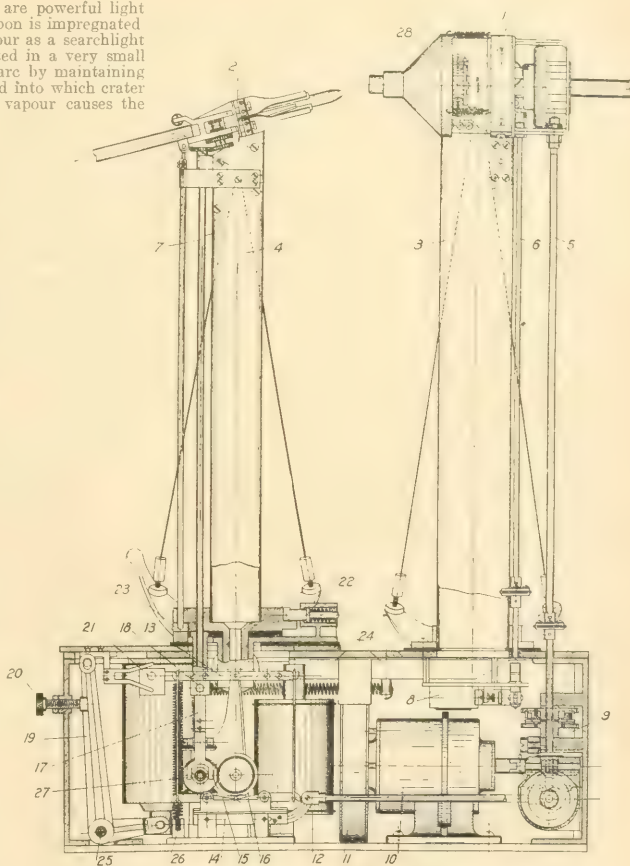


FIG. 2.—SPERRY SEARCHLIGHT OPERATING MECHANISM.

The Sperry Gyroscope Co., after two years' experimenting with this new form of arc, are now manufacturing projector searchlights giving a c.p. intensity at the arc corresponding to that shown in fig. 1 for the 36-in. size, and which, with an accompanying reduction in the divergence of the beam, gives an illumination on the target of six times that

in a small brass composition box with overall dimensions of about 3 in. wide by 3 in. high and 5 in. long, and a total weight of about 7 lb.

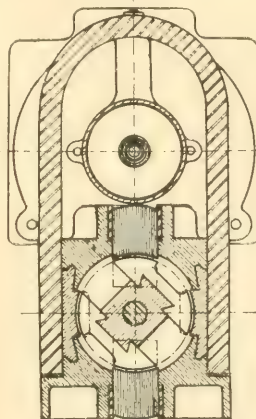
In operation of the hand controller, the pointer is kept in the direction to which the beam of the searchlight is to be trained. The vertical and the horizontal training motors are series wound, and both have the same system of speed control. By means of a double contact arrangement, two speeds are provided for each motor. On the first, or slow-speed contact, resistance is placed in series with the motor armature; on the second, or high-speed contact, all the resistance is cut out. The second or high-speed is about three times the first or slow-speed.

This controller is connected by an interior communication cable to the operating mechanism at the base of the searchlight, by means of which the drum is turned in azimuth or elevated or depressed, corresponding to the movement of the controller handle at the distant station.

A very important advance in this work has been in the manufacture in this country of carbons suitable for such searchlight arcs. Formerly the only source of supply of carbons suitable for these results was Germany, but after many months of co-operative work between the largest carbon manufacturers of this country and the Sperry Co., the latter is now able to manufacture superior carbons for this purpose.

The Sperry Gyroscope Co., which has developed this arc, is now using it in searchlights of 24-, 30-, 36-, and 60-in. dia. In addition, the Sperry lamps are being installed in old searchlights, replacing the old form of arc.

The supplementary pole pieces, which are made of soft-iron laminations, are also die-cast in their aluminum cases, and it will be seen from the lengthwise sectional drawing that the laminations extend a good distance behind the horse-shoe. It is between the ends of these projecting supplementary pole pieces that the coil unit is placed; this consists of a soft-iron core, having a L.T. and a H.T. winding; there is thus a magnetic circuit from one of the supplementary pole pieces through the core of the coil and back via the other supplementary pole piece. When the armature is in the corresponding position, the magnetic circuit passes from one main pole through a segment of the armature to one of the secondary poles, thence through the core of the coil unit, and back via the second supplementary pole piece, opposite armature segment and other main pole. It is now possible to explain the condenser effect of this circuit. When



SECTION OF MAGNETO SHOWING UNBOUND ARMATURE CONSTRUCTION.

THE BERKSHIRE IGNITION MAGNETO.

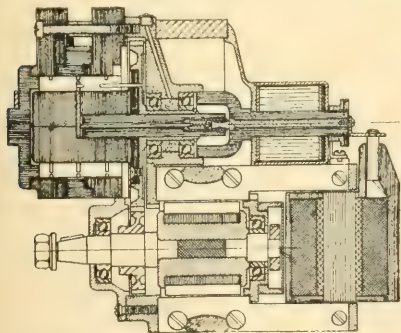
At a time when a good deal of attention is being devoted in the United Kingdom to the question of ignition magneto manufacture, to remove the dependency on German-made machines of the British motor-car industry which existed prior to the war, considerable interest attaches to any new design of magneto that may be introduced, especially when such new design embodies novel features, as is the case with the "Berkshire" machine, which has recently been brought out by the Berkshire Magneto Co., of Pittsfield, Mass., U.S.A.

One of the principal claims made for this new magneto is that, while it gives a strong spark at low speeds, and thus ensures easy starting of the engine to which it is attached, the power of the discharge increases at a lesser rate than the speed. It is, of course, possible to have too hot an ignition spark; if the high-speed discharge is very intense, it has a destructive action on the points of the sparking plugs and the contact breaker, and puts an undue strain on the condenser and the insulation.

Owing to the peculiar magnetic circuit of the machine under notice, it is claimed that the discharge current reaches

the armature is rotating, the passing of the iron portion across the faces of the pole pieces sends a series of magnetic "charges" into the projecting portions of the supplementary poles. Through the air surrounding the latter, a certain amount of magnetic leakage can take place, so that the upper and lower supplementary poles may be regarded as the inner and outer coating of the condenser. The air gap provides a constant leak or discharge resistance, so that the flux which passes through the core of the coil unit cannot be increased above a certain point.

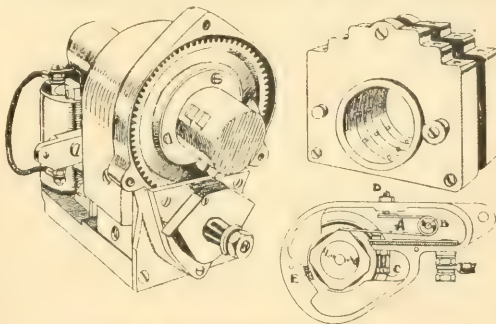
From the sectional drawings, it will be observed that a condenser is contained in a small round case mounted on top of the upper supplementary pole piece; thence the H.T. current passes to the central member of the distributor which



SECTION OF BERKSHIRE 12-CYLINDER MAGNETO.

one half of its maximum amount at a speed of 50 R.P.M., while at 150 R.P.M. it has attained 80 per cent. of the maximum intensity. This means that the spark produced at 150 R.P.M. is practically identical with the spark at 3,000 R.P.M.

Another feature of the machine is that there are no windings, either low or high-tension, on the armature. In fact, the only rotating member which carries electric current is the internal portion of the distributor. The horse-shoe magnet has two poles, while two supplementary poles of soft iron are placed in the mouth of the horse-shoe, these being magnetically insulated by aluminium. In the accompanying transverse sectional drawing of the magneto, it will be seen that there are four deep grooves in the armature. By this arrangement the four iron portions of the armature are made to correspond to the pair of main poles and the pair of supplementary poles in the field magnet. The iron parts of the armature are held together, and also magnetically insulated, by aluminium, the driving shaft and the armature pole pieces being locked together by a die-casting process.



DETAILS OF CONTACT-BREAKER AND H.T. DISTRIBUTOR.

carries a number of brass segments corresponding to the number of cylinders of the engine. In the outer part of the distributor are brass pins; between the pins and the rotating sectors, however, there is no actual contact, the current jumping across a very small air gap; the safety gap is contained within the distributor.

Turning to some of the mechanical details of the machine, the contact-breaker mechanism is interesting, the method of adjustment being on novel lines. The spring A is one continuous piece of steel, wrapping round the pin B, means of adjustment being provided at the points C and D. The lower, insulated, platinum point is carried on a small strip of spring steel backed by a stout strip of red fibre. The upper screw D adjusts the tension of the contact-breaker spring, and the lower screw controls the position of the contact-breaker

points. The valve gear mechanism is so arranged that it can be set for a certain amount of adjustment for any one of the four spark systems by removing a coupling screw.

The complete machine, however, includes a four-spark pattern for four and six-cylinder engines, and four-spark models for four, six, eight, and 12-cylinder motors. The construction is claimed to be particularly well adapted to the four-spark system, the machine, of course, then running at half the speed of the two-spark type. The makers point out that another advantage of the four-spark system is that it provides a six-cylinder magnet with a very wide range of adjustment, 45 deg. being easily obtainable, this being 45 deg. on the crankshaft. This wide range, coupled with the automatic limitation of spark intensity, gives, it is claimed, all the advantages of battery systems of ignition at low speed and of wound-armature magnets at high speeds, with a practical elimination of the ordinary disadvantages of both.

Finally, it may be mentioned that the new machines are characterised by light weight and strong mechanical details, and that, electrically and mechanically, they are excellent manufacturing propositions. The solid, unwound armature, for example, can be made a close fit within the magnet poles without any difficulty; the coil unit is easy to wind, and nearly all the non-magnetic parts readily lend themselves to production by die-casting.

OIL ENGINES AND STEAM ENGINES IN COMBINATION.

Abstract of Paper read before the DIESEL ENGINE CLUBS ASSOCIATION by GEORGE PORTER.

My object is to discuss some of the problems met with in extending a comparatively inefficient generating station of the "lighting load" order with a plant capacity round about 1,500 kW. and equipped with steam engines, some with condensers and some without, there are dozens of such stations dotted about the country, from 12 to 20 years old.

Some five or six years ago several papers were read, in which were discussed the advantages to be gained by the use of the Diesel engine. Some of the writers I think, rather over-stated their claims, and all conclusions were based chiefly on results obtained on the Continent with plant manufactured by Continental firms.

Now, however, the Diesel engine is making good headway; manufacturers and users have gained experience; the fuel oil question is in a fair way to being solved by utilising the products of the distillation of coal; and though the capital cost is, and will probably continue to be, high, the essence of the problem, *i.e.*, the balance in hand to credit of net revenue account in the annual balance-sheet, is found to improve in proportion to the use of the Diesel engine. The mixed stations have justified the wisdom of their engineers during the present extremely difficult times; but for their efficient oil engines many of them would be in a bankrupt condition to-day.

The capital expenditure on three specified stations up to the time when Diesel engines were put down, was (for generating plant only) as follows, *viz.*—

Station "A," £291 per kW.; Station "B," £280 per kW.; Station "C," £398 per kW.

Stations "A" and "C" condense the exhaust steam. Station "B" is a non-condensing station. The overall thermal efficiency of the three steam plants in the year prior to the adoption of Diesel engines was: Station "A," 19.5 per cent.; Station "B," 6.1 per cent.; Station "C," 2.6 per cent.

These results are not very encouraging when one considers the money that has been put into the plant in each case. Nevertheless, the figures are typical of stations of their class.

This thermal efficiency is arrived at by calculating the British thermal units equivalent to the units generated at the dynamo terminals (dividing 3,412 B.T.H.U.'s per B.O.T. unit) and working out the total as a percentage of the B.T.H.U.'s in the quantity of coal consumed. The figures given are not absolutely accurate, owing to the heat-values of the coals used not being certain.

As one can speak most fully from one's own experience, I trust I may be forgiven if I analyse the various figures tabulated for Station "A." In 1911, extensions of plant became imperative; what had been done in the past and the possibilities of the future were very carefully considered.

The capital expenditure on generating plant up to the end of the financial year 1910-11 was as under:—

ENGINE-ROOM PLANT.		
Engines, dynamos, and foundations ...	£1,600	£115.2 per KW.
Condensing plant and pipework ...	1,700	
BOILER-HOUSE PLANT.		
Boilers and their brick settings ... (nominal evaporation, 36,000 lb. per hour)	£3,602	£13.9 per KW.
Feed-pump, injectors, and pipework ...	1,500	
Chimney, economiser, and flues ...	2,100	
Gross capital expenditure ...	£291	
		£291 per KW.

On this outlay the annual charges for interest and redemption of capital amounted approximately to £1,200 or £2.25 per kW. installed.

On the other side of the account, 1 kW. of maximum load on the feeders produced (in 1910-11) 1,243 units, equivalent to about £21. Hence the capital charges on the steam raising and steam plant above described are as much as 19 per cent of the earnings. (Annual load factor 41.2 per cent.)

After consideration it was decided to extend the plant with Diesel engines. At the time an addition of 500 kW. was required, and it was decided to divide the capacity between two engines, firstly because a better "running plant" load factor could be obtained in this way; and, secondly, from motives of caution.

The capital cost of the extension worked out at £1,625 per kW. Two years after a third engine was obtained coupled to a 250 kW. dynamo at a capital cost of £1,927 per kW. In all the capital expenditure was £18.13 per kW. for 3,100 kW. capacity.

Station "B" spent £26.7 per kW. for 600 kW. and Station "C" assumed £18.06 per kW. for 340 kW. of plant. Local circumstances entailed a very heavy expense for foundations in the case of "B," while plant was more expensive in first cost than at the time when "I" was in the market. "B" profited by other people's experience in the matter of "accessories," and wisely spent rather more money on them—notably, on fuel oil storage tanks. "C" adopted engines and dynamos which required large foundations, with the result that the gross capital outlay was rather greater than it was in Station "A."

An equivalent steam plant for "A" would have necessitated an outlay of £7,450, equivalent to £14.8 per kW. The annual charges for interest and repayment of principal would have been £177 less for a steam plant than for a Diesel plant.

On a "running plant" load factor of 65 per cent., and with coal of about 13,000 B.T.H.U.'s per lb., I expected to produce 500 units, more or less, to a ton of coal—taking the whole steam plant into consideration. Inquiries in several quarters led me to expect confidently that a Diesel engine, under the same load-factor conditions,

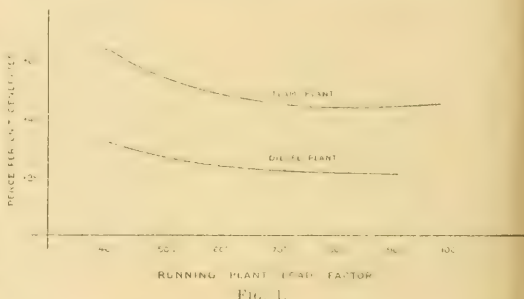


FIG. 1.

would deliver 3,200 units per ton of fuel oil of 17,500 B.T.H.U.'s per lb. Assuming a price ratio of 24 to 1 between oil and coal (as it was approximately for "A" in 1910 to 1911), there was a large margin in the earning capabilities of the two types of plant to cover the difference in the annual charges.

The problem was, however, complicated by the existence of the original steam plant, in conjunction with which the Diesel engines would be required to work. Undoubtedly the boldest course to adopt would have been to write off a part at least of the steam equipment. This plan was considered, but the sum required for the purpose was too great for the finances of the undertaking to bear.

Had more steam plant been added to the old, and allowing for a much shorter loan period and a higher rate of interest, the annual combined capital charges would have amounted to £1,662 per kW. of plant. The earning powers of one kW. were not expected to increase. The total capital cost would have become £221 per kW.

The following returns give some important figures for "A":—

Year.	Revenue per kw. of max. load.	Gross profit per kw. of max. load.	
1910-11	£21.2	£11.3	Steam plant only.
1911-12	20.4	10.4	Part Diesel about 2 months.
1912-13	19.1	11.1	Diesel plant 82.2 % of output.
1913-14	20.0	11.8	" .. 80
1914-15	27.3	14.9	" .. 91.7
1915-16	23.2	14.1	" .. 98

In the first column the revenue per kW. of maximum demand on feeders was artificially increased by the maximum output falling off during the last two periods, owing to restrictions, more rapidly than did the number of units sold. In the second column the figures of gross profit were adversely affected by the steam "stand-by" charges, two boilers being kept up for the greater part of the time in case of Diesel engine failures. During the last two years in the table the boiler house was entirely shut up, except for a month or so. There is no doubt that the efficient working of the Diesel engines effected a marked increase in the gross profit per kW. of maximum demand on the plant. In the year 1912-13 the tendency of the gross profit had begun to counteract the downward trend of the revenue curve.

An examination of the figures quoted shows that the lower cost of operating a Diesel engine plant quickly extinguishes the higher

annual charges for capital, although in the case of "A" the steam plant has an advantage of £.33 per kw. in respect of capital charges.

Five years ago opinions differed as to the feasibility of a Diesel engine in a "mixed" station. I think it is now the general practice to work the Diesel engines "for all they are worth," and to keep the steam engines in reserve.

A comparison of the generating costs of the three stations before and after adopting Diesel engines is instructive:—"A" shows a reduction of 35.5d. per unit generated; "B" shows a reduction of 10.6d. per unit generated; "C" shows a reduction of 27.6d. per unit generated; these figures being obtained in the face of rising fuel prices. Similarly the overall thermal efficiencies have improved:—"A": Thermal efficiency rose from 4.93 per cent. to 22.6 per cent.; "B": Thermal efficiency rose from 6.1 per cent. to 10.5 per cent.; "C": Thermal efficiency rose from 2.6 per cent. to 6.5 per cent. These figures depend, of course, on the proportion of the units generated by oil as a percentage of the total units generated. "B" having a steam plant of five times the capacity of its oil installation, was obviously unable to make so great a reduction as was "A," where the proportion was, roughly, 1 to 1; and "C," 1 1/2 to 1. The greatest reductions are in the items fuel, wages and repairs.

The cost of fuel per unit generated for station "A" at various load factors for the steam and oil sections of the plant is shown graphically in fig. 1. Coal costs 18s. 3d. per ton, fuel oil was at 64s. per ton. The figures are taken from the ordinary weekly records, and are the result of every-day running conditions.

From approximately full load down to half load there is a drop of 6.3 per cent. in the steam figures, and over a corresponding series there is one of 20 per cent. in the oil figures.

A statement of some of the "vital statistics" of eight generating stations having both steam and oil plants may be of interest: it shows a general tendency towards improvement in the financial position since the Diesel engine was adopted.

Station.	Reduction in fuel cost per unit generated.	Gross profit per kw. of max. load before adoption.	Gross profit per kw. max. load after adoption.
1	31d.	£11.3	14.1
2	25d.	9.9	10.7
3	26d.	8.8	11.3
4	18d.	11.1	15.2
5	29d.	10.7	6.9
6	21d.	8.4	10.2
7	11d.	9.8	11.5
8	66d.	13.4	15.1

The Diesel engine has this important advantage over the steam equipment. If valves are leaking and adjustments are not in order, the fact becomes quickly obvious. The indications on the gauges (and there are not many of them) draw one's attention to irregularities.

But a steam engine may run beautifully to the outward eye and ear although piston valves and piston rings may leak, and the valve settings may be wrong owing to eccentric strap wear; the boiler settings may be drawing many cubic feet of air into the flues; the fires may be too thick or too thin. In very many cases, provided the main steam gauge is showing about the correct steam pressure, there is a general feeling of satisfaction with the aspect of affairs.

Personally, I managed to improve the steam costs of "A" by 20 per cent. or so by the aid of flue thermometers, draught gauges, flue gas analysers, and graduated staffs in the boiler-feed water tanks; but even at that the benefit was but a fraction of that gained by purchasing plant that was inherently more efficient from the thermal point of view. Putting the three things together, capital charges, running costs, and gross profits, the advantage accruing from the use of the Diesel engine for installations within the limit indicated in this paper is manifest. The figures quoted for "A" showed the combined annual capital charges for fuel and redemption to be £1.95 for a mixed steam and oil plant, and £1.62 for a steam plant only, the difference being one of 20 per cent. Taking the running costs for the last completed financial year, the reduction in running costs from those obtained in pre-oil days was no less than 34.4 per cent.

I should like to urge on all Diesel engine users the great value of the indicator diagram as a quick and ready means of testing the condition of an engine. The "hand-drawn" cards are particularly valuable, as showing the distribution of the fuel oil among the cylinders. If cards are taken and filed for reference and comparison, it is not difficult to keep an engine well up to its test results. The outlay of £10 to £15 on an indicator set is a small matter in comparison with the losses that may occur if an engine is not periodically checked.

The choice of the most suitable Diesel engine to accept, when confronted with a number of them, is not easy.

I do not venture to lay down any rule for the guidance of anyone in this matter, but I will go so far as to say that my own preference is for (1) a low piston speed; (2) a low mean effective pressure from the full-load card; and (3) a low piston and crank-pin loading. The general design of the crankshaft and its bearings, the gudgeon pins, and the lubricating arrangements throughout must, of course, be examined also.

The transition from the paper stage to the practical one of operating the Diesel engine not unnaturally brought to light a number of occurrences with which engineers were not familiar. In course of time it was felt that a central body competent to collect and compile records and to act as a central authority to some extent was a necessity. In this way the Diesel Engine Users' Association came into being.

I should like to draw your attention to three subjects which have been of great interest and which are far from being exhausted.

The first is the question of the actual cost of Diesel engines. An endeavour to lay down any definite pronouncement in the matter of how much or how little oil should be used for various engines was found to be impossible. Mr. C. O. Milton, one of our most energetic members, gave us a communication on the subject and contrived to establish some relations between the lubrication of engines and the conditions under which they are used; but even here he lighted upon two series which did not agree and for which no explanation has yet been given. The actual rate of the destruction of lubricating oil in the cylinder of a Diesel engine is a matter which would well repay a careful investigation.

We are at present engaged in investigating the varieties of air compressors. One feature emerges as being of paramount importance, and that is the behaviour of oil-impregnated vapours under the influence of high pressures and temperatures. I think it is a line of investigation eminently suited to the labours and talents of the National Physical Laboratory.

Last, and perhaps of the greatest importance, is the question of fuel oil supplies.

Our engines will work well on the products of the distillation of coal—British coal—that coal which is used to-day so uneconomically that at the best but 15 per cent. to 20 per cent. of its available energy value is actually utilised. Continental users and manufacturers have used tar oils and tars with the greatest success for many years in their Diesel engines, and we can do so too. The cost of adapting an existing engine for the purpose is not excessive, and, under present conditions, at any rate, such cost will be abundantly repaid.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY will appear in the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Electric Cooker in India.

I have only to-day received my copy of the ELECTRICAL REVIEW for May 12th, in which I note that Mr. Meares criticises my statement that it is difficult to keep servants for more than a year in India.

I am afraid in this particular I fell into the error of generalising about India. While I venture to say that my statements are essentially correct as regards Rangoon, I recognise, of course, that in a country which holds so many different races as India the conditions may be very different in other parts. I am glad that Mr. Meares, than whom there is no one better qualified to speak, has found no more serious misstatement in my article.

In Rangoon the majority of the servants are not native to the province. They go there principally from Madras, under the attraction of much higher wages, but usually return to their own country after they have saved a little money.

After nearly a year of housekeeping in Australia, the Memsahib's feelings towards the Indian servants are much kinder than when amongst them. When we compare this beautiful country and its glorious climate with Rangoon, we wonder why white people willingly exile themselves in India; but when our thoughts turn to our dear old butler, well—India was not so bad.

Charles S. Jeffrey.

Sydney, N.S.W. 17th 1916.

High Prices.

I should like to utter a protest, and, at the same time, a warning to manufacturers, against the present, apparently unnecessarily, inflated prices of some of the electrical accessories in general use. As a typical example, cord grip holders, which before the war could be bought for 3s. 4d. to 3s. 6d. per dozen, are now fetching anything from 9s. 6d. to 16s. per dozen. I was last week asked the latter price, but, needless to say, did not pass an order.

Now if these articles could be sold before the war at 3s. 4d. per dozen, is there anything either in the advanced cost of materials or labour to justify such an exorbitant charge? I submit that, taking these advances into consideration, the selling price of this line should not be more than 6s. 6d. per dozen.

A traveller recently told me that the high prices ruling were due to the demand alone, there being no outside competition. If this is the case, manufacturers are taking an unfair advantage. But there are a number of neutrals and others already coming into the market, and, if they bring down prices, are we to deal with the manufacturer who has fleeced us, or the neutral who has brought down the inflated charges? As an instance of this, I recently bought an article, stated to be of Japanese origin, at 2s. 7 1/2 gross, but for a similar English article I am asked 20s. The present prices are 2s.

In conclusion, may I also protest against "brassed" iron terminal screw caps, substituted for brass screws, and very common and the nowadays.

C. Culmer Hodges, A.M.I.E.E.

Electricity Works, Dawlish,
August 30th, 1916.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

The Turbine Furnace.

A new type of furnace has been introduced by the **TURBINE FURNACE CO., LTD.**, of Caxton House, Westminster, S.W., which is adaptable to all kinds of boilers, and is easily installed. It has been designed, as shown in figs 1 to 3, on the principle of the impulse turbine, the air trough being compared to the nozzle, and the firebars to the blades of the turbine. The air for combustion is forced

for instance, at the North Dublin Union, with ordinary bars in a Lancashire boiler, using hard steam coal, the cost of fuel was 28s. per 1,000 gallons of water evaporated; with the turbine furnace, using 2½ breeze to 1 of slack, the cost was 18s. 1d. per 1,000 gallons, and with coke breeze alone, 13s. 11d., an economy of over 50 per cent. At Rathmines U.D.C. electricity works, a ten-days' test was carried out to compare the turbine furnace fitted to a Lancashire boiler and a mechanical stoker fitted to another boiler of the same size (30 ft. by 8 ft.). The former was able to burn a large proportion of coke breeze, and the cost of fuel per unit generated was reduced from 0·62d. with the ordinary stoker to 0·28d. with the turbine furnace; moreover, a single boiler fitted with the new

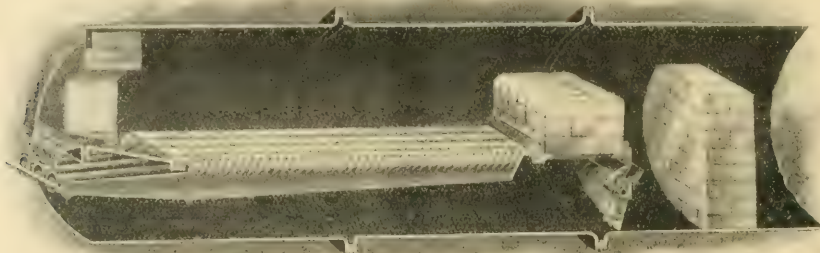
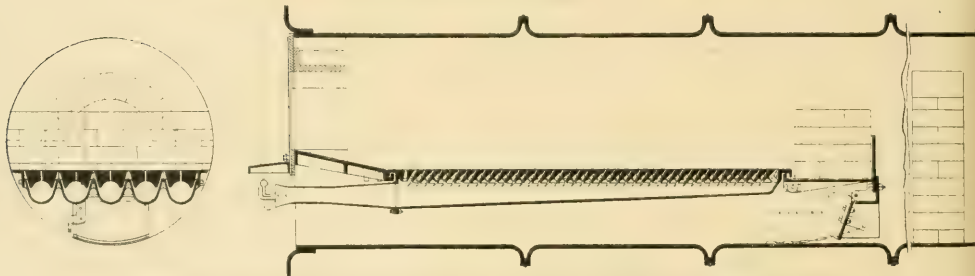


FIG. 1.—THE TURBINE FURNACE.



FIGS. 2 AND 3.—SECTIONAL VIEWS THROUGH AIR TROUGHS AND NOZZLES, TURBINE FURNACE.

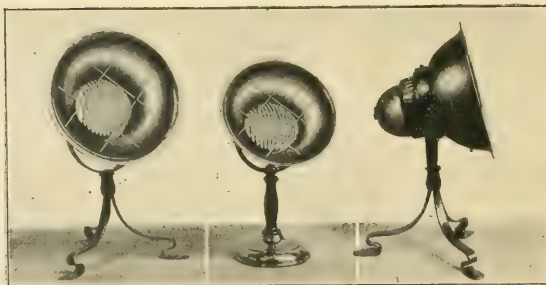


FIG. 4.—THE "D.G." BOWL ELECTRIC FIRE.



FIG. 5.—"D.G." FIRE.

between the bars, which offer a minimum of resistance, and each firebar receives an equal amount of air, which is distributed through the narrow air spaces in the form of fine sprays. It is claimed that by the design of the air injector an efficient pressure is obtained, the design of the air trough of diminishing section assures an even flow of the air for combustion, and the design of the firebars ensures the highest efficiency of the draught, each air space receiving an equal amount of air under pressure. The firebars project forwardly to intercept the air with a minimum of resistance. The air forced through the narrow air spaces is thoroughly diffused throughout the fire. There is perfect contact of air and fuel, and combustion with a minimum of waste gases. The grate consists of from four to six furnaces, each receiving its own air supply. This method, besides ensuring an evenly burning fire, makes it possible to use small steam jets for creating the draught. Special attention has been paid to the velocity and expansion of steam, flow of air, frictional losses, &c., with the result that a maximum of draught is obtained with a minimum of steam. There is no upkeep for moving machinery, nothing to get out of order, and the cost of generating forced draught by this method is said to be much less than by any other system.

Tests have been made on the furnace installed in various works :

furnace was able to take the whole load, whereas previously two boilers had been in use.

D.G. Bowl Fires.

The "D.G." bowl fire, which has been introduced by **MESSES. DRAKE & GORHAM, LTD.**, of Felix Street, Westminster Bridge Road, S.E., is made in two types, one rated at 1,000 watts, and supported on a three-legged black iron stand, and the other loaded to 750 watts, and mounted upon a black and copper pedestal. Both forms are illustrated in fig. 4, which shows also the larger model turned sideways, so that its construction can the more readily be followed. The heating unit, which is detachable, consists of a dome-shaped piece of special fireclay having vertical ribs on its rounded surface, between which is laid the spiral resistance wire. The element is mounted on a disk of asbestos stone or similar material, the connections to the terminal plate within the domed cover behind being of rigid perforated metal strip. Around the circular element is a bowl reflector of solid copper, accidental contact with the glowing coils being prevented by a light grid of stout wire.

As will be seen from the illustrations, the bowl reflector can be swivelled at any angle between the vertical and horizontal, and will stop in any position, but when turned to the horizontal posi-

tion it is held by a neat spring device, which prevents any possibility of the bowl tilting up and overturning a kettle or other vessel placed on the grid above the elements. Fig. 5 shows the fire with the bowl turned up so as to be available for heating water, or for making toast, the wire grid serving as a support, well away from the glowing coils. The elements, which run at a bright red heat immediately they are switched on, are guaranteed for 12 months, and can be renewed quickly at small cost. No switch is provided, so that so far as the control is concerned, the fire complies with the latest I.E.E. wiring rules for electric heaters. Overall the larger heater, 1,000 watts, measures 19 in. in height, the diameter of its reflector being 10½ in.; the smaller heater is 17 in. in height, with a 9-in. reflector. The reflectors are of solid copper, and the price is quite moderate.

The J-M Fire Extinguisher.

MESSRS. TURNERS & MANVILLE, LTD., of Hopetoun House, Lloyd's Avenue, E.C., have sent us particulars of their new fire extinguisher, which, it is claimed, possesses many advantages. In design it is cylindrical, with dished ends, and measures 3 in. in diameter by 12½ in. long. The pump and valves, which are enclosed in a separate container in the interior, deliver air to a compression chamber in the dome of the extinguisher; this arrangement prevents the chemical contents coming into contact with the main working parts, and allows for an even pressure of air in the discharge chamber. The nozzle, which is fitted in the concave base, is protected against accidental fall or damage, and is provided with a lever valve to prevent waste of extinguishing fluid. The pump spindle and leather are removable for examination or renewal.

Thirty full strokes of the pump will provide sufficient air to discharge the whole of the liquid contents in a steady non-pulsating stream to a distance of 30 ft.

The fluid will neither stain nor damage apparatus or fabrics with which it may come in contact; it is non-poisonous, free from moisture, and a non-conductor of electricity.

This extinguisher has been tested on burning petrol, celluloid, calcium carbide, carbon disulphide, and ordinary fires, also on electric arcs under severe conditions in the open, and in each case it has successfully extinguished the fires.

A High-Speed Squirrel-Cage Winding.

In an induction motor-winding patent, No. 1,191,209, issued to the WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., Frederick S. Martin proposes splitting copper strips so as to form loops which, when expanded to embrace the requisite number of slots, can be interconnected at the unsplit portions so as to form a short-

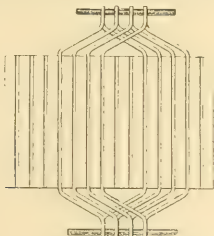


FIG. 6.—INDUCTION MOTOR WINDING.

circuited winding. The slotted strips have notches at their ends into which short-circuiting end rings are sprung. The whole forms thereby a squirrel-cage winding which will very easily withstand high-speed operating conditions.

SCIENTIFIC AND INDUSTRIAL RESEARCH.

The first annual report of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research, to which we referred last week, was published on August 31st. It is a document of some 30 pages, including five appendices, and covers a wide area, the treatment being somewhat discursive. It is summarised below.

After reviewing the policy pursued by the Government towards the encouragement of organised scientific support for trade and industry before the war, as exemplified by the inception of the National Physical Laboratory in 1900, with "its first modest capital grant of £13,000" and an annual allowance for maintenance of £4,000 (gradually increased to £7,000), which is compared with the Government grant of £100,000 a year to the American Bureau of Standards, the contribution of the Treasury to the expenses of the Engineering Standards Committee, the development of scientific research at the Imperial Institute, and the more generous Government support of the Imperial College of Science and Technology, the Report refers to the inadequacy of the national provision for scientific research, which was only brought home to the authorities by the shock of the great war, when it was found that we were unable to produce at home many essential commodities, such as optical glass, dyestuffs, &c. A Committee appointed by the Board of Trade on August 25th, 1914, to deal with the production of dyes, with the aid of capital

supplied by the Treasury and a grant of £100,000 for research, was the first outcome of the Government's awakening, and in May, 1915, the Boards of Trade and Education announced the impending appointment of an Advisory Council for the encouragement of scientific research in relation to industry. Explaining the details of the scheme in July, the President of the Board of Education remarked that the brains and processes that were necessary that day to the output of munitions had been, and would again be, needed for the arts of peace, and unless the matter were dealt with at once it would not be possible to bring into operation an effective system in the difficult period of reconstruction that would follow the war.

"Accordingly the Council decided to give science in its applications to industry precedence over pure science in their deliberations. They are under no misapprehension as to the relations between pure and applied science. It has been said that what people call applied science is nothing but the application of pure science to particular classes of problems. And, properly speaking, this no doubt is so; there are not two different kinds of science. At the same time, the Council realise that they have to deal with the practical business world, in whose eyes a real distinction seems to exist between pure and applied science. The average manufacturer is impressed with the importance of quick returns; he cannot afford to wait. . . . Apart from the long period of work and preparation which a properly organised research laboratory attached to a factory involves before important results can be looked for, and apart from the risk that an unsuitable director of such a laboratory may involve a firm in heavy pecuniary loss, there is the plain fact that 'the difficulties that present themselves to manufacturers or merchants seldom afford an indication of the true nature of the problems to be solved. They are generally secondary in their nature, and a direct attack on them is likely to be as empirical as the symptomatic treatment of disease.' Thus such quick-result inquiries as the manufacturer is induced to make are very likely to be fruitless and to reduce his enthusiasm for science still further."

Another consideration which alone would have compelled the Council to begin with research of directly industrial application was that the universities, which are the natural homes of research in pure science, had been so depleted of both students and teachers by the war that they were barely able to continue their routine work, and any effective encouragement of research in pure science must await the return of peace.

Inquiries showed that there were certain researches being conducted or directed by professional associations in the period preceding the war which stood in grave jeopardy of enforced abandonment. These investigations had been paid for by the voluntary contributions of several great engineering and other professional societies, and thus carried with them the best guarantees of their necessity and effectiveness. The Council decided, therefore, to save as many of these derelict researches as possible, and accordingly recommended the payment of a series of grants to the societies concerned.

The chairman and other officers of the Council have interviewed representatives not only of the Royal Society and the Chemical Society, but of all the principal engineering societies throughout Great Britain, and other important professional societies, in all cases with gratifying results. The engineering trades have long been alive to the need and value of scientific research, while the chemical and textile trades had made less progress in the systematic use of science. But now there are signs of a change, and already textile research into the electrification of fibres during manufacture is proceeding at the University of Leeds with funds provided by the Textile Institute, and proposals are before the Council for fundamental researches into the cellulose fibres which form the basic material of the cotton and paper trades.

While these inquiries and interviews were taking place, the Council had invited the assistance of the universities and technical colleges of the country in the formation of a register of researches actually being conducted on the outbreak of the war. A careful survey of the amount and the character of the provision made in our higher educational institutions for research work is being made as a part of the Council's preparatory arrangements for a systematic programme of aid to individual researchers. It is hoped that the register will enable suitable workers to be rapidly found when proposals for special lines of inquiry come before the Council, and that a survey of the directions in which research is now proceeding in our universities and colleges may enable the Council to make helpful suggestions to individual workers from time to time, as the need for research in particular directions becomes apparent.

The Council also has under consideration the possibility of inducing firms in some industries to assist the progress of research by informing it in confidence of the problems they have in hand or in contemplation. Knowledge even of negative results may be valuable as a saving of time or as helping to determine more hopeful directions of attack. Even this modest degree of co-ordination will be abortive unless the principal manufacturers are willing to trust the discretion of the Council. There are indications of a change of view among certain firms which give hope that a more far-reaching co-operation may be possible, and the necessities of the war have led to an exchange of information once tenaciously reserved,

which may survive the present critical days. Some manufacturers at any rate are beginning to realise that their most numerous and dangerous enemies are not their fellow-countrymen engaged in the same trade, but powerful combinations of manufacturers in other countries supported by every device of science and art that their Governments can provide.

Any assistance that the industries, or even individual firms, can give, from their accumulated experience, in bringing science to bear rapidly upon manufacturing problems will be of benefit to the trade as a whole and indirectly, if not directly, of advantage to each manufacturer. In the numerous conferences the Council has had with representatives of different industries, it has been impressed with the spirit of co-operation which is growing up and the willingness to accept suggestions for the initiation of research for the benefit of the trade as a whole. Co-operative research, when it has done its utmost, will always leave ample room for individual initiative and ability in the application of its results, more than sufficient as an incentive and as a means to outstanding success.

Almost all advanced students left in the faculties of science and technology are working for the Ministry of Munitions, the Admiralty, or the War Office; the Council directed its efforts to make a complete inquiry in the universities and technical colleges as to the existence of any students or teachers not engaged on war duties who might be retained for scientific research, whether pure or applied, if the Council would assist them. Among the duties assigned to the Council is the formulation of proposals for the establishment and award of research studentships and fellowships. The Vice-Chancellors and Principals or Deans of Faculty were accordingly asked to consult the heads of their several departments and to submit proposals, making it clear that with the heads of the departments and not with the senates or faculties or other university authorities would rest the responsibility for the recommendations put forward. The responsible professors and teachers have in nearly every case exercised great care and discretion in making their proposals, and nothing could show in more lamentable and honourable clearness the service of the universities to the country in the hour of her need than the resulting list. The Board of Education and the Scotch Education Department had been able to retain with the concurrence of the military authorities a certain number of advanced students in science, technology, and medicine, who were medically fit, because it had been foreseen that they would be required in the several national war services as they completed their studies. But all these and more than these were needed, and from the small remainder not taken for urgent scientific work the Council has only been able to recommend grants to some 40 individuals, amounting in all to a sum not exceeding £6,000.

The Council hopes to bring more reality into those academic laboratories which are now much dominated by the text-book and the syllabus of examination, and so encourage a better professional training for chemists, physicists, and other men of science. It also hopes to give assistance in correlating the researches being made into the same problem by encouraging the interchange of information; in industrial research, especially in the circumstances in which this country now finds itself, it would be deplorable if those engaged in working on the same subject at different public institutions were not to keep each other informed of the progress made. At the same time, it is recognised that there is a danger in bringing technical problems too pressingly to the notice of teachers and students in educational institutions. It is desired so to order the relations of workers in pure science to the industries going on around them that they may receive the stimulus of a wider outlook than is always attainable under the limitations of an academic system of syllabus and examination. In this way it may be possible in the end to create such an atmosphere that the new generation of students will cease to draw a distinction between "theory" and "practice," and technologists of all ranks will through them attain to the view that sound practice is only theory tempered by compromise.

Owing to the relatively high organisation of the engineering profession in relation to the several branches of the engineering industry, a number of researches bearing on industrial engineering problems was already in progress before the establishment of the Council, and a considerable number of applications for aid to new researches was received immediately it got into touch with them. These facts and the representations of the societies urging the establishment of stronger machinery for dealing with the manifold aspects of engineering research, led the Council at once to set up a series of strong standing committees to assist it.

Standing Committees have already been set up on Metallurgy, Engineering, and Mining. Each of the committees consists of about 15 members, of whom approximately half have been nominated by the professional societies concerned, the remainder being appointed directly by the Council. The Committees were appointed in the first instance for the period of one year in order to facilitate any changes in constitution or terms of appointment that experience might suggest.

The Council hopes with the assistance of the standing committees, the professional societies, the Home Office, and the Board of Trade gradually to construct panels of names which will enable it to obtain the very best advice on the different aspects of the problems it is called upon to solve.

The number and scope of the standing committees will

need extension from time to time, but the absence of strong professional societies working in conjunction with the other scientific industries in this country makes it inadvisable to proceed hastily in so important a matter.

(To be continued.)

WAR ITEMS.

A.E.G. Electrical Co., of South Africa.—Under the Enemy Trading Act, the A.E.G. Electrical Co., of South Africa, Ltd., has been ordered to be wound up, and Messrs. J. G. Carter and H. P. Webber, accountants, have been appointed liquidators.

Work for Civilian War Prisoners. It has now been decided that civilian prisoners of war may be employed on work not connected with the war, in several ways. In suitable cases, in the internment camps, they will be allowed to do work, on materials supplied by employers, which does not require elaborate plant or equipment; or, a number of prisoners may be specially interned in suitable premises, where they can live and work on some process of manufacture, if the employer is willing to install the necessary plant and provide the technical supervision required. Proposals to employ fewer than 100 men under an arrangement of the latter kind cannot be entertained, as a rule, owing to the cost of guarding the prisoners. The employer must pay the regular rate of wages paid to British workmen for similar work. A deduction will be made for maintenance and other expenses, and the balance will be credited to the man.

The Employment Department of the Board of Trade is prepared to receive from employers inquiries and proposals, and to make the necessary arrangements with the authorities concerned. Inquiries should be addressed to the Assistant Secretary, Board of Trade Employment Department, Queen Anne's Chambers, Broadway, Westminster, S.W.

Tramways and Lighting Restrictions.—At a Northern Police Court a ratepayer complained that the municipal authorities permitted flashes of light to be emitted from the overhead wires of the electric tramway system during the hours of restricted lighting. He considered the flashing when the trolley was being changed to be a danger to the town. Moreover, the cars were running at night without blinds. The Magistrates' Clerk, in advising complainant to keep a record of such incidents, secure witnesses, and lay an information, said it was rather an absurd thing that these lights were flashing at night, when all other lights were obscured. The Chief Constable: I agree. I believe the tramways manager is doing what he can. I have not seen it myself, or I should have done something.

A Labour Exchange Proposal.—Great antagonism has been aroused throughout the North of England by a proposal which has been extensively promulgated by highly-placed Labour Exchange officials that, after the war, the whole system of the engagement of labour for any purpose should be in their hands. Startling as it may appear, the proposal is that it should be made a penal offence for any person to offer service to an employer, or any employer to take a person into service, except through the Labour Exchanges. The *Yorkshire Post* has energetically sounded the note of alarm, and has ascertained the views of the chief employers and trade union leaders in the great industries in regard to the matter, with the result of the accumulation of a striking mass of condemnation of the proposal from both employers and employed. It is believed in the North that the proposal, has its origin in Socialistic circles in London, where it has been determined to take permanent advantage for Socialistic ends of the disturbance of normal employment conditions caused by the war.

Ministry of Munitions: New Order.—In pursuance of the powers conferred upon him by Regulation 30 (A) of the Defence of the Realm (Consolidation) Regulations, 1914, the Minister of Munitions orders that the war material to which the Regulation applies shall include war material of the following classes and description, namely:—

All machine tools and machinery driven by power and suitable for use in cutting, stamping or working metal, including:—Lathes, milling and drilling machines, planers, shapers, screw machines, chucking, boring, slotting, and grinding machines, boring and turning mills, power presses, punching, shearing, forging, cutting-off, gear-cutting, and centring machines.

The Minister of Munitions gives notice (1) that he permits all persons until further notice to purchase or enter into negotiations for the purchase of the war material referred to in the above Order, provided that such purchase or negotiations are from or with persons holding a special permit from the Minister to sell such war material and not otherwise; and (2) that he permits the insurance of any such war material. All applications for a special permit in connection with the above Order should be addressed to the Director of Machine Tools, Armament Buildings, Whitehall Place, London, S.W.

Boy Munition Workers.—The Rev. R. R. Hyde has been appointed by the Ministry of Munitions Organising Officer of Boys' Welfare. The employment of boys in large numbers in factories has rendered it desirable that special provision should be made for their welfare.

Controlled Establishments.—The Minister of Munitions announces that he has made further orders under the Munitions of War Acts, 1915 and 1916, under which 161 additional establishments have been declared controlled establishments. The total number of controlled establishments under the Munitions of War Acts, 1915 and 1916, is now 4,212.

Italy Ousting the German Trader.—The Government has ordered the Prefects throughout Italy to compile lists of all business concerns in which Germans or Austrians are in any way interested, with a view to their registration, and the Administration has specially instructed the officials to trace all cases in which fictitious Italian or neutral nominees have been left in charge, with the view of destroying Germany's after-war hopes and of giving Italy economic freedom.

Exemption Applications.—The Burv (Lancs.) Tribunal recently heard an appeal by Mr. W. Clough, tramways manager, on behalf of a motorman. It was stated that if one man were taken away it would mean the withdrawal of a car from the service, and 8,000 workpeople were carried regularly on the cars. Conditional exemption was granted.

At a sitting of the Carnarvonshire Tribunal, on August 22nd, the Military representative appealed against conditional exemption granted by the Gwynfal Tribunal to five employees of the Marconi Wireless Co., at Cefndu. It was contended that the local Tribunal had no power to grant exemption, but it was intimated that the men would not be called up until the department that employed them authorised their calling up, which was equivalent to exemption. The certificates were withdrawn on this understanding.

Folkestone Tribunal has allowed two months' exemption to a stoker appealed for by the Electric Supply Co.

Before the Hants Appeal Court, Mr. P. Grover, of Messrs. Grover, Smith & Willis, electrical engineers, of Basingstoke, appealed against final exemption until October 1st granted by the local Tribunal. It was stated that Mr. Smith, a partner, had been given conditional exemption, and that Mr. Willis was engaged in an Admiralty factory. As the Ministry of Munitions had requested the firm to carry out certain work, the appeal was put back to see if Mr. Grover becomes badged.

The Isle of Thanet Tramway Co. appealed, at Broadstairs, for an electrical engineer (18), engaged at a sub-station; the supervisor of sub-stations (25); an electrical engineer (28), in charge of a sub-station; a sub-station attendant (33), four car drivers, a permanent-way labourer, a ticket inspector and driver (36), a traffic inspector and driver (38), and a store-keeper (31). The manager said that he did not think that the Board of Trade would allow women to drive cars on their line. If the military would co-operate in giving substitutes, he was quite willing to release the men. The Military representative intimated that he was endeavouring to arrange for substitutes. The Tribunal exempted the supervisor of sub-stations, and put the other cases back for a fortnight with a view to substitutes being found. Prior to the war the company had 274 men; now they have 91.

The Skipton Tribunal has granted final exemption to September 30th to a partner in a firm, who is consulting engineer to several public companies and the local hospital.

Torquay Tribunal, on the appeal of the Corporation, has exempted a fireman at the electricity station so long as he remains in his present occupation.

At Diss, the Electric Supply Co. appealed for the manager, and conditional exemption was conceded.

Richmond-on-Thames Tribunal has given a local electric light contractor exemption until October 1st, to allow him to complete contracts in hand.

A Boscombe electrical engineer, appealing at Bournemouth for time to complete contracts and to get in debts, has been granted until October 1st final. The same Tribunal conditionally exempted an electric wireman, who has only one eye, appealed for by a firm who have lost 11 out of 12 men.

The Swindon Tribunal has conditionally exempted B. J. Rowland (35), electrician with Messrs. Hutton Bros., the only man left with the firm.

The Rugby Urban Council appealed to the local Tribunal for exemption for the man in charge of the refuse destructor. The Chairman asked the Military representative if it was wise to jeopardise the health of the town for the sake of one man for the Army. Conditional exemption was granted.

The Lewisham Tribunal adjourned for three weeks, with the object of a badge being obtained, an appeal by Mr. R. P. Mills, electrician, who stated that he was engaged on Government work.

Mr. J. L. French appealed at Bexhill-on-Sea for exemption for an electrical wireman, stating that he had lost six out of seven men. Exemption refused.

Twenty-six employees were appealed for at Oxford, on August 31st, by the Electric Tramway Co.; the Military representative offered no objection to temporary exemption for drivers, and suggested with regard to the traffic superintendent and inspectors, that three under 30 should go into the Army, and the other two be left to the company. It was pointed out that the inspectors were also drivers. The Tribunal granted conditional exemption to all except four.

Messrs. W. Lucy & Co., Ltd., appealed at Oxford for absolute exemption for D. G. French (18), brass fitter, engaged on electrical switch work for a new factory. It was stated that French two years ago replaced a man who had gone into the Army. The firm had lost 75 men. As a badge had been applied for, the case was adjourned for a month.

At Oxford, the question of unstarring R. J. Child (23), electrician with Mr. J. Goudrey, was considered. The star was granted on February 24th, and Capt. Baldry said that they had instructions from the War Office that no man, no matter what his age or occupation, was to be considered starred. The only men now exempted were those who held a certificate from the Ministry of Munitions. The Tribunal decided that Child should go before the Medical Board. The same decision was arrived at in the case of A. E. D. Chaundry (22), electric wireman with Messrs. Hill, Upton & Co., electrical engineers.

At Dawlish (Devon), the Electric Supply Co. applied for exemption for the manager and secretary, Mr. C. C. Hodges, who has already had three months' postponement. Mr. D. Anderson, director of the company, stated that they had advertised for a successor, but had been unable to fill the post. Exemption was extended until the end of November.

The East Kent Appeal Court has rejected a Military appeal against exemption granted to a stoker at the Margate Corporation dust destructor, on the ground that he is indispensable.

At Blackpool, exemption until the end of September was allowed the foreman of a firm of electrical engineers; the same Tribunal granted exemption until the end of October to a tramway motor-man, employed by the Corporation.

At Blackburn Military Tribunal, on August 30th, Mr. T. Barton, electrical engineer, applied for an assistant who had sole charge of a motor plant at large works in Darwen. Conditional exemption was granted, though an application for an apprentice in charge of an electrical plant in a colliery, by the same employer, was dismissed.

At Macclesfield, on Wednesday last week, an electrical engineer in business on his own account appealed; he had important work in hand at local factories, and three months' exemption was granted.

At Bath, the Electric Tramway Co. appealed for a driver. The manager said that owing to shortage of staff, 25 per cent. of the service had been stopped. Conditional exemption was allowed.

BUSINESS NOTES.

Copper Prices.—The week's changes. Messrs. F. Smith and Co. report:—Wednesday, September 6th. Electrolytic bars rose from £122 to £130, ditto sheets, from £147 to £148, ditto rods, £146 to £147, ditto H.C. wire, 18 to 19, 4½d.

Messrs. James & Shakespeare report:—Wednesday, September 6th. No changes in prices quoted last week.

"Empire-Made Goods" in N.Z.—U.S. Consul-General Winslow states that a campaign for Empire-made goods has been started in Auckland, New Zealand, and is likely to spread all over the Dominion.

The Auckland Provincial Industrial Association has taken the matter in hand, and a Committee has been appointed to organise the work with the idea of securing the co-operation of all merchants, manufacturers, storekeepers, and others in carrying into effect an attractive demonstration in favour of Empire-made products. The financing of this scheme, which is expected to cost from £1,000 to £5,000, is to be taken over by the merchants and manufacturers of the city.

Johannesburg Municipal Power Station.—Referring to Mr. Dolson's paper, reprinted on page 231 of our last issue, Messrs. Erith's Engineering Co., Ltd., inform us that the Erith stoker referred to was the old type for intermittent cleaning, and was installed seven years ago, in 1909; it was supplied to the unconditional order of a Johannesburg firm, and duly paid for; it was identical with stokers supplied in 1906 and 1907 to Durban electricity works. Burning about 25 cwt. hourly of Transvaal coal, cleaning took seven minutes every four hours; and as Mr. Dolson says, it showed great flexibility, needed no arches, and combustion was as nearly as possible perfect. The modern Erith-Riley stoker retains these advantages with the added feature of continuous automatic discharge of ash and clinker; this improved stoker has been installed at Edinburgh, Hull, Worcester, West Hartlepool, Luton, and many other power stations.

Catalogues and Lists.—MESSRS. KELVIN, BOTTOMLEY AND BAIRD, LTD., 16-20, Cambridge Street, Glasgow. New pamphlets on industrial pyrometers of the thermoelectric type, and switchboard moving-coil and moving-iron instruments of various patterns.

MESSRS. J. & W. B. SMITH, 15, Farringdon Road, E.C.—Catalogue of electric flash lamps and batteries.

MESSRS. S. B. GOSLIN & SON, 13, Artillery Lane, E.—Leaflet showing that they pour castings daily in iron, brass and other metals.

The Russian Electrical Market.—The Russian journal *Elektricheskaya promyshlennost* has published an article on the Russian market for electrical goods which is of some significance to British manufacturers. The Russ. imports of German electrical goods, it says, represented in 1909 a sum of £700,000 and in 1913 £1,700,000. The war has, however, forced Russia to seek other suppliers and importers have turned to England. Unfortunately that country has not been able or willing to take any particular interest in the Russian market. The Germans exported to Russia in 1913 12.6 per cent. of their whole exports of electrical machines, while England sent only 2.7 per cent. of her exports of these articles. Thus Germany sold to Russia six and a-half times more than England. Russians are now thinking of looking to the United States and regret that the English will not consider their market, probably because of the reputation for commercial punctuality of Russians not being good. The article discusses this side of the subject, explaining that this belief is erroneous, and affirms that England has every reason to seek an outlet for her machinery in Russia, as disregard of the opportunity can only end in forcing Russian importers to resort to the United States.

As a matter of fact, it is stated that America is already profiting by the opportunity afforded for capturing the Russian market. American agents have already taken orders for considerable quantities of telegraph and telephone apparatus and many tons of copper wire. There is a strong demand for small motors of from ½ to 4 H.P., for educational electric appliances, for X-ray apparatus, and for every kind of electrical material. It seems that a month ago it was impossible to purchase a single battery cell in the whole of Petrograd, and it is the opinion of many American agents that the Russian market can absorb huge supplies in the future. Between 125,000 and 150,000 German merchants are interned in Siberia, and the Russians earnestly desire that the Americans shall take their places. Three-fifths of Russian capital has indeed been offered American firms if they will contribute two-fifths, in order to establish manufactures in Russia.

According to some reports it is possible to sell direct and thus eliminate the commission agents. The abolition of vodka is said to have greatly improved credit, so that sales are now effected for cash without difficulty; while the deposits in savings banks have risen 1,100 per cent. as a result of the better economic situation of the country.

The large field which Russia affords for hydro-electric engineers and manufactures is shown by the fact that in European Russia, including Finland, and in the Ural and the Caucasus, the utilisable hydraulic power is estimated at about 10,000,000 kW., while the amount utilised is less than in any other country in Europe. In round figures, only between 180,000 and 220,000 kW. is developed, of which 180 per cent. consists of small installations.

According to an Italian report, the Germans neglected to develop Russia's water wealth, in order to preserve a market for their own manufactures; the French prefer to lend capital to the Russian Government, rather than concern themselves with the development of local Russian industries; while the wilful abstention of Great Britain leaves the great Russian market to go begging to whatever country chooses and has the initiative to take it up.

Dissolutions and Liquidations.—**ELECTRICAL OIL REFINING CO. LTD.** This company is winding up voluntarily with Mr. J. E. Frost as liquidator; a meeting of creditors is called for September 8th, at 29, Great St. Helen's, E.C.

HIGH-TENSION INSULATORS, LTD. A meeting will be held at 32, Sackville Street, W., on October 3rd, to hear an account of the winding-up from the liquidator, Mr. G. T. Broadbridge.

C. DALES & SONS watchmakers, jewellers, opticians, and electricians, 113, Poole Road, Bournemouth.—Messrs. C. and T. H. Dales and C. Dales, jun., have dissolved partnership; Messrs. C. and T. H. Dales will attend to debts and continue the business under the same style.

THE PHENIX ELECTRICAL CO. and the CALEDON ELECTRICAL CO.—Notice is given in the *Edinburgh Gazette* that these companies, of which Robert Walker and Thomas Henry Large were the sole partners, have been dissolved by mutual consent as at August 3rd, 1916. Messrs. Thomson, Jackson, Gourlay & Taylor, chartered accountants, 24, George Square, Glasgow, are authorised to attend to all debts due to the dissolved firms, and will discharge their liabilities. Mr. Walker will carry on business for his own behoof at 2, Oswald Street, Glasgow, under his own name, and Mr. Large will carry on business at 40, Broomielaw, Glasgow, under the name of the Phoenix Electrical Co.

MOND NICKEL CO., LTD.—A meeting will be held at 39, Victoria Street, S.W., on October 11th, to hear an account of the winding-up from the liquidator, Mr. R. Mathias.

HERBERT FROOD CO., LTD. (the predecessor of the present company of the same name and title).—A meeting will be held at the Sovereign Mills, Chapel-en-le-Frith, on October 12th, to hear an account of the winding-up from the liquidator.

TYNESIDE ENGINE WORKS (CARDIFF), LTD.—A meeting will be held at Butte Docks, Cardiff, on October 6th, to hear an account of the winding-up from the liquidator, Mr. W. P. Annear.

Book Notice.—*Science Abstracts*, A and B. Vol. XIX. Part 8. August 24th, 1916. London: E. & F. N. Spon. Price 1s. 6d. each part.

British Goods for France.—It is announced by the Board of Trade that, in agreement with the British Government, the French Government has just set up at King's House, Kingsway, W.C., a special office for the issue of licences for the importation into France and Algeria of goods of British production or manufacture which are included in the list of articles prohibited to be imported into those countries.

Sale. On September 13th and 14th there will be a sale of electric plant, tools, and machinery at Millwall. Particulars are given in our advertisement pages.

Bankruptcy Proceedings. **JAMES REID WHITEHOUSE**, 43, St. Andrews Road, Golders' Green, Middlesex, managing director of an electrical company. The following are creditors:—

Sim Electrical Co., London ..	£243	Ross & Ford, London ..	£14
Electrical Co., London ..	11	Cannon Brooke, London ..	8
Armstrong Co., London ..	125	Russell, M., & Co., London ..	105
Edwards & Sons, London ..	1	Beacock & Son, London ..	30
Garnett & Co., London ..	10	Schneider, London ..	4
Acton Lamp Co., London ..	10		

Australian Tariff Revision.—The Government has approved a definite policy to give Australian industries a measure of protection by revising the tariff schedules in such a way as to create an effective and substantial barrier against the inundation of imports, which for years has had a paralysing influence on industry in this country. The Government will ask Parliament to impose duties on manufactures that can be produced by Australian workmen, sufficiently high to avoid the stifling influence of competition with the outside world. There is a probability that after the fixation of duties in relation to importations from the United Kingdom, second preference will be shown to the Allies, with a third scale for neutrals and a prohibition against enemies.—*The Age*.

LIGHTING AND POWER NOTES.

Aberdeen. **YEAR'S WORKING.**—The report of Mr. J. A. Bell, the city electrical engineer, on the year's working of the electricity undertaking to July 31st last, shows that 15,004,420 units were generated, as against 12,475,920 in the previous year, and the total income was £75,873, an increase of £15,642. The working expenses amounted to £39,180, leaving a gross balance of £35,682. After payment of interest on capital, £9,717, instalment of sinking fund, £18,183, and depreciation on motors, &c., £1,041, there remained a net profit of £8,792, an increase on 1915 of £4,157; this has been placed to reserve fund, which now stands at £39,119. The increase in output for the year had only once been exceeded in the history of the undertaking, and the motors connected were largely in excess of the previous year. The revenue account showed a total increase of £15,840; of this £7,555 was due to increased charges, the remainder being new business; increased costs, amounting to £11,268, were principally due to the extra cost of coal and the all-round increase in supplies, &c. The reserve coal stock has been increased by 1,500 tons during the year; with the 120 new customers added, the total number connected to the mains is 3,474.

PRICE REDUCTION.—At a meeting of the Electricity Committee it was proposed that the rate for lighting should be the ordinary rate, plus 5 per cent., and the rate for power the ordinary rate, plus 20 per cent., being a reduction of 5 per cent. in each case compared with last year.

Accrington.—The Electricity Committee has instructed the electrical engineer to carry out the conversion of a boiler, in lieu of purchasing a new air-cooler for the 2,000-kw. turbo-alternator, at an estimated cost of £60.

Ayr.—The estimates of the Corporation electric light department for 1916-17 show a debit balance of £1,650, arising from increase in the price of coal and restricted lighting consumption.

Canada.—The recent Government report on the power possibilities of the Winnipeg River, in Manitoba, shows that over 400,000 H.P. could be developed at various sites within easy transmission distance of Winnipeg. At the present time two power developments are in existence, viz., that of the Winnipeg Electric Street Railway Co., which is 58 miles from the city, on the Pinawa Canal, and comprises nine turbine units developing 28,000 H.P., with a 60,000-volt transmission, and that of the city authorities at Point du Bois, where there are five 3,000-kw. units and three 5,000-k.v.a. units giving about 25,000 H.P., which can be increased to 77,000 H.P. with additional plant. In this case the transmission is at 66,000 volts, and the direct distance 75 miles. There are other seven sites, which could be exploited, and with the present unregulated flow of 12,000 sec. ft. nearly 250,000 H.P. could be obtained, while if the river were regulated to maintain a minimum flow of 20,000 cb. ft. per sec., it is considered that some 418,000 H.P. could be obtained.

The seven sites referred to, and the H.P. with 12,000 and 20,000 cb. ft. per sec. are as follows:—Pine Falls, 37,900 and 63,100 H.P.; Du Bonnet Falls, 57,300 and 95,500 H.P.; McArthur Falls, 18,400 and 30,700 H.P.; Lower Seven Sisters, 12,600 and 37,900 H.P.; Upper Seven Sisters, 9,900 and 29,600 H.P.; Upper Pinawa, 12,300 and 12,300 H.P.; and Slave Falls, 26,600 and 44,400 H.P. The falls vary from 18 to 56 ft., and the distances from Winnipeg from 52 to 74 miles. The cost of developing these sites with the low flow is estimated at £2,664,000, and with the high flow at £4,909,000, and the power costs at 100 per cent. load factor at '65 and '59d. per unit respectively, or at 50 per cent. load factor at '13d. and '118d. respectively.

The development of the Du Bonnet site has already been taken in hand by the Winnipeg River Power Co., which is controlled by the same interests as the Winnipeg Railway. The plans for this plant—called the Great Falls Development—include eight 21,000-H.P. turbines with 11,000-Kw. generators, and an 110,000-volt transmission to Winnipeg.

While Winnipeg is well off for water power, Calgary also has within 30 miles, 48,100 H.P. available, and the Western Canada Power Co. at Stave Lake, 35 miles from Vancouver, has a possible development of 100,000 H.P.

Chile.—By decree of July 1st, 1916 (Ministry of Industry and Public Works), an honorary Commission was appointed to make a study of the water power available in Chile for the purpose of hydro-electric development.

The local Press quotes the estimate of Prof. Don Arturo E. Salazar, of the University of Chile, that proper hydro-electric development in Chile would reduce the cost of electricity for the small consumer for commercial purposes from the present price of 70 centavos gold (\$0.255 United States currency) to 3 centavos gold (\$0.01095).—*American Consular Report*.

Continental.—**NORWAY.**—According to the *Elektrotechnische Zeitschrift*, electrotechnical plants in Norway have rapidly increased in number and importance in recent years. The following are figures taken from recent official publications:—

	—1st July—	
	1913.	1915.
Generating plants	1,316	1,515
Generator capacity, KW. ...	457,879	649,127
Batteries, No.	151	137
Ditto, capacity, KW.	13,534	19,304
Power taken by motors, KW. ...	159,091	216,809
Ditto by electrochemical works, KW.	199,690	304,128
Ditto by other users, KW. ...	16,841	29,603
Apparatus installed, No. glow lamps	1,303,302	1,965,440
" " " arc lamps	4,774	3,603
" " " motors	16,460	24,689

The table shows the remarkable reduction in arc lamps, the steady increase in glow lamps, and the falling off in accumulator batteries, with the concurrent considerable increase in the energy utilised in the electrochemical industry. The average power of the installations, which was 350 kw. in 1913, advanced to 430 kw. in 1915. At the present moment there are installed in Norway 0'8 glow lamps and about 0'09 H.P. of motors for every inhabitant.

Dundalk.—**RAILWAY SUPPLY.**—The U.D.C. held a public inspection, last week, of the addition to the power house which is to supply electricity to the railway locomotive works. Five 320-H.P. engines are now installed. The contract with the railway company commenced on September 1st, and it is estimated that when the scheme is fully working, the output of the station will be the fourth on the list of Irish cities, ranking after Dublin, Belfast, and Cork.—*Irish News*.

Eastbourne.—**PRICE INCREASE.**—The T.C., on Monday, decided to increase the price of energy by $\frac{1}{2}$ d. per unit as from October 1st.

Glasgow.—**COAL SUPPLY.**—In view of the scarcity of coal the Electricity Sub-Committee on the purchase of coal has met and conferred with the District Coal and Coke Supplies Committee for Scotland, with a view of obtaining its assistance in getting adequate supplies of coal for the electricity department, and the latter has undertaken to use its influence with contractors for getting delivery of supplies in arrear, and also for getting adequate supplies of coal for the current year.

Greenock.—**POWER SUPPLY.**—A large number of new consumers have lately been added by the Corporation electricity department, comprising firms having small workshops and factories with electric motors ranging from 2 to 100 H.P. The motors now supplied from the department's mains represent some 27,000 H.P.

Hedworth.—**STREET LIGHTING.**—The Leicestershire and Warwickshire E.P. Co. has notified the P.C., agreeing to carry on the public lighting on the terms suggested for the time being (£1 per week for a dozen or less lamps).

Hexham.—**PRICE INCREASE.**—The Hexham and District Electric Supply Co. has given notice that, from October 1st, the charges for electricity for lighting will be raised $\frac{1}{2}$ d. per unit, and for lighting and power by $\frac{1}{2}$ d. per unit.

India.—The Calcutta Electric Supply Corporation has installed a B.T.H. turbo-alternator of 6,000 kw. normal, and 7,500 kw. overload, capacity. The turbine has 11 stages, and is designed to run at 1,500 R.P.M. on steam of 150–170 lb. pressure superheated 100° F.; it exhausts into a surface condenser designed to maintain a vacuum of 27 $\frac{1}{2}$ in. The generator supplies three-phase, 50-cycle current at up to 6,500 volts. A similar turbine plant is to be installed by the Bombay Electric Supply and Tramways Co.

Further information regarding the new Tata hydro-electric scheme for Bombay shows that if a separate company is formed, it will work in close co-operation with the existing one. It is proposed to provide 60,000 H.P. in Bombay for 3,600 working hours per annum. An independent power house, transmission lines, and receiving station will be built, but will be interconnected with the existing installation, thus giving two practically independent sources of power. The plans entail a dam to raise the water 112 ft., the water being drawn off through a 9,100-ft. tunnel, giving an

average working head of 1,735 ft. The reservoir storage will be 18,000 million cb. ft., of which 13,000 millions will be available for generating power. The same voltages of transmission and distribution are proposed as for the present installation.

The Mysore Government has provided a sum of Rs. 75,000 for the electrification of the Kolar Gold Fields pumping plant, and has sanctioned an expenditure of 1 $\frac{1}{2}$ lakhs of rupees for electrifying the pumping stations of the Bangalore city, and civil and military station water supply, thus saving about 50 per cent. on fuel charges.—*Indian Engineering*.

Japan.—**ELECTROLYTIC PLANTS.**—A company has been formed in Osaka, with a capital of 353,000 yen, for the manufacture of caustic soda. It is stated that the company intends to use the electrolytic process, and is going to erect a factory at Kyushu, where hydro-electric power is fairly cheap. The salt used will be Kwantung monopoly salt, the price of which for industrial purposes is 63 sen per 100 kin (about 1s. 1 $\frac{1}{2}$ d. per cwt.). The machinery is to be Japanese. An output of 300,000 lb. of caustic soda per month is spoken of; as a by-product, bleaching powder will be obtained. At present there are two companies manufacturing caustic soda in Japan, one at Yamaguchi, and the other at Tokio. They produce respectively about 3,500 and 400 tons per annum.—*Indian Textile Journal*.

Korea.—It is reported that business men of Tokio are planning a new hydro-electric company to utilise the water power of the Namchon River in the south of the Korean peninsula. The company will be capitalised at \$1,500,000, and will purchase the rights of the present Taiku Electric Co. The plant of the company will be located at Hyopchon, South Kyongsang Province.—*Indian Textile Journal*.

Leeds.—**LOAN SANCTION.**—The L.G.B. has sanctioned the borrowing of £35,000 by the Corporation for extensions of electricity mains and new sub-stations on the understanding that the money will be expended in specified directions.

London.—The Notting Hill Electric Light Co. has issued a notice that from September 29th the company will make a minimum charge of 10s. for the supply of electricity through slot meters.

Manchester.—The Improvements and Buildings Committee of the Corporation has passed a plan for an addition to the transformer house at the Stuart Street generating station of the Corporation.

Ripon.—**E.L. SCHEME.**—The City Council has appointed Mr. George Wilkinson, of Harrogate, to prepare the necessary plans and particulars for obtaining a provisional order for electric lighting for the city.

Salford.—The T.C. has been recommended to seal agreements for the supply of energy to Salford Electrical Instruments, Ltd., Zama, Ltd., and Erskine Heap & Co., Ltd.

Shipley.—**LINKING-UP SCHEME.**—The Sub-Committee appointed to consider the advisability of linking-up with Bradford, has considered the electrical engineer's report, which states that a small saving in coal would be effected, but he considered that there were serious disadvantages to the scheme. The Sub-Committee suggested that before a definite statement is submitted to the B. of T. there should be a further interview between the two authorities. The U.D.C. has approved of the Sub-Committee's recommendation to attend a further conference with Bradford.

Rochdale.—The long-drawn-out dispute between the Gas and Electricity Committee and Tyre Yarns, Ltd., and Fabric Weavers, Ltd., respecting the interpretation of a clause in the agreement of supply has been settled. The firms named contended that they were entitled to a rebate because another firm taking less electricity than they were was being charged on a lower basis. Failing a settlement the firms asked that the matter should be submitted to arbitration by the B. of T. in accordance with another clause of the agreement. The Electricity Committee decided to empower Sir John Snell to settle the dispute on behalf of the Corporation without resort to arbitration. The settlement reached is that the company shall pay for current up to March 31st last £7,673, instead of the £8,048 originally demanded; this year's charges are to be revised downwards in accordance with the demand of the firms, but a small extra charge is to be made for current in excess of the contract quantity. The Committee also agrees to revise its contracts with three other firms, so that no consumer shall be supplied at cheaper rates than those included in the Tyre Yarns contracts, where the supply is given under similar circumstances.

Tasmanian Water-Powers.—Mr. Hartwell Conder, writing on the above subject in the *Australian Statesman and Mining Standard*, points out that the pioneers of hydro-electric work in Tasmania were the Launceston municipal authorities who secured 1,800 H.P. from the River Esk; this scheme encouraged several other country towns and one or two mines to erect small plants, but all were dwarfed by the Great Lake scheme, promoted by the Hydro-Electric Power and Metallurgical Co., and finally, taken over by the Government, the ultimate possibilities of which are estimated at between 50,000 and 100,000 H.P. Contemporary with this, the Lake Margaret scheme of the Mount Lyell Co. was

completed, 100,000 H.P. and a possible expansion to 100,000 H.P.

In view of these developments the writer goes on to discuss the total power available in the island, and summarises the various sources as follows:—

Class I.—	H.P.
Central Lake scheme	50,000 add
Makutosh Lake Co.	9,000
Launceston T.C.	1,800
Class II.—Schemes partly surveyed:	
Lake Rolleston	17,000
Stanley River	12,000
Class III.—Schemes superficially examined:	
Sedgwick Valley	10,000
Lake St. Clair	10,000
Total	130,000

Other locations offering prospects are the Makutosh River, Gordon River, Arthur River, Forth River, and Mersey River. On the whole it would appear that over 200,000 H.P. and under 400,000 H.P. are available.

Twickenham and Teddington.—PRICE INCREASE.—The Electric Supply Co. owing to the increased cost of coal, &c., has increased the price of energy to all consumers by 10 per cent.

Warrington.—ANNUAL REPORT.—The income of the electricity undertaking during the year ended March 31st last was £34,493 compared with £25,419 for 1914-15, and the expenditure was £24,213 compared with £16,858, leaving a gross profit of £10,199. The net profit was £2,495, which has been transferred to the appropriation account, making a credit balance of £9,424, after transferring £1,000 in aid of the rates and meeting expenditure on machinery and switchboard. The reserve fund now stands at £9,358.

Winchester.—PRICE INCREASE.—The T.C. has decided to increase the price of energy, as from the meter readings for the Michaelmas quarter, for lighting, power, heating, and cooking by 15 per cent.; and for supplies by prepayment meters by 10 per unit.

Worcester.—The Electricity Committee reports that it has been found necessary to agree to requests from the staff for extra pay for overtime and for increases of salaries and wages. The effect will be to add £148 a year to the wages bill.

TRAMWAY and RAILWAY NOTES.

Australia.—WAGES DEMANDS.—Close on 3,000 members of the Australian Tramway Employés' Association in Victoria, Tasmania, and Western Australia are concerned in fresh demands for increased wages, which have been served on the employers in those States. The bodies affected are the Melbourne Tramway Board; Prahran and Malvern Tramway Trust; Hawthorn Tramway Trust; Melbourne, Brunswick, and Coburg Municipal Tramway Trust; North Melbourne and Essendon Electric Tramways Co.; Ballarat and Bendigo Electric Supply Co.; and the Fremantle, Kalgoorlie, and Hobart tramway systems.—*Melbourne Age.*

Blackpool.—ACCIDENT.—An alarming smash occurred in Central Drive recently: the vehicles concerned were a Corporation car on the Marton route; a Blackpool, St. Anne's and Lytham car, and two motor char-à-banc from Southport. One of the latter had broken down and was being towed by the other. The front char-à-banc contained 28 passengers and the other 18. Both cars had to be removed to their respective depôts, the St. Anne's car being badly damaged.

Twelve car-lifting jacks are to be purchased and placed at suitable positions on the Corporation tramway system.

Bradford.—WAGES.—The Society of Tramway and Vehicle Workers has sent in an application for an advance of wages for drivers, conductors, and the parcel staff—based on the increased cost of living—the granting of which would incur an additional cost of £20,000 a year to the department.

Burnley.—DEPRECIATION ALLOWANCES.—Mr. Mozley, the tramway manager, has submitted a statement showing the sums he considered it was necessary to set aside annually for depreciation:—Rails, amount expended £86,796, annual depreciation, £2,787; paving, £43,770, £845; overhead, £15,549, £331; depôt buildings, rails, &c., £44,061, £185; general offices, £3,000, £13; centre offices, £5,165, £22; waiting rooms, &c., £407, £7; machinery, £2,800, £50; tower wagon, £642, £32; house, Queensgate, £375, £11 11s; rolling stock, £54,647, £1,359; total amount expended, £257,213, total annual depreciation, £5,672.

Glasgow.—Representations in favour of a modified all-night service of cars were submitted by a deputation of the Springburn Ward Committee at the last meeting of the Tramway Committee. The basis of the appeal was the convenience that would accrue to the large number of workers engaged on nightwork in scattered parts of the city and environs.

The Tramway Committee, after considering the application of the drivers and conductors for a war bonus of 6s. per week, has agreed to raise the working hours to from 54 to 56 per week, with ordinary pay plus a bonus of 2s. per week to men and 1s. per week to women, and time and a-half overtime rates. The question of improving the car lighting is under consideration, so far as this is possible without infringing regulations.

Liverpool.—TRAFFIC RETURNS.—Big increases in receipts on the tramways were reported at a meeting of the Tramways Committee on the 1st inst. Since January 1st the receipts had amounted to £478,451, an increase of £23,912 compared with the corresponding period of last year, and the passengers carried had numbered 10,321,389; while the car-mileage was 8,322,190, a decrease of 58,534. For the past seven weeks the mileage was 1,115,251, a decrease of 9,338 compared with the corresponding period a year ago; the receipts for the seven weeks were £107,320, an increase of £8,109, and passengers carried numbered 22,097,820, an increase of 1,115,315.

London.—P.O. TUBE RAILWAY.—With reference to the "Note" in our issue of August 25th (page 211) referring to the London Post Office Tube Railway, we are informed that Mr. Asquith's Parliamentary answer related solely to the construction of the tunnel, and in no way to the electrical equipment. Further, we understand that no invitation for tenders for electrical equipment has yet been issued, and no decision has yet been arrived at with regard to the system of electric traction to be adopted.

Manchester.—The Tramways Committee has decided to recommend the Council to apply to the B. of T. in accordance with the provisions of the Special Acts (Extension of Time) Act, 1915, for a further extension of the period limited for (a) the construction of the tramways, and (b) the compulsory purchase of lands for street widening, referred to in Sec. 31 of the Manchester Corporation Act, 1911. It has been decided that women guards be paid the annual advances as provided in the scale of wages in operation as regards male guards. Sir George Askwith (Chief Industrial Commissioner), in forwarding to the Corporation a letter from the Workers' Union respecting an application for an advance of wages for workmen in the permanent way department, suggests that the matter should be referred to the Committee on Production for settlement, and the Tramway Committee has agreed to the suggestion, and has instructed the general manager to prepare, and present the Committee's case at the arbitration. Corporation Committees are being recommended to follow the lead of the Tramways Committee, and allow an extra day's wages in lieu of the Whit Monday and August Bank Holiday, to workmen who, being entitled to holidays on those days, were working in accordance with the decision to forgo the holidays.

New Zealand.—The Palmerston B.C. has been authorised to raise a loan of £86,000; £66,000 will be devoted to an electric tramway undertaking, and £20,000 for an electric lighting installation; the undertaking will not be proceeded with until the conclusion of the war.—*Board of Trade Journal.*

Salford.—WAR BONUSES AND RATE RELIEF.—Additional war bonuses are being recommended by the Tramways Committee for payment to tramway workers. If the recommendation is adopted it will mean an addition to the working cost of the department of over £2,774 per annum, and £1,804 to men serving with the Forces, and the total charge under this heading will be nearly £10,000. The Committee declares that probably the payment of the increased bonuses may prevent it from handing over at the end of the year the sum promised for rate relief.

TELEGRAPH and TELEPHONE NOTES.

China.—An American Consul reports that great improvement has recently been made in the service of the Chinese Telegraph Administration. New territory has been reached, and new offices have been opened in fields already covered. In order to ensure speed in the transmission of telegrams, the Wheatstone automatic system has been adopted on all trunk lines. In order further to accelerate the transmission of telegrams, three years ago the Administration began the installation of the automatic duplex system on its more important lines, the first installation being made on the Pekin-Tientsin line. In May and June this system was put into use between Pekin and Hankow, and Hankow and Shanghai. It is the intention of the Administration gradually to extend the duplex system.

Illicit Wireless Plant.—At Gisborne, N.Z., a boy, 16 years of age, named E. M. Goffe, was charged with erecting a wireless plant without the consent of the Government. Mr. Edward Goffe, father of the boy, was charged with aiding his son in committing the offence. Evidence was called showing that the plant, if properly fitted up, could send messages a short distance, and could receive from Auckland and Wellington. The offence was admitted as far as a technical breach was concerned. The magistrate fined the junior defendant £2, and costs 7s. The father was fined £10, costs 7s.

Telephone Register.—In future, Australian subscribers whose telephones are connected with an exchange in which the common-battery system is in use can obtain an automatic recording register, which will enable them to check the number of calls they originate. The instrument will be affixed to the subscriber's telephone, and the annual rental is 10s. at the outset. This boon will be available to a limited number of subscribers only. It has been decided to install the instruments on telephones connected with Central and North Sydney exchanges.

Women Wireless Operators.—At the beginning of the year the Marconi Co., with a view to determining the suitability of women as wireless operators, established a school at one of their stations. The school has been well attended, and the experiment is regarded as encouraging. Some of the pupils have been already drafted to stations, where they are doing very satisfactory work. Sending by female operators has a tendency to be too light, but it is thought that some of the learners will become quite efficient with more practice, that a number will prove very useful understudies, and that a proportion may turn out successes on the wireless circuit. Until these points can be determined, the work of the school will be discontinued for the present after September 30th.—*The Times.*

Victorian Railways :—

1,000 amp.-hour storage battery, £267.—W. Adams & Co., Ltd.
G. Weymouth Pty., Ltd.
1,000 amp.-hour storage battery, £267.—W. Adams & Co., Ltd.
Scientific Instrument Co., Ltd.
1,000 amp.-hour storage battery, £267.—W. Adams & Co., Ltd.

Continued.

Glasgow.—The Sub-committee on Electricity Works recommends the purchase of two 5-ton motor-wagons, one from Edison Accumulators, Ltd., and one from the General Vehicle Co., at a total cost of £2,990.

Manchester.—The Tramways Committee has accepted the tender of Messrs. F. Smith & Co., Ltd., Salford, for copper trolley wire.

Salford.—Tramways Committee :—

H. H. H. Ltd., Manchester, road recorders, £220.

Electricity Committee :—

Lea Recorder Co., Ltd.—Steam recorder, £134.

Royleys, Ltd.—Feed water heater, £115.

FORTHCOMING EVENTS.

Institution of Mining Engineers.—Thursday, September 14th. At 11 a.m. At the Technical College, Glasgow. Annual general meeting.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—**SYDNEY.**—September 20th. N.S.W. Government Railways. One 50-ton electrically-operated overhead travelling crane for Zara Street power house, Newcastle. October 11th. One motor-driven air compressor for Zara Street power house. Electrical Engineer, 61, Hunter Street.

ADELAIDE.—September 27th. Deputy P.M.G. Telephones, telephone material, instruments and parts. Schedule Nos. 12, 13 and 14.

PERTH.—October 4th. Deputy P.M.G. Telegraph and telephone measuring instruments and parts. Schedule 301 W.A.*

MELBOURNE.—November 1st. Victorian Railways. 50,000 flame arc carbons. Chief Storekeeper, Railway Offices, Spencer Street.*

October 18th. Victorian Government Railways. Electric time releasing mechanisms for automatic signalling. Contract No. 20543.*

September 29th. City Council. Insulated and H.D. copper cables. See "Official Notices" to-day.

November 1st. For the Victorian Railway Commissioners. 50,000 yellow flame arc carbons.*

October 17th. For the Deputy P.M.G. (1) sleeves and tapes (Schedule No. 1,353), and (2) 3,400 standard with low lighteners (Schedule No. 1,359).*

Burnley.—September 19th. The B. of G. invites tenders for electrical goods. Tender forms from J. S. Horn, Clerk.

Edmonton.—September 20th. Electric lamps for six months. Mr. F. Shelton, Clerk. B. of G., Lower Tottenham.

Government Contracts.—September 8th (11 a.m.). Incandescent lamps for the Office of Works. See "Official Notices" to-day.

London.—Supply of electric light fittings for Australia House, Kingsway, W.C. Particulars from Mr. H. H. Turner, 48, Broadway, Westminster, S.W.

L.C.C.—September 15th. Asylum and Mental Deficiency Committee. Supply of electric lamps. Mr. H. F. Keane, Clerk, 2, Savoy Hill, W.C.

CITY OF WESTMINSTER UNION.—September 20th. B. of G. Six months' supply of electric lamps, fittings, &c. Mr. W. J. Lickley, Clerk, Gardens Offices, Princes Row, Buckingham Palace Road, S.W.

Manchester.—September 12th. Tramways Committee. (a) Permanent-way special trackwork, and (b) permanent-way point tongues and crossings. Specifications, &c. (£11s., returnable). Mr. J. M. McElroy, General Manager.

September 12th. Tramways Committee. Supply of pitch. Mr. J. M. McElroy, General Manager, 55, Piccadilly.

New Zealand.—**INVERCARGILL.**—September 28th. Borough Council. Steam turbo-alternator, condensing plant, and switchgear. Specifications from the Tramway Office. Contract No. 40.*

GISBORNE.—October 2nd. B.C. Cooling tower at the power station. Specifications from the Town Clerk.—*N.Z. Shipping and Commerce.*

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The Sydney Municipal Council is recommended to accept the following tenders :—

Large motors for lifting out. Four 10-horse power fixed type motors complete, to be manufactured by the Electric Construction Co., £714; three 60-horse power, 40-2, B. W. Watson, Electric Ltd., two 10-horse power, ditto, of American manufacture, £674, Aust. General Electric Co. Steelwork for new workshop at power house, £4,609.—L. Scrutton and Co., Ltd.

Consumers' meters, 5 and 10 amp. and 20 amp., £1,957. Standard Wagon-Herberts Ltd.

Ten 3,000-volt feeder panels for the substations at Lang Park, Philip Street, and the abattoirs, £1,840.—Australian General Electric Co.

THE BRITISH ASSOCIATION.—I.

For the fourth time in its history, the British Association for the Advancement of Science is meeting in Newcastle-on-Tyne, where the 88th annual gathering was inaugurated on Tuesday night, when the President (Sir Arthur Evans, D.Litt., LL.D., F.R.S., &c.) delivered his address on "New Archaeological Lights on the Origins of Civilisation in Europe." The Association met in Newcastle in 1838, 1863, and 1889, and, but for the present disastrous war, this year's visit would have been of especial interest, particularly to the engineering section, for there have been, immense developments on the whole of Tyneside in all branches of that industry, and in none has this advance been more marked than in the electrical section, for the city forms the nucleus of one of the greatest supply systems in the country.

The first event in connection with the visit was the delivery of a popular lecture on Monday night by Dr. Dugald Clerk, F.R.S., whose subject, "Gas, Oil, and Petrol Engines," was admirably illustrated. On Tuesday there were various meetings of the Council and Committees, and the former body unanimously nominated the Hon. Sir Charles A. Parsons to fill the office of President of the Association for 1917-18, when the meeting will be held at Bournemouth. The appointment of this gentleman, head of the electrical and engineering firm of C. A. Parsons & Co., at Heaton-on-Tyne, and chairman of the Parsons Marine Steam Turbine Co., Ltd., is very pleasing to the district.

The Council also considered a proposal for the constitution of a Committee on organisation in relation to problems arising out of the war. A Committee was appointed, and recommended that the Organising Sectional Committees should meet to consider problems, if any, arising in their special departments of science which might call for investigation in connection with the future effects of the war upon the national and imperial welfare, and the proper methods of investigation of such problems. It was further resolved that a Research Committee should have power to report through the Organising Committees of the Council when the Association was not in session. A number of valuable proposals received from the Organising Sectional Committees had been transmitted to the Council, and action arising out of several of these was proceeding.

The business of the various sections was commenced in earnest on Wednesday morning. In the Engineering Section the President (Mr. Gerald Stoney, F.R.S.) delivered his address, in the course of which he emphasised the importance and value of highly-educated labour in various trades. One of the things which handicapped our industries was the reluctance of employers to utilise such labour. Not only on the scientific side was there much to be done in the way of putting our house in order, there was also

posed to be done on the management and commercial side if it was necessary to put into a position of most competition effectively. In this section a paper on "Limit Gauges" was read by Mr. E. T. Cunningham, C.B. F.R.S., in which he dealt with gauges for plain cylindrical work, screw gauges, and form and position gauges. This was the only matter dealt with in this section.

A considerable stress was laid in the Economic and Statistics Section, the President of which (Prof. A. W. K. Atkinson, M.A.) spoke upon "Some Thoughts on Reconstruction after the War," in the course of which, after pointing out some of the effects of the war on our economic existence, he dealt with the need for national organisation. Then followed the presentation of a summary of a report on "Means for the Promotion of Industrial Harmony." The report suggested, *inter alia*, that both employers and employed should form local and national associations of one trade, and local and national federations of trades, and the election of an industrial council from the two national associations. The proposals were discussed by Archdeacon Cunningham, Prof. W. R. Scott, Sir Hugh Bell, and Mr. E. Jackson.

In the Chemistry Section, Prof. G. G. Henderson, D.Sc., F.R.S., the President, remarked on the awakening of the country to an appreciation of the importance of chemistry. Mr. F. H. Carr read a paper on "Some Aspects of the Future of the Synthetic Chemical Industry of Great Britain," and Mr. C. M. Whittaker dealt with "The British Coal-Tar Colour Industry in Peace and War."

NOTES.

Institution and Lecture Notes.—Nottingham Society of Engineers. The first meeting of the 1916-17 session will be held at the Wallace Hotel on October 18th, at 7.30 p.m. The Council wishes this meeting to be given to the reading and discussion of short papers on engineering subjects, which should not take more than 10 minutes to read. Six papers will be read by an independent reader, and members will then be asked to vote for the two best papers, so that they can be discussed and prizes awarded. The Council has appointed Mr. J. F. Chambers to the post of secretary, resigned vacant by the resignation of Mr. H. G. Price, his address being The Elms, Daybrook, Nottingham.

Institute of Metals.—The annual autumn meeting will be held on Wednesday, September 20th, commencing at 4 p.m., at Burlington House, London. Sir George T. Bell will preside, and a number of important metallurgical papers will be presented and discussed.

The Government Research Council having made a grant of £1,000 per annum towards the cost of carrying on the research inaugurated by the Institute into the causes of the corrosion of marine condenser tubes, it has been found possible by the Corrosion Research Committee, which has recently been reconstituted so as to include representatives of all bodies interested in the subject, greatly to extend its sphere of activities. Two salaried investigators have been appointed in the persons of Captain G. D. Bengough, D.Sc., and Dr. O. F. Hudson. They will conduct scientific researches on the Committee's condenser plant now about to be installed, by the courtesy of the Brighton Corporation, in the Brighton Electricity Works. The plant will be worked under ordinary industrial conditions, the microscopical and other examination of the metal treated at Brighton being carried out in the metallurgical laboratories of the Imperial College of Science and Technology, South Kensington.

Fatalities.—Horace Dean Smith (27), of Irlam, an electric stripper crane driver at the Partington Steel and Iron works, Irlam, was struck by an ingot mould, and received fatal injuries, last week; at the inquest a verdict of "Accidental death" was returned.

A young man named George Dixon was killed by electric shock at Hebburn on Wednesday evening, having touched a street-lamp standard with his hand.

An inquest has been held at Manchester into the death of a woman tramway conductor, on a single-deck car, who apparently leaned out of the car to speak to the trolley girl on the rear platform, not noticing a motor wagon which was being overtaken, and got her head crushed between the vehicles. Verdict, "Accidental death."

A verdict of "Accidental death" was returned in the case of George Edward Stithman, a press driver at the Western Electric Co.'s works, North Woolwich, who was struck by a flying piece of the machine, sustaining concussion and a fractured skull.

An inquest was held at Bilston on Monday respecting the death of a lad named Atkins, at the works of Messrs. Thompson Bros., boiler-makers. A witness said he found the lad, a riveter, who had been working at a vice, suffering from shock. He was carried into the stores, and artificial respiration was resorted to, but without avail. Witness explained that before he saw the lad he caught

his foot accidentally against a piece of angle iron, one end of which was on a track which was to be electrically welded and the other on the iron leg of the vice. He supposed this must have set up an electric circuit, producing shock, which caused death. Harold Brook, electrical engineer to the power company supplying the current, said the main voltage was 210, but it was transformed to 110 for welding purposes. The jury found that Atkins died from shock caused by an electric current accidentally transmitted.

Volunteer Notes. FIRST LONDON ENGINEER VOLUNTEERS Headquarters, Chester House, Euston Place, S.W. Orders for September, 1916, by "Lieut.-Col. C. B. Clay, V.D., Commanding.

Members are requested to take special note that during this month the lectures will be on Wednesdays, in place of Tuesdays.

Drills will be held under the Sergeant-Major on Tuesday evenings, as during August.

The range will be open on Thursday evenings, as during August. Instruction Classes at Regency Street will be held as usual for Platoons Nos. 9 and 10.

Entrenching.—Every Sunday at Victoria Station (S.E. & C. Railway). Booking-office, 8.45 a.m.

MAJOR G. YEASLEY, *Adjutant.*

RED BATT. (OLD BOYS) CENTRAL LONDON VOLUNTEER REGIMENT.—Battalion Orders by Capt. R. J. C. Eastwood (Commandant), Thursday, September 7th, 1916:—

Saturday.—The Battalion will parade at Liverpool Street Station (Low-Level entrance, G.E.R.) at 8.40 a.m., for Entrenching duties. Those who cannot take the early train will parade at 1.20 p.m.

Sunday.—The Battalion will parade at 9.30 a.m. for Entrenching duties.

Bisley Range will be open for practice on Sunday, 10th inst. The Range will not be open on Saturday, 9th inst.

G. H. F. DUNCAN, *Acting Adjutant.*

Australian Industrial Inquiry.—On the suggestion of Mr. Herbert Brookes, president of the Victorian Chamber of Manufacturers, the Government proposes to organise a Commission to visit the United States and investigate methods of production and manufacture as well as conditions of employment.

The Commission will consist of six representatives of the manufacturers in Australia, one from each State, with six representatives of the workers, one also from each State. The Chamber of Manufacturers in each capital city will be asked to submit three nominations, and the central Labour organisation in each State similarly to nominate three men. The selection will then be made by the Commonwealth Government.

The following industries are to be investigated by the Commission:—Iron trades, engineering, &c.; timber trades and building material, &c.; leather trades; textile trades; paper trades; trades engaged in the preparation of foodstuffs.

The manufacturers' representatives will be appointed from the several States as follows:—Iron trades—New South Wales; textile trades—Victoria; leather trades—South Australia; trades engaged in the preparation of foodstuffs—Queensland; timber and building material trades—Western Australia; paper trades—Tasmania.

The same principle will apply in the selection of the representatives of the Labour organisations.

A secretary will be appointed, and the Commission will be accompanied by a journalist.

The scheme, says the *Australian Statesman and Mining Standard* has not met with universal approval; the methods of manufacture are well known in Australia, and Mr. Brookes's recommendation referred more to the study of industrial relations in all industries in actual operation.

Tramways and the Kinematograph.—Our contemporary, the *Electric Railway Journal*, recently contained a sensational view of a car taking a plunge from a viaduct spanning a ravine. The explanation given was that a moving picture firm bought up a discarded car from the Ithaca Traction Corporation, using it for picture making; as the plot developed, the villain (represented by a dummy), having been knocked out by the hero, was left on the front platform of the car, which, after gathering speed on a grade, was derailed by a switch on the viaduct, breaking through the imitation railings and falling some 300 ft. to the bottom of the gorge. The car is said to have landed head-on in the bottom, and a good many tramway men will, no doubt, be interested to view the remains.

A Novel Gas Turbine.—A recent issue of *Power* contained a brief description of a gas turbine introduced by the Detroit Gas Turbine Corporation. Its principle of operation consists in compressing a charge of the mixture, firing it at constant volume in an explosion chamber, which results in a very high pressure, and allowing the products of combustion to impinge on a series of moving and stationary blades. The arrangement shown consists of eight radial gas compressor cylinders, which compress the gas mixture to about 90 lb. per sq. in. prior to its discharge into firing chambers round the periphery of the turbine, from which the products of combustion at high pressure impinge on two rows of moving blades separated by a row of stationary blades. The moving blades are carried on the outer casing which revolves about the driving shaft on ball bearings, and is geared to the shaft through a 3 to 1 reduction giving a shaft speed of 3,000 r.p.m., which corresponds to 24,000 explosions a minute. The rotor diameter for a 200 H.P. turbine is said to be 21 in., and the weight 335 lb.

Appointments Vacant.—Assistant master in electrical engineering for the Polytechnic, Regent Street W.: shift engineer for North R.D.C.: two electricians (£22 10s. p.m.) for Rhodfa-mains attendant (£2) for Leek U.D.C. See our advertisement page to-day.

Educational Notes.—**ROYAL TECHNICAL COLLEGE, GLASGOW.**—We have received the College Calendar for 1916-17 giving particulars of the various engineering courses. Prof. Magnus Maclean is at the head of the Electrical Engineering Department.

WEST HAM MUNICIPAL TECHNICAL INSTITUTE. The new session commences on September 20th: day and evening courses in electrical engineering are provided. Particulars are given in our advertisement pages to-day.

GOLDSMITHS COLLEGE (UNIVERSITY OF LONDON), NEW CROSS, S.E.—The new session begins on September 25th. Mr. W. J. Lineham is at the head of the engineering department. See our advertisement pages to-day.

Field Operating Theatre.—A motor field operating theatre, which is about to be presented to the Italian Government by the Wounded Allies' Relief Committee, has been on view in the grounds of Aldford House, Park Lane, London, W. The electrical installation includes three 100-c.p. lamps and other smaller lamps in the interior of the theatre, together with two electric fans, and on the outside Blériot head lamps, side lamps, and tail lamp. The current is supplied by a Blériot 12-volt, 200-watt dynamo, which is driven by the engine, and gives 15 amperes when the vehicle is running at 12 miles an hour and 25 amperes when stationary. The construction has been carried out under the supervision of Mr. J. N. Walford.

Copper.—The figures for copper supplies, as shown in Messrs. H. R. Merton & Co.'s circular, are of an encouraging nature. While the price at the end of July, 1916, was £111 per ton (standard copper), it is shown for the end of August to be £109 10s. While it has been impossible to estimate the stocks in Rotterdam, Hamburg and Bremen, and no figure can be given for American stocks, the supplies usually known as "European visible supplies" stand at a very healthy figure. The total supplies for the month of August, 1916, were 43,239 tons, which compares most favourably with August, 1915 (30,518 tons), and, of course, with August, 1914 (25,429 tons), and even shows up fairly well against the average for the 12 months preceding the war (47,740 tons). Taking the quantities under their various headings, we find that the European arrivals from North America were 25,367 tons, about $\frac{1}{2}$ rd less than the pre-war average; those from Spain and Portugal to England and France low (following an unusually high delivery in July). "Other countries" gave double the pre-war average; Chile shipments were more than $\frac{1}{2}$ rd higher, and Australian about $\frac{1}{2}$ rd below. The supplies for last month have only three times been exceeded since August, 1914, i.e., in March, 1915 (43,272), May, 1915 (46,032), and June, 1916 (44,526).

NORWEGIAN COPPER EXPORTS.—The export of copper, copper ores, and pyrites from Norway was prohibited from Tuesday last. This measure has been adopted in order to secure the retention of some 3,000 tons of manufactured copper required in connection with electric works and street railways which has been obtained from America. At the same time it is understood that concessions will be made for export to the belligerent countries against compensations for the same quantity of manufactured copper to neutrals.

"Cold Light" Again.—The daily Press, forgetting that the fallacy was exposed by us some years ago, and unable to discriminate for itself between fact and fiction, has once more got hold of the "cold light" system of Prof. Dussaud, and is treating it as a novelty. The essence of the system is to spin a number of electric lamps on a wheel, each lamp being energised in turn for a fraction of a revolution, so as to give the impression that the light is continuous. As the heat developed whilst the lamp is burning is dissipated whilst it is out, the lamps remain cool—hence the term, "cold light." It is merely a roundabout and elaborate way of obtaining the same result as would be secured by burning one lamp and keeping it cool with a water-jacket or a fan. Whatever advantages are claimed for the Dussaud system can be far more easily and cheaply obtained by other means.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials. Mr. S. W. CARTY, late of the electrical department of the Liverpool Corporation tramways, has been gazetted to a captaincy. He has recently returned from the Sudan, and the following is an extract from a recent letter which Mr. J. H. C. Brooking has kindly sent us:—"As you know, I went to Egypt last February, and first week in April I was sent in charge of a detachment of lorries and men to the Sudan to take over the transport of supplies, &c., of the Western Frontier Force, who were operating against the Sultan of Darfur. It was over 2,000 miles south of Alexandria, and we went by rail to Assouan (Shallal) and then down the Nile on barges to Wadi Halfa,

and on by Kitchener's Railway over the desert to Khartoum, and thence again by rail to El Obeid (Kordofan). From there I trekked due west 200 miles over sand, desert, and through the bush, where nothing but camels had ever been before, and safely carried supplies, going backwards and forwards from the railway at El Obeid. Of course, there was no road, only a track; it was some job, as we had all sorts of stores to take, oil, petrol, bombs, spare engines and parts for the Flying Corps, telegraph poles, boxes of stuff all manner of kinds. Darfur lies between French Equatorial Africa and Kordofan (British Territory). As you know by the papers, the Sultan's army was beaten and dispersed, and he fled, so we have taken over the country. I got specially thanked by the Sirdar (General Sir Reginald Wingate), who is Kitchener's successor in the Sudan."

PHILLIP YELLOWLEES, who was employed as an electrician on H.M.S. *Nottingham*, was three hours in the water when that ship sank before being picked up. Prior to joining the Navy, Yellowlees was in the employment of the Electric Supply Co., Jedburgh.

The Aylesbury U.D.C. has appointed Mr. MARK WHITTLE, of Horwich (Lancs.), as assistant electrical engineer, subject to his being exempted from military service.

Mr. D. H. DAVIES, chief electrical assistant at the Stockton Corporation undertaking, has been appointed electrical engineer and tramway manager to the Heywood Corporation at a salary of £200 per annum. There were 50 applicants for the post.

General.—Mr. E. J. Fox is resigning the position of London manager of Messrs. Stewarts & Lloyds, Ltd., in order to take up the position of general manager of the Stanton Iron Works Co., Ltd., near Nottingham, with a seat on the board as managing director. Mr. Fox succeeds in March next Mr. J. A. Longden, whose services will, however, be available to the company, as he remains a member of the board of directors.

Mr. C. F. ASHBY, district manager of telephones at Canterbury, has been promoted to an important position at Norwich, and will be succeeded by Mr. MACLEAN, of Plymouth.

We learn that Mr. EGORON MOLLER, of the Allmänna Svenska Elektriska Aktiebolag, of Vesterås, has arrived in London to organise the manufacture of transformers in England by the Swedish General Electric, Ltd.

Mr. J. N. STEPHENS (manager of the wiring supplies department of the British Thomson-Houston Co.) has joined the Royal Flying Corps as Second-Lieutenant (Assistant Equipment Officer).

Roll of Honour.—Last week we mentioned that Captain H. C. SPARKS had received the D.S.O. for conspicuous gallantry; we are pleased to add that the French Government has awarded him the "Croix de Guerre" with palm leaf (which, we understand, is a special honour), for the same action on July 1st. Captain Sparks was awarded the Military Cross in June last.

Driver W. OWENS, accidentally killed whilst on active service, was assistant storekeeper, and Rifleman W. BRADLEY, killed in action, was a warehouseman, with Messrs. Downes and Davies, electrical engineers, of Liverpool.

Private RICHARD MASSEY, who was formerly employed with the Electrical Apparatus Co., Ltd., has been killed at the Front. He was only 19 years old, and was one of the first members of the Corpus Christi School Volunteer Training Corps.

Lieutenant F. G. DUNCAN STONEY, R.E., who has died from wounds, was the only son of the late E. D. Stoney, and was on the staff of Messrs. Ransomes & Rapier, Ipswich, when war broke out. His commanding officer wrote that he would be very very difficult to replace, not so much on technical grounds, though he was the best educated scientifically of any of the officers in the Division, but because of his many-sided nature. The General also expressed his personal sorrow and appreciation of his ability, and a further letter of appreciation was written by the N.C.O.'s and men of his section.

Private C. CASHMORE, Oxford and Bucks L.I., who was with the British Thomson-Houston Co., is reported killed in action.

Private ARTHUR N. HENDERSON, King's (Liverpool) Regiment, who was with Messrs. Pulford Bros., Ltd., electrical engineers, Liverpool, has died from injuries received while engaged with a bombing party.

Gunner F. GOODMAN, R.F.A., who has died of wounds, was formerly employed by the British Thomson-Houston Co.

The Military Medal has been awarded to Private CHARLES SMITH, formerly a tramway conductor with the Bradford Corporation.

The *Calcutta Weekly Statesman* records the death in action of Mr. JOGENDRA NATH SEN, B.Sc. Mr. Sen left India in 1910, gained admittance to Leeds University, and after taking an engineering course for three years, graduated as a Bachelor of Science. Soon afterwards he secured a position under the manager of the Leeds Corporation electric lighting station, and was ultimately placed on the staff as an assistant engineer. On the outbreak of hostilities with Germany Mr. Sen joined the West Yorkshire Regiment.

Lance-Corporal JOHN HENRY ANDREWS, Manchester Regiment, formerly with the British Westinghouse Co., is a prisoner of war at Dulmen, Westphalia.

Private ARTHUR WEBB, Manchester Regiment, a former employé of Messrs. Baxendale & Co., Ltd., is missing.

the obligation to provide a fixed sum of £9,000 per annum, and a provision that the net profits of the company up to £9,000 per annum should be set aside for the service of the interest and sinking fund was substituted. Before arriving at net profits the directors are of opinion that some provision must be made towards the expenditure referred to, and they have therefore set aside £4,000 for this purpose. During the year the tramcars travelled 593,434 car miles, as against 582,114 car miles in the year 1914, and carried 2,192,135 passengers, as against 2,125,094 in the year 1914. The earnings per car mile in 1915 were 13.52d., as against 13.12d. in 1914, with an expense of 9.93d. per car mile, as against 9.48d. in 1914. The number of units consumed in 1915 were 692,935 (£7,939), as against 632,165 (£7,242) for the year 1914. During the past year the whole of the Boulder Road has been re-made between Kalgoolie and Boulder, and this, in conjunction with the heavy motor-car traffic, has given very bad tracks for quick services, and increased power consumption. The "A" debenture stock has been further reduced by the sum of £1,800, and the amount of stock outstanding at the date of the accounts was £48,000.

At the annual general meeting the CHAIRMAN, in moving the adoption of the report and accounts, said that the profits of the undertaking were still very small. The competition of motor-cars still continued, and it was of a most unfair character, because the tramway company was compelled to run a continuous service for the benefit of the town, whereas the motor-cars did just whatever they pleased, running whenever there was a chance of getting good traffic. It was probable that the scarcity of petroleum would do away with that form of competition, but it was doubtful whether they would receive any great benefit, so many low-grade mines had had to close down and so many miners had joined the fighting forces and left Kalgoolie. For the moment the only thing they could do was to go quietly on and hope for the best. The first debentures had certainly been reduced to £48,000, but behind those came the second debentures, and unless some miraculous change took place there seemed very little probability of anything ever coming to the shareholders. The high cost of labour was against both mining and agricultural development, and it was doubtful whether the Transcontinental Railway would bring the benefits anticipated to the town.

The report was unanimously adopted, and the retiring director, Mr. C. C. Baker, re-elected.

Manila Electric Railroad and Lighting Corporation.

The report for the twelve months ended December 31st last states that the gross earnings of the companies for the year were \$1,494,737, a decrease from the previous year of \$107,213, or 6.69 per cent.; operating expenses and taxes, \$762,958, a decrease of \$55,455, or 6.78 per cent.; while the net earnings from operation were \$731,828, a decrease of \$51,757, or 6.60 per cent. Interest charges during the year were \$264,975, and sinking fund requirements were \$41,500, leaving a surplus for the year of \$425,353. The directors maintained the annual appropriation for the replacement and renewal fund of \$80,000, and, deducting this from the year's surplus earnings, there remains an available surplus for the year of \$345,353. From this amount there were paid four dividends of 1½ per cent., making 6 per cent. for the year, aggregating \$300,000, leaving \$45,353 over all disbursements and reserves, which was transferred to surplus account, making total accumulated surplus to December 31st last \$1,778,835. Against this amount was charged \$55,000 to provide for a special reserve recommended by the company's auditors, leaving total accumulated surplus and reserves, as per balance sheet, of \$1,723,835. In the railway department the earnings decreased \$107,801 and the operating expenses increased \$5,045; in the electrical department the earnings increased \$22,138 and the operating expenses decreased \$42,568. In the other departments the earnings decreased \$21,550 and the operating expenses decreased \$29,343. Almost all the local industries and business houses followed a policy of retrenchment, which caused decreased revenues to the insular and municipal treasuries, which, in turn, had to resort to the assessment of additional taxes. During the year there were purchased under the sinking fund provisions of the company's mortgage \$37,000 face amount of the 5 per cent. 50-year first lien and collateral trust sinking fund gold bonds, making a total of \$255,000 face value of bonds held by the trustee. There were also purchased under the sinking fund provisions of the mortgage of the Manila Suburban Railways Co. \$5,000 face value of the first mortgage 5 per cent. 40-year sinking fund gold bonds of that company, making a total of \$19,000 face value of bonds held by its trustee.—*Financier*.

The report for the year ended December 31st (as given in the *Financial Times*) states that while the combined earnings of the companies in Brazilian currency have fully realised the expectation of the board, being considerably greater than those of the previous years, the result is not so satisfactory when such earnings are converted into Canadian currency. Converting the earnings during 1915 at the average rates prevailing prior to the war, the net revenue in Canadian currency would be increased by over \$3,000,000. The revenue of the company in Canadian currency resulting from the year's operation was as follows:—Revenue from securities owned and under contracts with sub-

sidary companies \$5,339,192, and from interest on advances to subsidiary companies \$273,683, a total of \$5,612,876. Deducting general and legal expenses, administration charges, and interest on loans, amounting to \$218,074, and the dividends paid on the preference and ordinary shares, there remains a surplus carried forward of \$545,421. During the first half of 1915, dividends on the ordinary shares at the rate of 1½ per cent. each were paid on March 1st and June 1st respectively. As, however, contrary to expectations, the exchange value of the milreis continued to fall, the board decided to limit the dividends payable on September 1st and December 1st to ½ of 1 per cent. each, making a total dividend of 4 per cent. for the year. Although rigid economies have been effected, the cost of operation and maintenance has been adversely influenced by the rise in the price of materials and by the enormous advance in ocean freights. This advance has particularly affected the earnings of the gas business, as owing to the requisition by the British Government of some of the steamers employed in the company's service for carrying coal, it became necessary to charter other steamers at rates greatly exceeding those which would have been payable under normal conditions. It is, therefore, remarkable that, notwithstanding the adverse circumstances, the results for the year have been so satisfactory, and with a return to normal conditions the revenue should be not only equal to that obtained prior to the war, but should show a considerable and steady increase. Conditions generally in Brazil are showing distinct signs of improvement. During the year further shares have been acquired in the Companhia Telefonica do Estado de Sao Paulo and in the Companhia Rede Telefonica Bragantina, and with those subsequently purchased this company now holds 95 per cent. of the share capital of each company. This company has also made advances for the purpose of carrying out necessary improvements and extensions to the telephone systems, which, when completed, should result in material increases in the revenue. A quarterly dividend of 1½ per cent. has been declared on the preference shares, payable October 2nd, to shareholders of record of 15th inst.

Consolidated Gas, Electric Light & Power Co. of Baltimore.

The report for the year ended June 30th states that the gross income amounted to \$7,431,768, and the operating expenses and taxes to \$5,848,076, leaving net earnings of \$3,583,692; fixed charges absorbed \$1,580,057, and dividends paid and payable \$1,131,803, leaving \$671,831, out of which there has been placed to reserve for depreciation, amortisation, &c., \$550,000, to reserve for contingencies \$134,541, and charged off to bond discount \$90,000, leaving a net surplus of \$97,299. The growth in the sale of both gas and electricity has been phenomenal, and the increase in the sale of electricity has broken all previous records. The gross income from sale of electricity was \$3,881,665, against \$3,301,199 in 1915, an increase of \$580,466, while the electricity sold, kw.-hours, was 189,475,608, against 126,933,209 in 1915, an increase of 56,542,398. The power sales department is negotiating for power installations aggregating 60,000 H.P. The company is now completing the installation of a steam turbine of 27,000 H.P. as an addition to its steam generating station. On May 1st last the properties of the Patapasco Electric & Manufacturing Co. were formally taken over.

Stock Exchange Notice.—The Committee has been asked to allow the following to be quoted in the Official List:—

Mexican Electric Light Co., Ltd.—Deposit receipts for 5 per cent. first mortgage gold bonds.

Mexican Light & Power Co., Ltd.—Deposit receipts for 5 per cent. first mortgage gold bonds and 5 per cent. second mortgage 50-year bonds.

Mexico Tramways Co.—Deposit receipts for general consolidated first mortgage 50-year 5 per cent. gold bonds and 6 per cent. 50-year mortgage bonds.

Pachuca Light & Power Co.—Deposit receipts for 5 per cent. first mortgage 50-year bonds.

Underground Electric Railways Co. of London, Ltd.—£15,000 additional 6 per cent. income bonds.

Amalgamated Wireless (Australia) Co.—The report for the half-year ended December 31st states that the business has been interfered with by the war. There are 85 subsidy ships, and the manufacturing department and training school are doing good work. The net profit amounts to £2,230, which, with £1,102 brought forward, makes available £3,332, which is to be carried forward. The radio-telegraphic traffic for the half-year and subsidies amounted to £11,045, and other gross profits to £912. The share capital is £140,000, and reserve funds £14,112.—*Commonwealth Engineer*.

Shawinigan Water & Power Co.—A dividend of 1½ per cent. for the quarter ended 30th inst. on the common shares, payable October 10th to shareholders of record 30th inst., has been declared.

Bolckow, Vaughan & Co.—The directors have decided to pay to the ordinary shareholders a further dividend of 8 per cent., less tax, in addition to the interim dividend paid in March last.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—The directors announce an interim dividend of 2½ per cent. on the ordinary shares, payable 29th inst., less tax.

STOCKS AND SHARES.

TUESDAY EVENING.

Markets have been in very cheerful fettle, the excellent news from the various Fronts assisting the sentiment, although during the early part of the week they were quite eclipsed by the general delight over the burning of the Zeppelin. In the air there is vague talk of peace, the proposals for which, be it carefully noted, are to come from the other side. People are laying their plans, financial and otherwise, for what is going to happen upon the conclusion of the war; and one man in the Stock Exchange, carried away by the fervour of the moment, exclaimed that these are already peace markets. Nor did he find much strenuous denial, though the statement aroused good-humoured banter.

Home Railway stocks are once more in a better position. Considerable buying of the low-priced issues is something of a feature. Metropolitan participated in this, and rose 1½. Districts hardened to 19, though the price failed to keep the improvement. The chief centre of interest is Brighton deferred, which has its electrified system, as well as its prospects of improved business after the war, to attract investment attention.

South-Western deferred, too, which has been languishing in neglect for some time past, rose a point to 26, at which the immediate yield on the money, assuming the dividend for this year to be the same as that in 1915, comes out to nearly 6 per cent. The Home Railway market generally is good. Whether it will remain so depends solely upon the continuance of demand; we have too often seen strength in this section succeeded by prompt return to dullness for the observer to place much reliance upon a display of improvement.

The Brazilian Traction, Light & Power Co. has issued its third annual report, for the year ended December 31st, 1915. The company, of course, draws its revenue from three subsidiaries, the Rio de Janeiro Tramway, the Sao Paulo Tramway, and the Sao Paulo Electric Companies. From the earnings point of view, the company flourished finely; but in the course of conversion the gross receipts of 8 million dollars fell to 5½ million dollars. Each division of the company contributed improvement to the profit and loss account; and if it had not been for the fall in the milreis, the results would have been excellent. As it is, however, the company is paying 4 per cent.; and unless the exchange rises, there seems to be little chance of this rate being increased. The price of the shares fell a point to 61½.

Mexicans, on the other hand, are firmer, with the exception of the common shares of the Mexican Light & Power Co., which have eased off to 19. The company's 5 per cent. first bonds have advanced to 43, the rise being shared by the similar bonds of the Mexico Tramways.

A meeting of Mexican Light & Power bondholders is to be held on October 5th, at which it is to be proposed that prior lien bonds should be created, to rank ahead of the present bonds as regards principal and interest; while it is further proposed that the directors shall be allowed to waive all payments of dividends due, or falling due, for such time as they shall think fit. Holders of the bonds should make it their business to attend the meeting next month, and, pending further details, to withhold their support from one side or the other.

The experience of some of the other utility companies in Mexico, Brazil, and the United States has not been generally flattering to the holders of the bonds, in those cases, of course, where prior lien issues have been sanctioned and made; and proprietors of Mexican Light & Power bonds, bearing this in mind, will be well advised to preserve an open mind at present. At the same time, there is no getting away from the unfortunate fact that most Mexican companies affected by the rebellion of the past three years must be in want of money, and that there is very little chance of the British Treasury permitting the issue of fresh capital while the war is in progress. Truly the position is a difficult one, and it is hard to know what to do for the best.

Gains have been secured by the British Columbia Electric Railway stocks, the preference putting on 3 points to 70, and the deferred at 51 showing a gain of a point. The tramway section is firm as a whole. Brisbane Electric Investment ordinary rose to 6½, and the preference are better at 4½.

Electric shares have quietly improved. Several of them were quoted ex dividend last Thursday, and in some cases the deductions, or part of them, have been regained. Westminster rose to 6½. Metropolitan are 5s. up at 2½. South Metropolitan are a good spot, with buyers about at 19s. The preference are steady at 22s. ex dividend. General Electric ordinary have risen to 13½, the preference retaining their rise of last week at £10. Edison & Swan 5 per cent. debenture stock at 62½ is 2½ up, and the tone of the miscellaneous market is strong throughout.

British Insulated ordinary put on 5s. at 12½. Callenders at the same price are a similar amount better. India-Rubbers at 12½ are another ½ to the good; and Henleys at 6½ have not only recovered their dividend of 5s., but have added an equal amount to it. The rises are genuine in every case; and, as we have noted before, the demand outstrips the supply.

Eastern Telegraph ordinary at 149 is a little harder, but the other issues in this group show no change. New York Telephone 4½ per cents. are par. Orientals are a feature of strength, a rise of 3/16 taking the shares to 2½, at which the return on the money looks so slender that the expectations of an increase in the dividend appear to have good ground. Indo-Européens rose 4½ to 49, but Great Northerns, after their jump of last week, reacted 10s. to 42.

The feature of the Marconi market is the strength of Americans, the price touching 20s. This was in part a reflection of the recovery in American rails brought about by the reported settlement of the threatening coal strike, which this time last week looked as though it were going to plunge into industrial America into something approaching chaos. Marconis themselves are a shade easier at 3/3/16; and there is nothing much doing in Canadians, the price remaining at half-a-guinea. The Anglo-American stocks and shares are steady, and there is no change in either class of Globe Telegraph and Trust.

The rubber section keeps very strong, and the price of the raw material revolves around 2s. 3d. per lb. The autumn dividends are expected to be uniformly good, and the early arrivals foster this impression. There is pronounced strength in the iron, coal, and steel list. Copper shares are somewhat heavy. Buyers predominate in the armament group, and, generally speaking, the industrial market is one of the most active in the Stock Exchange.

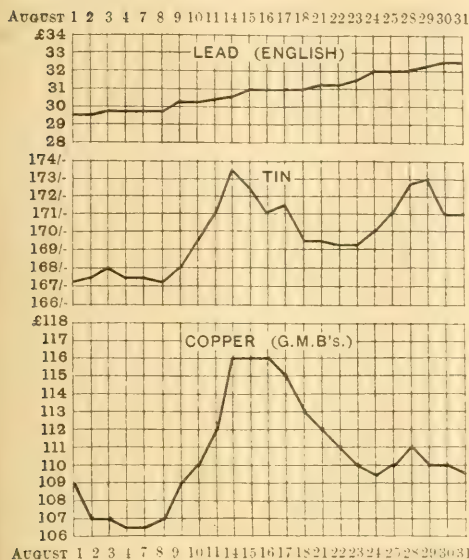
SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend		Price Sept. 5, 1916.	Rise or fall this week.	Yield p.c.
	1914.	1915.			
Brompton Ordinary	10	10	63	—	47 18 3
Charing Cross Ordinary ..	5	5	65	+ ½	6 18 0
do. do. do. 4½ Pref. ..	4½	4½	39	—	6 8 7
Chelsea	5	4	8	—	6 18 4
City of London	9	8	124 ½	—	6 10 8
do. do. 6 per cent. Pref. ..	6	6	102 ½	—	6 17 1
County of London	7	7	11	—	6 7 8
do. 6 per cent. Pref. ..	6	6	106 ½	—	6 18 0
Kensington Ordinary	9	7	64	—	6 7 8
London Electric	4	8	12	—	6 10 6
do. do. 6 per cent. Pref. ..	6	6	42 ½	—	6 18 4
Metropolitan	3½	8	23	+ 1	5 9 1
do. 4½ per cent. Pref. ..	4½	4½	31	—	7 4 0
St. James' and Pall Mall ..	10	8	63	—	6 8 0
South London	6	5	24	—	6 18 10
South Metropolitan Pref. ..	7	7	12 ½	—	6 7 3
Westminster Ordinary	9	7	62	+ ½	6 12 0
TELEGRAPH AND POWER.					
Anglo-Am. Tel. Pref.	6	6	103½	—	6 16 0
do. Def.	80½	39/6	28½	—	7 8 9
Chile Telephone	8	6	7	—	6 14 5
Cuba Sub. Ord.	5	6	64	—	6 8 6
Eastern Extension	7	8	144	—	6 7 6
Eastern Tel. Ord.	7	8	139	+ 1	6 7 6
Globe Tel. and T. Ord. ..	6	7	124	—	6 8 0
do. Pref.	6	6	104	—	6 10 4
Great Northern Tel.	22	22	42	—	6 4 9
Indo-European	13	13	49	+ ½	6 11 8
Marconi	10	19	49	—	6 3 9
New York Tel. 4½	4½	4½	100	+ ½	4 10 0
Oriental Telephone Ord. ..	10	10	24	+ ½	4 8 11
United R. Plate Tel.	8	8	12½	—	6 16 5
West India and Pan.	1	1	14½	—	—
Western Telegraph	7	8	16	—	6 6 8
HOME RAILS.					
Central London, Ord. Assented	4	4	74	—	6 8 1
Metropolitan	1½	1	26½	+ 1½	3 17 8
do. District	Nil	Nil	184	—	Nil
Underground Electric Ordinary	Nil	Nil	11½	—	Nil
do. "A"	Nil	Nil	6½	—	Nil
do. "C" Income	6	6	89½	—	6 14 0
FOREIGN TRAMS, & CO.					
Adelaide Sub. 6 per cent. Pref.	6	6	5	—	6 0 0
Anglo-Arg. Trams, 1st Pref. ..	5½	6½	32	—	7 6 8
do. 2nd Pref.	6½	6½	8	—	—
do. 5 Deb.	6	6	76	—	6 13 4
Brazil Traction	4	4	61½	—	6 10 0
Bombay Electric Pref.	6	6	104	+ ½	6 14 3
British Columbia Elec. Rly. Pice.	5	5	71	+ 5	7 0 10
do. do. Deferred	Nil	Nil	63	—	Nil
do. do. Deb.	4½	4½	68	—	6 5 0
Mexico Trams 6 per cent. Bonds	—	Nil	48	+ 1	Nil
do. do. 6 per cent. Bonds	—	Nil	86	Nil	Nil
Mexican Light Common	Nil	Nil	19	—	Nil
do. Pref.	Nil	Nil	84	—	Nil
do. 1st Bonds	Nil	Nil	43	+ 1	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	14	15	84	+	4 16 0
British Aluminium Ord. ..	5	7	26½	—	6 7 8
British Insulated Ord. ..	15	17½	124	—	7 0 0
British Westinghouse Pref. ..	7½	7½	49½	—	6 2 6
Callenders	15	20	124	+ ½	6 0 0
do. 6 Pref.	6	6	44	—	6 17 8
Castner-Kellner	20	—	84	—	6 8 3
Edison & Swan, £3 paid ..	Nil	—	106	—	Nil
do. do. fully paid	Nil	—	11	—	Nil
do. do. 6 per cent. Deb. ..	6	6	62½	+ ½	8 0 0
Electric Construction	6	7½	176	—	8 11 6
Gen. Elec. Pref.	6	6	10	—	6 0 0
Henley	20	26	163½	+ ½	7 0 9
do. 4½ Pref.	4½	4½	42½	—	6 8 0
India-Rubber	10	10	122	—	6 3 4
Telegraph Co.	20	30	89	—	6 4 0

* Dividends paid free of income-tax.

METAL MARKET.

Fluctuations in August.



Canadian Trade.—U.S. Consul G. Willrich, reporting on the trade of Quebec Province during 1915, says that the disturbing influences on the trade and commerce of Quebec brought on by the European war were successfully overcome by a gradual process of adjustment, and by the end of 1915 general conditions were considered fairly satisfactory. The large volume of munition orders led to the enlargement and erection of new plants, and greatly helped to restore commercial and industrial stability. Other industries and manufacturing plants also felt the impetus caused by the generous distribution of orders for war material, so that a great number were forced to run at full capacity by the end of the year. One of the principal benefits, however, was the great reduction in the number of the unemployed, leading even to a scarcity of skilled labour, which was overcome, however, by the employment of skilled mechanics brought from the United States. The return of prosperity was hastened by a realisation of greater economy on the part of all classes of the people, coupled with an increased production of food products and manufactures.

The exports of aluminium to the United States for 1915 show a substantial decrease, due to the fact that the requirements of the British Government were in excess of the available supply. The only other aluminium works in the British Empire, that of the British Aluminium Co., Ltd., in England, is controlled by the Government. Practically the entire output of the Shawinigan Falls plant was either sold directly to the War Office or supplied to American or Canadian manufacturing plants for the purposes of the British Government. Early in 1915 the Canadian Government put an embargo on aluminium shipments to countries other than British Protectorates, although shipments were permitted to a few American firms working on war contracts. There were exported to the United States from Quebec 17,000 tons more of asbestos in 1915 than in 1914, at an increased valuation of £121,626. Asbestos is the chief mineral product of this Province. The industry was unfavourably affected by the outbreak of the war, as Germany and Austria were the principal markets for the higher grades of asbestos. There has been an increased demand for this article, however, from the United States, Great Britain, France, and Italy, due in a large measure to military and naval requirements. This demand has greatly revived the industry, which has continued to improve ever since.

Profit-sharing.—Nearly 9,000 employes of the General Electric Co.'s plant in Schenectady have received their first extra payments as a result of the most successful year in the company's history. Similar distributions were made to long-service employes in other localities, so that about \$550,000 was distributed among 19,000 employes. The second extra payment, to be made next February, will probably be somewhat larger in total.

NOTES ON OLD AND NEW CONVERTING PLANTS.

[COMMUNICATED.]

So far as this country is concerned, the first notable example of the use of rotary converters was on the Central London Railway, for prior to its opening in 1900 the few electric railways that existed were worked entirely with continuous current. Three-phase transmission had, it is true, been adopted on the Dublin tramways, but the sub-stations were small and insignificant compared with those which were set to work on the opening of "The Twopenny Tube." The fact that there have been few interruptions in the supply on this line shows that these early converters, like the remainder of the plant, were well designed, although the experience of the last 16 years has led to distinct improvements, and, viewed in the light of modern practice, the original Central London plant has certain imperfections. Not all the early faults of this railway's sub-stations were due to inexperience; they were due in a large measure to the want of space. The electrification of the tube railway running through the heart of London incurred many difficulties not met with when electrifying the suburban sections of main lines, such as those of the South-Western. On railways like the latter the plant is not placed in the bowels of the earth, but is erected in spacious and well-ventilated buildings which do not impose troublesome restrictions upon the electrical designers. The converters, transformers, and switchboards are very accessible, and much less dangerous than those built in the past, whilst the new methods of starting, &c., make the operation of the later sub-stations comparatively easy.

When the Central London Railway commenced working, the method of starting rotaries on the alternating-current side was, to say the least, crude. When the generating plant had been shut down, the only way of energising the line afresh was to start a rotary on the A.C. side. As the converters were not fitted with induction motors, and as there were not, in the early days, any tapplings on the secondaries of the transformers, full pressure had to be applied to the slip rings. As the machine ran up to speed, taking, of course, a very large current at a very low power factor, the field switch was closed in the ordinary way, but sometimes it was closed at the wrong instant. The starting operation then had to be repeated, for the field switch was not of the throw-over type. It was soon seen that what was wanted for starting rotaries, by applying A.C. to the slip rings, was reduced pressure and a throw-over field switch, so that if a machine excited with incorrect polarity, matters could be rectified by reversing the direction of the exciting current. Hence it is now usual to fit rotaries, started in this way, with a throw-over field switch and switches or controllers for bringing different transformer tapplings into use, thus allowing a low pressure to be used first, and full pressure afterwards. Many rotaries have for a long time past been started with induction motors, and, until quite recently, it has been necessary to synchronise. But the need for this has now been removed by electrically connecting the induction motor and converter. Instead of the inner ends of the stator windings terminating in a star or neutral point, they are connected to the rotary's slip rings. The result is that current passes through the induction motor into the converter, and this current pulls the rotary into step. The operator simply closes the A.C. switch on the low-voltage contacts, and transfers it to the full-pressure contacts at the proper instant.

In the direction of inventing methods for regu-

lating the voltage of rotaries, much good work has been done. Provided that a wide variation is not necessary, it has been usual, for a long time past, to insert reactances between rotaries and their transformers, or to design the latter with a fair amount of magnetic leakage. With a simple vector diagram it can readily be shown that when the current lags, as a result of increased excitation produced by increased current passing round the series windings, the pressure at the slip rings rises, whilst when the current lags, as a result of reduced excitation, the applied pressure is reduced. For many kinds of service this method of regulation answers admirably; although it is, of course, obvious that it precludes the machine from operating at unity power factor at all loads. Sometimes the transformers have been provided with tapplings and a regulating switch for bringing different pressures into use, but on large machines this is impracticable, for a switch capable of changing the connections whilst the machine is running is bulky and expensive. For a wide variation, there is nothing better than a booster coupled to the rotary and electrically connected in series between the transformers and the slip rings. When the converter has a large number of poles it may be expedient to depart from the practice of directly coupling the booster to the rotary shaft. It may be more economical and convenient to use a high-speed booster, driven by a high-speed synchronous motor. But in any case it is obviously unnecessary to design the booster to deal with the full voltage variation required, for by reversing the direction of current round its field magnets, the voltage either assists or opposes that of the transformers. With this system of regulation the rotary can run at unity power factor at all loads.

If a booster be directly connected to a rotary converter it acts as a generator when adding to the transformer voltage, and as a motor when opposing it. In a simple converter—one without a booster—the armature currents at unity power factor have practically no reaction effect on the poles. But a direct connected booster produces an additional converter armature current and a reaction on the fields proportional to this current. If the booster raises the voltage, this additional armature current acts on the commutating poles and magnetises them in the same direction as the main series coils, and when the booster lowers the direct-current voltage the additional current demagnetises the poles. The effect on commutation is, in both cases, bad, for the commutating poles do not produce a field proportional to the load. To eliminate the trouble various schemes have been tested. The latest and most successful, due to the General Electric Co., of America, involves the use of a relay with direct and alternating coils and a shunt winding on the commutating poles, in addition to the ordinary series winding. When the excitation in the shunt winding is correct, the pulls of the relay coils balance one another. The pull of the A.C. coil is proportional to the main A.C., and to the voltage of the A.C. booster, whilst the pull of the D.C. coil is proportional to the current in the commutating windings, and to the D.C. voltage. When the pulls are not balanced a contact point is moved one way or the other, thereby closing a circuit which operates a motor-driven rheostat in the shunt winding circuit of the commutating poles, and the variation of excitation so produced compensates for the reaction of the booster currents.

The early 60-cycle rotary converters, as many engineers know, were very poor machines indeed. Fundamentally, the difficulty was one of commutation. At 60 cycles the limitations of peripheral speed in machines of considerable output involved the adoption of a somewhat exaggerated multipolar design, and a large commutator to permit the number of segments necessary between poles to give a conservative voltage per bar. A 60-c. synchronous

converter of even a few hundred kw. capacity had a commutator running at an unpleasantly high peripheral speed, even when chances were taken with the voltage between bars. At 25 cycles the greatly reduced rotative speed made the commutator construction easier, particularly in the case of machines rated at 1,000 kw. or more. Small converters up to perhaps 100 kw. could be, and were, readily made for 50 and 60 cycles, but at higher outputs the difficulties were formidable. Later, 60-cycle rotaries were built in modest numbers and, by great designing skill, were made to work fairly satisfactorily. But the commutating difficulties were always appearing, and for a long time these rotaries were not at all popular. Far better results were obtained on fitting interpoles. It is claimed that 60-cycle rotaries are now nearly, if not quite, as good as 25-cycle machines. In the United States many 60-cycle machines are at work, but in common with this country the opinions of engineers differ, and for the higher periodicity circuits motor-generators are sometimes chosen. The La Cour cascade converter running at half-synchronous speed is undoubtedly very satisfactory on the higher periodicity circuits, and has met with much favour in this country. If the choice lies between a motor-generator and a 60-cycle rotary, the saving in favour of the latter may be considerable. Taking a specific case of two 1,500-kw. sets, Mr. L. B. Bonnett, of the General Electric Co., of America, shows in a recently published article that by using 60-cycle rotaries the gain per annum amounts to no less than £1,908. There are, of course, various considerations which govern the selection of converting plant which on the whole are well understood by central-station men.

The speeds of the latest 60-cycle motor-generator sets are approximately the same as those of 60-cycle rotary converters. The 1,000-kw., 720-volt, 60-cycle rotaries and motor generators made by the General Electric Co., of America, both run at 720 R.P.M., and the 1,000-kw., 600-volt machines at 900 R.P.M. In sizes above 1,500 kw. it is becoming quite general practice to build motor-generators with two direct-current machines and one motor, a design that permits almost twice the speed that would be permissible with a single generator. The generator of a motor-generator can be made to give from a single commutator a higher voltage than can be obtained from a rotary of standard frequency. But it has been found that, in general, the cost of a single direct-current machine for a given voltage above 2,000 is greater on account of its lower speed than that of two machines connected in series. The higher speed at which the series-connected machines work also reduces the cost of the A.C. motor.

One of the faults of rotary converters is that they do not readily lend themselves to converting D.C. into A.C. when the load is an inductive one. Before satisfactory tripping devices were invented to cut out machines in the event of racing, several rather bad accidents occurred. The trouble is attributable to the fact that lagging currents demagnetise the field magnets, and since an inverted rotary runs as a shunt-wound continuous-current motor, its speed is inversely proportional to the field flux interlinked with the armature turns. If a leading current were drawn from the machine, the field would be strengthened and the speed of the rotary would fall. To overcome the difficulty the plan adopted has been to use a separate exciter driven by an induction motor, the current for which is supplied from the slip rings of the rotary converter. The exciter has to be designed so that a slight increase in speed makes a big difference to its volts; so that the field flux of the rotary is as nearly as possible constant, irrespective of the lagging currents which the machine may be called upon to give. The exciter must, therefore, work low down on the saturation curve. In practice, however, rotaries intended

always to work in the ordinary way have, as a result of some disturbance, become inverted and raced with disastrous results. These accidents, however, occurred before the introduction of adequate protective devices, and it should not be supposed that there are serious risks at the present time. One of the worst accidents that have taken place as a result of rotaries becoming inverted occurred on the Commonwealth Electric Co.'s system at Chicago. The accident was of such a notable character that the main facts connected with it are worth recalling. Two large turbo-alternators were running on the bus-bars of the station, and from these bus-bars a number of rotary converters were fed. The rotaries in turn supplied direct current to d.c. bus-bars, and to these bars a large battery and two large continuous-current generators were connected. The first thing that happened which led up to the accident was that one of the alternator armatures burnt out. Immediately the switchboard attendant opened the main switch, but omitted to open the field switch. Had it not been for the field coils of the machine being burnt, nothing further would have happened. The field coils of the faulty machine went to earth and partially short-circuited the exciter which supplied exciting current to the burnt-out alternator and to the one still running. The exciting current of the running alternator was greatly reduced, and the rotaries, with a large source of power on the d.c. side, supplied a.c. to the alternator and motored it. The current which the generator took was, of course, a lagging one, which partially demagnetised the fields of the rotaries, and their speed increased considerably. As the alternator had to run in synchronism with the rotaries, its speed increased also, with the result that the revolving structure "burst." The accident served to show that although rotaries may not be intended to work inverted, they may under unforeseen circumstances do so, and that adequate precautions should be taken to meet such contingencies.

What engineers, especially those interested in railways, are beginning to look into is the question of employing higher voltages than those used hitherto. For the first 1,200 and 1,500-volt schemes two rotaries were connected in series, and with the exception that they were insulated more liberally than usual they were built on the same lines as ordinary 600 and 750-volt machines. On the Shildon-Newport line of the North-Eastern Railway this plan of connecting two machines in series has been adhered to, but on the Bury to Manchester lines of the Lancashire and Yorkshire Railway, and on various lines in America, currents at pressures as high as 1,500 volts are taken from single rotaries. Even in the early days of high-pressure working it was found that two rotaries in series worked well. At the beginning the main trouble was that of flashing over when short circuits occurred on the line, but this was partially remedied by supporting the brush gear from the frame of the machine instead of from the bearing pedestal. Commutating poles, however, have played a big part in the evolution of high-voltage machines, as might be expected from the fact that with their aid it is possible to increase the voltage between commutator bars as well as commutator speeds. Rotary converters for periodicities up to 35 cycles per second are now built for d.c. pressures up to 1,500 volts. In the United States a number of 1,200-volt rotary converters have been at work for a considerable time, two of the most notable installations being the 500-kw. machines built for the Portland Oregon Railway and the Michigan United Traction Co. In the latter case two machines are connected in series to give 2,400 volts. For higher periodicities, in the neighbourhood of 60 cycles per second, high-pressure rotaries are not at present made. On railways taking current from existing stations working at or

about 60 cycles, such, for instance, as the Puget Sound lines of the Chicago, Milwaukee and St. Paul Railway, motor-generators are employed. The line pressure on the above lines is 3,000 volts, and each converter consists of a synchronous motor driving two 1,500-volt d.c. generators. On account of the cost and constructional difficulties associated with the field windings of 1,200- and 1,500-volt machines, it has been found convenient in some cases to energise the field windings from a directly connected exciter designed for 125 volts. This exciter, however, will not, in the absence of special precautions, drop its volts sufficiently at times of short circuits. To meet the case, a resistance normally short-circuited by a contactor is connected in the converter field circuit, and when the circuit-breaker opens as a result of a "short," this contactor also opens and resistance is interposed in the field circuit.

The converters on the Butte, Anaconda and Pacific railroad and on numerous interurban railways in Michigan, all consist of two 500-kw. motor-driven generators or rotary-converters connected in series to give 2,400 volts. This procedure is necessary when using rotaries on account of limitations of design, and when using motor-generators on account of cost. When two 1,200-volt rotaries are connected in series to give 2,400 volts, the machine on the earth side is sometimes self-excited, and the one on the other side—that is to say, the machine connected to the trolley wire—is excited from the machine that is connected to earth.

High-voltage d.c. rotaries are usually liberally rated. Some have been designed to stand 200 per cent. overload for one minute, others 200 per cent. overload for five minutes and 100 per cent. overload for half an hour. Those intended for very heavy traction service have been fitted with compensating windings in addition to commutating poles. Flashing over at the commutator has in the past been one of the main difficulties with which builders of rotaries have had to contend, and at the higher pressures these difficulties have not diminished. It has been found, as a result of careful experiment, that the design of the shunt across the commutating pole windings has an important influence on how rotaries behave on short circuits. If this shunt has only resistance, and next to no reactance, flashing at times of sudden changes of load is very liable to occur. By giving the shunt a proper amount of reactance, however, the trouble is greatly diminished, for the current then divides properly with sudden changes of load.

The practice of bridging the commutating poles with magnetic material has also given good results, and when these bridges have been provided it has in some cases been possible to work rotaries without any shunts at all. Of course, the remedies that have been applied to the troubles of the lower-voltage machines apply in a great measure to those that work at higher voltages. For instance, it has long been known that short feeders must be avoided. On many 600-volt systems where flashing over has been a great trouble, marked improvement has been made by cutting out the feeders which terminate only a short distance from the machines. Any rotary will flash over if the short circuit is sufficiently severe, and since the severity depends upon the distance at which it occurs from the source of supply it is obviously inexpedient to have feeding points in the vicinity of the machines. Although there are now, in different parts of the world, a good many h.t. d.c. systems in operation, no serious damage as a result of short circuits has been reported, but, of course, if trouble did arise the practice of altering the position of feeding points would be applicable. Reactances in circuit with the feeders would of course be advantageous, but investigation has shown that they are too bulky and expensive. A scheme viewed in a more favourable light is to

introduce in each loop circuit a resistance which under normal conditions is short-circuited by a quick-acting mechanism, which inserts the resistance in circuit the moment a "short" occurs. Experience indicates pretty clearly that short circuits on H.T. D.C. apparatus are on the whole less destructive than those which occur on 600-volt apparatus. It is the amount of current that seems to count, and not the pressure.

Although high-pressure converters are a little more likely to flash over than those that work at lower voltages, they will not, if properly designed and protected, give appreciable trouble. All converters have as a result of great perseverance and skill been brought to a high state of perfection, and they are a credit to the electrical profession.

LIGHTING COMPANIES AND LOCAL AUTHORITIES.

FROM A LEGAL CONTRIBUTOR.]

APART from the Electric Lighting Acts, there are certain statutes "on the books" which affect the relations between electric lighting companies and local authorities. The supply of electricity having been in vogue for many years, the questions arising on these statutes have for the most part settled themselves, but, with a view to enabling our readers to avoid such disputes in the future, it may be convenient to refer to some of the material sections of these Acts and to the cases decided thereunder. First, as to the right of an electric supply company to interfere with the surface of a street or highway: By Sec. 149 of the Public Health Act, 1875, all streets are vested in the urban authority, and, by the same section, any person who, without the consent of the urban authority, wilfully displaces or takes up, or who injures the pavement, stones, materials, fences, or post of, or the trees in any such street shall be liable to a penalty not exceeding £5.

A question has arisen as to whether this section vests the soil of the highway in the local authority, so as to enable them to order a lighting company to remove wires already placed beneath the surface.

This point was considered in the case of *Patterson Vestry (St. Mary's, County of London) v. British Electric Lighting Co.* (1890, 1 Q.B. 174). In that case it appeared that land under which a company proposed to run a pipe or drain was vested in them for the company purpose of their undertaking. Under a private Act a road running over this land had been transferred to and vested in a local authority. The local authority gave no consideration for the road. On the local authority applying for an injunction to restrain the company from laying a pipe or drain under or trespassing on the road, it was held that the road was vested in the local authority only for the purpose of a road; that they had no right to the subsoil, and consequently that no injunction could be granted.

Another case decided that the section does not enable a local authority to maintain an action for an injunction to restrain the erection of a telephone wire across a street.

It is now well known that a local authority may contract with a company to light streets by electricity. In making such a contract, the provisions of Sec. 171 of the Public Health Act, 1875, have to be remembered. It provides that with respect to contracts made by an urban authority under the Act, the following regulations shall be observed, namely:

1. Every contract made by an urban authority whereof the value or amount exceeds £50 shall be in writing and sealed with the common seal of such authority.

2. Every such contract shall specify the work, materials, matters or things to be furnished, had or done, the price to be paid, and the time or times within which the contract is to be performed, and shall specify some pecuniary penalty to be paid in case the terms of the contract are not duly performed.

Absence of a penalty clause renders the contract unenforceable. In the case of *British Insulated Wire Co. v. Prescott U.D.C.* (1895), 2 Q.B. 463, it was held that this enactment was obligatory, and not directory only; so that a contract which did not specify any pecuniary penalty could not be enforced against the contractor.

Although the Electric Lighting Acts do not vest in the local authority any power which enables them to obtain the suspension of wires from the electric lighting companies, local authorities have considerable powers as to the regulation of overhead wires.

Thus by Sec. 13 (1) and (2) of the Public Health Acts Amendment Act, 1890, it is provided that "An urban authority may from time to time make, alter, and repeal by-laws for prevention of danger or obstruction to the public from posts, wires, tubes, or any other apparatus stretched or placed above, over, along, or across any street (whether before or after the adoption of this part of this Act for the purpose of

any telegraph, telephone, lighting, railway signalling, or other purpose."

By such by-laws provisions may be made for the inspection and examination by the urban authority of any such posts, wires, tubes, or other apparatus, and for the prohibition of any such posts, wires, tubes, or other apparatus being or continuing to be stretched or placed as aforesaid in such manner as to be dangerous or to cause obstruction to the public.

Again, by Sec. 14 (1) and (2): "If any post, wire, tube, or other apparatus so exempted as aforesaid is, during the period of such exemption in the opinion of the surveyor of the urban authority in such a state or position that immediate danger to any person is to be apprehended, he may give information to any justice, who may thereupon summon the owner or lessee thereof or other person interested therein forthwith to appear before a court of summary jurisdiction." The court may thereupon: (a) make an order requiring such owner, lessee or other person, or all or any of them, to remove or remedy the source of danger; or (b) make an order authorising the surveyor to do so at the expense of such owner, lessee or other person, or of all or any of them; or (c) make such other order as may appear to the court under all the circumstances of the case to be necessary and proper.

The provisions of this Act do not, however, apply to any works of any undertakers within the meaning of the Electric Lighting Acts, 1882 to 1888, to which the provisions of those Acts apply.

Another Act which is frequently discussed between companies and local authorities is that known as the Public Authorities Protection Act, 1893. To refer to its provisions at length is unnecessary; suffice it that it compels anyone who is suing a local authority to commence his action within six months of the injury; it entitles the successful local authority to solicitor and client costs, and it enables the local authority to tender amends. Finally, if the court is of opinion that the local authority has not been given a proper opportunity of tendering amends before the action was brought, the plaintiff may have to pay costs if successful.

Various cases in relation and incidental to the supply of electricity illustrate the effect of this Act. For instance, in *Ambler v. Bradford Corporation* (1902), 2 Ch. 555, the defendants, in providing a generating station for Bradford, acquired some land which adjoined a stream, and upon that they proceeded to erect certain sluices, the object of which was to divert the stream so as to supply condensing plant placed in the works which they erected on the adjoining land. In 1890 a heavy thunderstorm burst over the Bradford Valley, filling the Bradford Beck and causing a flood, which the plaintiffs alleged, by reason of the obstruction of the sluices, and the consequent heading back of the water, forced up the water on to the plaintiff's premises, causing damage to large quantities of goods and machinery belonging to the plaintiffs, for which they sued the Corporation, and on the trial of which judgment was given in favour of the Corporation, with costs as between party and party. It was held that the defendants, in carrying out the works under the powers conferred upon them by their provisional order, were acting in execution of a "public duty or authority" within the meaning of Sec. 1. (b) of the Public Authorities Protection Act, 1893; that the judgment obtained by the Bradford Corporation carried costs, to be taxed as between solicitor and client; and that the appeal would be allowed, with costs as between party and party.

In another case, *Chamberlain v. Bradford Corporation* (1901), 64 J.P. 806, it appeared that a municipal corporation acting under a provisional order, hired electricity meters from a third person. The plaintiffs brought an action against them for infringement of their patent for electricity meters. Judgment having been given in favour of the Corporation, it was held that the Corporation were entitled, under Sec. 1 (b) of the Public Authorities Protection Act, 1893, to costs as between solicitor and client.

The protection of the Act does not, however, extend to contractors working for local authorities.

We have dealt with the general powers of local authorities over streets and roads, the contractual relations of lighting companies and local authorities, and the Public Authorities Protection Act. There remain to be considered certain provisions of Acts of Parliament relating more particularly to London.

The fact that the local authority has general control over the streets and roads in its district enables them to alter the position of pipes and wires beneath the surface as and when occasion arises. Thus Sec. 98 of the Metropolitan Management Act, 1855, provides that: "The vestry may alter the position of any mains or pipes in or under such street, such alteration to be made subject to the approval of the engineer." The authority need not, apparently, replace wires in exactly the same position after they have altered the road. In *Southwark and Vauxhall Water Co. v. Wandsworth Board of Works* (1898), 2 Ch. 603, it appeared that a local authority, acting under the power conferred by the above Act, proposed to lower the surface of the streets in their district. Upon motion by a water company, whose pipes lay under the streets, to restrain the local authority from carrying out their proposed works without also lowering the pipes at least the same distance, it was held that the section imposed no duty upon the defendants to lower the plaintiffs' pipes; that they had in no way injured them, or otherwise interfered with them, and therefore the plaintiffs were not entitled to the injunc-

tion claimed. The law was thus stated by Chitty, L. J.: "I am unable to find in the section any express or implied duty cast upon the road authority, when they exercise their power of altering the level of the road, whether by raising or lowering it, to exercise at their own expense their power of altering the position of the pipes for the benefit of the company owning the pipes, much less any duty to place the pipes at a depth below the new surface corresponding with the depth at which they stood below the old surface. I think no such duty is cast upon the appellants."

Although it only concerns electric lighting companies within the Metropolis, the London Building Act contains certain provisions with which it is necessary for the electrical engineer to be familiar. Thus by Sec. 145 of this Act, it is provided that notice must be given where a building structure or work is about to be begun, two clear days before it is begun. The point of interest is what is included in the phrase "Structure or Work."

In *Whitechapel Board of Works v. Crow* (1901), 84 L.T. 595, the appellants, being a local authority within the meaning of the Electric Lighting Acts, 1882 and 1883, had, in pursuance of those Acts, obtained a provisional order confirmed by statute. Under the provisions of that order they constructed boxes in the street in connection with the supply of electric light. It was held that such boxes were buildings, structures or works within the meaning of the London Building Act, 1894, Sec. 145, and that notice under that section must be served on the district surveyor before the erection of such boxes.

This case was followed in *Charing Cross & Strand Electric Supply Co. v. Woodthorpe* (1903), 67 J.P. 256. It was there held that a street box of an electric lighting company, built of brick underneath a pavement, and large enough to hold a man, is a "building, structure, or work" within the meaning of Sec. 145 of the London Building Act, 1894.

The fact that the company's provisional order requires them to give notice to the Postmaster-General and to the street authority of their intention to construct the box, does not exclude the operation of the Building Act; and they must therefore give notice also to the district surveyor.

Finally, in the County of London Electric Supply Co. v. Perkins (1908), 98 L.T. 870, the company had similarly been summoned for omitting to serve a building notice under Sec. 145 of the London Building Act in respect of a street box which measured internally 27 in. in length and width and 30 in. in depth from the surface of the footway. It was argued that the case differed from *Whitechapel Board of Works v. Crow* (Supra), and *Charing Cross & Strand Electric Supply Corporation v. Woodthorpe* (Supra), for the reason that, in the first place, the structure here was much smaller than in the previous two cases, and, in the second place, notices had been served on the Postmaster-General, the Borough Council, and the London County Council in accordance with the company's order. The Court declined to distinguish the case from the other two.

FRENCH ELECTRICAL AND OTHER TRADE.

SEVERAL reports have recently been made by U.S. Consuls on the position of commercial and industrial affairs in France. Consul-General Thackara, writing home in April from Paris, said:—

"There was great activity in the electrical industries of France during 1915. The plants were kept well employed in supplying the heavy demands for electrical material of every kind for the equipment of factories. There were large orders placed for direct-current motors for operating machine tools and other machinery, and important contracts were made for the equipment of hydro-electric plants. None of the leading French railway companies contracted for the new electrification of their roads in 1915, and trade in material for electrical railways and tramways was confined almost exclusively to repair work. There was a notable increase in the manufacture of metal-filament lamps in France during 1915, and the output would have been much greater had there not been a great scarcity of glass bulbs. But little progress was made in the development of the small power, half-watt lamps for domestic lighting, their use being mostly confined to special purposes for army use. There was an increased demand, however, for half-watt lamps of higher intensity than is, of 200, 600, 1,000, and 2,000 c.p. Prices in the electric lamp trade, which had been seriously depressed by foreign competition before the war, became much more favourable, notwithstanding the great increase in the cost of production. As a rule all the prices of electrical products have advanced considerably. As most of the output was furnished to plants working on war orders the question of prices was not as important as that of speedy deliveries.

"The prospects for the French electrical industry appear bright. After peace is restored there will be a period of intensive activity. Many of the important industrial plants, especially mining and metallurgical industries, are situated in the invaded districts, and probably have been either destroyed or badly crippled, and for the re-establishment of these plants and for the creation of new industries that are projected for

manufacturing in France many products that were imported from enemy countries, a great quantity of electrical and other machinery will be required. The situation is of intense interest to American manufacturers, as they will undoubtedly be called upon to supply many of the wants of the French consumers."

Mr. W. H. Hunt, writing in the same month from the St. Etienne Consular district, as the result of interviews with

"The commercial and industrial conditions in the district at the close of 1915 were, on the whole, better than at the same period in 1914. In some lines they were very good, notably the remarkable activity in the iron and steel mills, which has been the means of furnishing employment to thousands of men and women and thus materially increasing the purchasing power of the people.

"No statistics are obtainable relative to the amount or value of the production of iron and steel during 1915, but it may be said that from a low ebb the production has increased to such an extent that all former records have been surpassed, while values have risen steadily with sharp advances during the last half of 1915. The industries sustained various setbacks during 1914, culminating in the demoralisation arising through the workmen being mobilised at the outbreak of the war, but influences from the same source have contributed to the revival. While certain phases of the industries are obviously temporary, and the permanency of others is doubtful, it is believed that the headway gained is likely to carry the industries into a period of activity extending over several years. Every effort is being exerted to cope with the changed conditions; new mills are being constructed, while furnaces are being fired that had been abandoned for years. A considerable rise in the prices of all raw materials is reported, due in part to the domestic sources of supply being cut off by reason of the ore-producing regions being in the possession of the German forces, as well as to the unprecedented rise in freight charges. Wages likewise advanced 50 per cent., for which the increased cost of living, scarcity of labour, and high scale of wages paid by the Government factories are chiefly responsible.

In giving advice to those interested in sending American goods to the market, Mr. Hunt says:—

"The St. Etienne Consular district being inland, direct importing is limited. American goods reach this district through large wholesale houses established at Paris, which send travelling salesmen periodically through the district. There are many useful American-made novelties that could be successfully marketed in this district, but the large and small local retailers have no facilities nor the required capital to carry out the necessary work to create the demand. Some plan ought to be worked out that would enable local merchants to get in direct touch with American manufacturers. The attention of American manufacturers and exporters is called to the question of corresponding with French merchants in their own language, and the printing of explanatory trade literature in French so far as possible. This Consulate is ready at all times to render aid of this kind, and local merchants come to this office regularly with letters and cablegrams to be translated. Frequently they are so brief and with technical phrases that it is sometimes difficult to put them into intelligible French. Timely service of this kind during 1915 was the direct cause of promoting several shipments of American shoes and belting and sole leather valued at \$30,000.

"In normal times French merchants do not care to pay for goods before they are received, and they are accustomed to and expect to receive credits varying from 30 to 90 days. The French merchants want American goods, yet business must be done in their way. American manufacturers as a rule refuse to quote prices otherwise than f.o.b. New York, or more often their home town. With such quotations it is difficult, if not impossible, for the French merchant established in an interior district like St. Etienne to figure on this basis whether he will be able to sell the desired goods at a profit or not. It is possible that this disinclination on the part of American manufacturers to quote c.i.f. prices may explain the reason why the merchants in this region handling certain kinds of American goods prefer to buy them through Paris agencies or wholesale importers."

The Grenoble district report (Consul T. D. Davis) says:—

"Numbers of responsible business men are anxious to establish permanent relations with American houses for the sale of American goods, it being the popular view that the United States will necessarily supply the greater part of the commercial and industrial needs of the country after the war. At that time there should be a good demand in this section for industrial machinery, machine parts and supplies, hardware, . . . and automobiles and motor trucks. There should also be a fair demand for electric fixtures. There will be, of course, a temporary demand for American manufactures of almost every kind, and if articles of good quality are offered and the price with the freight and tariff added is not too high, a permanent trade in many lines may be established. A most important matter, however, is the attitude of the American exporter on the question of credits. There are instances where Americans have exacted of French buyers of reputed large credit that they deposit the amount of probable aggregate orders in American banks before shipment would be made. In one case a credit of 900,000 francs (\$173,700) was required to be established with a designated

American bank. These terms were complied with, and a business transaction in effect has resulted, but it should occur to those who desire to establish permanent relations with French merchants of the interior provinces that these terms will be met only so long as the abnormal conditions make it absolutely necessary. Unless arrangements can be made through the establishing of better banking facilities or otherwise by which credit can be extended to reliable concerns, permitting at least 30 days, preferably 60 or even 90, for the payment for merchandise after delivery, with suitable discount for cash payments, the amount of trade that will be held in this district against competition will be negligible."

REVIEWS.

Installations Electriques de Force et Lumière. Schémas de Connexions. By Adr. Curchod. Paris: Dunod et E. Pinat. Price 71. 50c.

A brief preface by M. P. Janet introduces us to this extremely practical little work. He remarks that its format will permit of its being placed in an inside pocket, next to the indispensable slide-rule, and this is true, though we predict confidently enough that if it were subjected to much pocket use it would soon drop to pieces. We have had occasion to remark in reviewing other French technical publications, that they are very poor examples of the book producer's art.

Briefly, there are 80 plates, consisting of diagrams of connections of all kinds of apparatus, with 45 pages of descriptive matter, and a feature which we should like to see in our own technical literature, viz., a list of the symbols used in the work, with their meaning.

Forty plates deal with continuous-current installations, from the single machine supplying a lighting network, with field rheostat, voltmeter, and amperemeter, to compound-wound machines paralleled on bus-bars to many feeders.

The next 23 plates deal with alternating-current connections, then follow five on the transformation of alternating into continuous current, and 12 on miscellaneous apparatus.

Altogether, this is a useful work for the practical man, and the mere tracing-out of the diagrams themselves forms an exercise the educational value of which is by no means to be despised. Considering the price, however, we must repeat that we do think the binding ought to be improved.

The Dynamical Theory of Gases (Second Edition). By J. H. Jeans, M.A., F.R.S. Cambridge University Press. Price 16s. net.

While the first edition of this book aimed at developing the theory of gases upon as exact a mathematical basis as possible, the present edition attempts to render as much as possible of the book intelligible to the non-mathematical reader; in order to accomplish which the author has divided it to a large extent into mathematical and physical chapters. Thus the student whose interest lies chiefly on the experimental side can get an intelligible account of the present state of the subject by reading certain chapters and regarding the more mathematical ones simply as material for reference.

The work, of course, is a very complete treatise on its subject, and the mathematics is far beyond the range of the practical man—even though the latter be very completely and scientifically trained. Nevertheless, in the more physical parts there are many matters which he can grasp, and which are of great interest in these days of atomic and electrical discovery. A very useful idea is that of substituting a two-dimensional concept for a three-dimensional one when considering the motions of molecules. The molecules are likened to billiard balls (for want of more precise knowledge), and as it is difficult to imagine in detail the movements of a large number of spheres flying about in three dimensions, the vessel in which the gas is enclosed is represented by a billiard table, the cushions of the latter taking the place of the walls of the vessel. It is surprising how many of the properties of gases can be illustrated by this imaginary apparatus.

The author devotes some space to the quantum theory, which has of late years rather revolutionised the position of the kinetic theory. He illustrates the difficulties encountered in the latter by considering the dissipation of energy of the billiard balls. For no matter how elastic the billiard balls and table may be, the motion of the balls, once started, cannot continue indefinitely. The energy dissipated by collisions is transformed into energy of internal vibrations. A gas should similarly in a short time lose the energy of translational motion of its molecules, and replace it by energy of internal vibration of these molecules and energy in the surrounding ether. It does not do so, however, and it was not until the quantum theory was introduced that anything like a satisfactory explanation could be found. This theory states that there is no true analogy between the two cases when we consider questions of internal vibrations and transfer of energy to the surrounding medium. For the motion of the billiard balls is governed by the well-known Newtonian laws,

whereas the internal motions of molecules, and their transfer of energy to the ether, are now believed to be governed by an entirely different system of dynamical laws.

The author chiefly deals with the quantum theory in the last chapter, where he considers it in relation to radiation. To the physicist, especially to the physicist who is also a mathematician—the book will be found of great value. It represents an immense amount of labour, is splendidly printed and bound, and contains some 436 large pages.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., The Electric Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 11,836. "Electrically-operated clocks, &c." W. AUSTIN. August 21st.
- 11,884. "Electric bicycle." J. F. SHAW. August 22nd.
- 11,907. "Circuitings for armature or proximate cables and electric conductors." A. H. GIBSON. August 22nd.
- 11,919. "Magnets." M. L. MAGNOLIO SANDRATI & D. K. MORRIS. August 22nd.
- 11,924. "Improving machines." STERLING LEECHMAN & ELECTRIC CO. August 22nd.
- 11,942. "Magnets." K. ORD-MACKENZIE. August 23rd.
- 11,956. "Electrical stop-motions for knitting machines." H. COLLINS, LTD., AND W. H. C. SPENCER. August 23rd.
- 11,961. "Mountings for electric, &c., lamps, and fittings thereof." SIR W. G. ARMSTRONG, WHITEWORTH & CO. AND A. S. CHEETHAM. August 23rd.
- 11,968. "Electric glow lamps, enclosed are lamps, &c." C. O. BASTIAN. August 23rd.
- 11,972. "Line signalling keys." F. G. BELL, W. C. DAVEY, THE STERLING LEECHMAN & ELECTRIC CO. August 23rd.
- 11,982. "Spark plugs." J. J. PATE. August 23rd.
- 12,013. "Spark plugs for internal-combustion engines." BAXTER AND CANTER & E. W. SCHER. August 24th.
- 12,016. "Electro-magnetic switches." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). August 24th.
- 12,019. "Primary electric cells." J. W. NICHOLSON. (G. N. ANTONOFF). August 24th.
- 12,033. "Apparatus for wireless telegraphy." MARCONI'S WIRELESS TELEGRAPH CO. & J. ST. V. PLETTS. August 24th.
- 12,043. "Electrical fuseboards or systems." W. PRESTON, W. SANDERS & CO. AND A. CRAWFORD. August 25th.
- 12,044. "Electrical fuses, and parts appertaining thereto." A. CRAWFORD, W. PRESTON AND W. SANDERS & CO. August 25th.
- 12,045. "Electrical fuseboards or systems." A. CRAWFORD, W. PRESTON AND W. SANDERS & CO. August 25th.
- 12,063. "Electric machines." SOC. D'ELECTRICITE NIMELIOR. August 25th. (France, August 27th, 1915).
- 12,066. "Electric resistance elements." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). August 25th.
- 12,070. "Mouthpiece for telephone transmitters, &c." O. THOLE. August 25th. (Norway, August 25th, 1915).
- 12,090. "Telegraph systems, and apparatus therefor." AUTOMATIC TELEPHONE MANUFACTURING CO. & S. R. SMITH. August 26th.
- 12,099. "Dry cells." G. L. TAYLOR. August 26th.

PUBLISHED SPECIFICATIONS.

1915.

- 11,168. MANUFACTURE OF ELECTRICAL CONDUCTOR OR WIRE REFINING BARS AND APPARATUS THEREFOR. E. Fewkes. August 3rd. (Cognitive application, 13,415/15.)
- 11,335. ELECTROLYTIC RECOVERY OF ZINC FROM ORES AND OTHER ZINC-BEARING MATERIALS. U. C. Tainton. August 5th.
- 11,336. ELECTROLYTIC RECOVERY OF METALS FROM THEIR SOLUTIONS AND APPARATUS THEREFOR. U. C. Tainton. August 5th.
- 11,510. DYNAMO-ELECTRIC MACHINES. U.S. Light & Heat Corporation. August 9th. (August 14th, 1914.)
- 11,512. ELECTRIC CONNECTIONS FOR ELECTRICALLY-HEATED IRONS AND LIKE UTENSILS. C. KROZ. August 9th.
- 11,544. MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS. British Thomson-Houston Co. (General Electric Co., U.S.A.). August 10th.
- 11,566. EXPLOSION ENGINES COUPLED TO DYNAMO-ELECTRIC MACHINES. Soc. Anon. des Etablissements L. Blierot. August 10th. (September 16th, 1914.)
- 11,568. ELECTRICAL TRANSFORMERS. A. Schaanning & G. Harlow. August 10th.
- 11,715. JEWELS FOR MEASURING INSTRUMENTS AND THE LIKE, AND METHOD OF MANUFACTURING THE SAME. British Thomson-Houston Co. (General Electric Co., U.S.A.). August 13th.
- 11,790. SHORT-CIRCUITING AND BRUSH LIFTING GEAR FOR ALTERNATING-CURRENT MOTORS. Lancashire Dynamo & Motor Co., H. B. Whitmore & R. J. Roberts. August 16th.
- 13,301. IGNITION SYSTEMS FOR INTERNAL-COMBUSTION ENGINES. H. Randolph. September 20th. (December 24th, 1914.)
- 13,901. FITTINGS FOR ELECTRIC INCANDESCENT CANDLE LAMPS. C. H. Burt and Huntall, Ltd. September 30th.
- 14,214. ELECTRICAL MEASURING INSTRUMENTS. C. E. Foster. October 7th.
- 14,819. INTERNAL-COMBUSTION ENGINES HAVING ELECTRICAL ACCESSORIES. J. B. Ferguson. October 20th.
- 14,995. CONTACT-MAKING AND BREAKING DEVICES OF MAGNETO-ELECTRIC MACHINES FOR IGNITION IN INTERNAL-COMBUSTION ENGINES. M. S. Conner. October 23rd.
- 16,185. ELECTRIC INSULATORS. A. R. Muller. November 17th. (Patent of addition, 27,738/12.)
- 16,540. ELECTRIC BATTERIES. E. C. R. Marks (Interstate Electric Novelty Co., U.S.A.). November 23rd.
- 17,021. ROTARY INTERRUPTER FOR ELECTRIC IGNITION DEVICES. Robert Bosch (firm of). December 22nd. (February 18th, 1915.)

1916.

- 5,398. ELECTRIC INSULATING COMPOSITIONS. E. Soberg & J. Anderson. April 12th. (101,067.)
- 5,680. IGNITION CONTROLLERS FOR INTERNAL-COMBUSTION ENGINES. W. O. Kennington. April 18th. (101,070.)

THE
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No. 2,025.

ELECTRICAL REVIEW.

INDUSTRIAL PROBLEMS.

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PRESIDING over the Engineering Section of the British Association at Newcastle last week, Mr. Gerald Stoney delivered an address which is bound to attract attention in engineering circles, if only for the candour and fearlessness with which the author alluded to certain blemishes on the fair fame of the industry. His theme was "errors committed in the past"; some of the points with which he dealt have often been referred to in these columns, and we welcome the confirmation of our views conveyed in his remarks, which we have reproduced almost *in extenso*.

The want of appreciation of scientific methods, and scientifically trained men, amongst engineering firms—which, one would think, should be the very first to perceive their advantages—with which Mr. Stoney opens his address will soon, we hope, be a thing of the past; the importance of such aids, which under modern conditions are indispensable to success, has been recognised in many quarters and effectively driven home by the war. In this reform the great engineering institutions have played a part which reflects credit upon their Councils. The value of research, especially on a large scale under national auspices, was also fully emphasised by the author, and need not be laboured here. But perhaps the most noteworthy passages in the address are those in which Mr. Stoney discusses the relations between employers and employed, and the changed conditions which have arisen from the replacement of the individual employer by the limited liability company—a change to which many of the Labour troubles of to-day can be directly traced.

Mr. Stoney explains, in language which any workman can readily grasp, the functions of the capitalist and the impossibility of dispensing with his assistance, but focuses attention on the responsibilities which the capitalist must discharge towards the workers, the neglect of which is at the root of much of the distrust which so generally reigns between the two parties. The propagation of the gospel of "Welfare Work," and the carrying into effect of its teachings, will go some way to remedy this state of feeling and bring about more cordial relations, but we believe the crucial questions are concerned with the fixation of rates of wages, and the correlated question of the amount of work to be done. The present system of payment on time appears to us to be analogous to selling electricity by contract; the amount of payment is independent of the work done, and naturally he who sells the work tries to keep down the quantity delivered. A fairer system is to pay in accordance with the output, a system analogous to sale of energy by meter; this involves discrimination between individual capacities for work. But as in electricity supply a still better and more equitable plan is to charge a fixed sum plus so much per unit, so in the workshop the best system is that which assures to the workman a reasonable weekly wage, plus a bonus depending directly upon his output. As Mr. Stoney says, the question is a difficult one, and when we come to the adjustment of prices for piece-work, the difficulties are multiplied. Yet they must be faced, for the question is of fundamental importance. We note that Mr. Stoney corroborates the view to which we have given expression from time to time, that price-cutting on piece work is largely responsible for the restriction of output on the part of the men. As he

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observes, "If the price has been fairly fixed, why should it be reduced because the man makes large wages due to his skill and industry?" The employer gets the benefit of the increased output with practically no increase in the standing charges, and "*it is much more important to get large output than to pay small wages.*" There is the case in a nut-shell. As the rule that the price must be cut if a man makes more than time-and-half imposes a penalty on the inferior workmen, who cannot maintain the same rate of output, it is obvious that the men in self-defence are simply compelled to set a limit to the production per man. The present circumstances afford a unique opportunity for putting an end to both these evil practices—price-cutting and limitation of output. We do not altogether agree with the author that it is pleasant to the workman—at any rate, the good workman—to "slack"; a capable man takes a pride in doing his best and quickest, and in this he should be encouraged by an adequate reward. The principle of a minimum standard wage plus payment in proportion to output above a minimum limit, which, as we have pointed out, is somewhat analogous to the well-known system of charging for electrical energy, has already been adopted in coal mining, and though it possesses obvious drawbacks, it is worthy of careful study. The same may be said of Mr. Stoney's further remarks on works management, which we commend to the attention of both employers and workmen—as he says, "what is really wanted is common honesty and common sense on both sides, for one side is as bad as the other at present."

Mr. Stoney's severe comments on the conduct of the large armament firms in connection with the shortage of ammunition, while not directly falling within our sphere, cannot be passed over without attention. So grave a charge, if it emanated from a less responsible source, might be regarded as the fruit of prejudice or jealousy, but coming from so well-informed and so sincere a critic, it calls for an answer from the firms concerned—and especially from certain newspapers which threw the blame of the shortage upon the late Lord Kitchener. On the remaining subjects of the address—combination of employers, standardisation of specifications, the necessity of research work, and the deficiencies of our educational system—few engineers will be found to differ from the author, whose outspoken and instructive address deserves the most careful consideration.

The Decimal System.

A NOTEWORTHY feature of the sittings of the Economic Science Section of the British Association last week was the inclusion of a paper advocating the adoption by this country of the decimal system of coinage, weights, and measures. Not the least significant fact attending this innovation—for we believe the subject has not been touched upon by the B.A. for many years—was the identity of the author of the paper, Sir Richard Burbidge, who, as the managing director of one of our most successful "stores," has attained a position of the highest standing in commercial circles, whilst the reader of the paper, in the absence of the author, was Dr. Hunter, of the well-known Tyneside firm of Swan, Hunter & Wigham Richardson, Ltd., who in the main agreed with Sir Richard's conclusions. Moreover, Mr. Gerald Stoney, President of the Engineering Section, strongly supported the proposal, and Sir Henry Cunningham, the well-known economist, also advocated the adoption of the decimal system by ourselves, in conjunction with the rest of the English-speaking world. Mr. Goriol, an Australian delegate, stated that Australia and New Zealand were only waiting for the Mother Country to move, and Prof. A. W. Kirkaldy, President of the Section, also

urged that the Anglo-Saxon world should act together in bringing about this much-needed reform.

For some time past the daily Press has shown a modest degree of interest in the subject, and leader writers have urged that the time had come to deal with the question resolutely. Hitherto the flabby wait-for-a-mandate attitude of our Government has been the greatest obstacle to progress, and we cordially welcome the accession of the lay Press to the ranks of the agitators, as an indication that public opinion is being aroused. We have done all that we could to stimulate interest in the subject—our readers hardly need be reminded that in October and November last year, in a series of articles extending over seven weeks, we endeavoured to explain the necessity of the change, and to dispel some of the illusory ideas which prevail with regard to the difficulties in the way of its accomplishment. Since then progress has been made—slow, it is true, but not less sure for that; the Council of the Institution of Electrical Engineers has definitely declared in its favour, and other public bodies have expressed their approval, while Press references to the subject grow continually more frequent. We cordially welcome a leading article in the *Daily Telegraph* of Monday last, on "Necessary Reforms," which concludes with this admirable summary:—

Germany and Austria-Hungary recognised many years ago the virtues of the decimal system. Their policy of uniformity conferred no slight benefit upon them in their relations with foreign markets. When peace comes it is imperative that this advantage should not any longer be theirs to our injury. This is essentially a matter for the trading communities. Their interests are menaced by adherence to a currency and system of weights and measures which hinder trading. We are inclined to the belief that, as in other reforms, the necessary changes would prove far less disturbing than is sometimes anticipated, since the movement would be from chaos to order. Once the reforms were carried out, our only wonder would be that we had so long been blind to their advantages.

IN our issue of March 31st we drew attention to the proceedings at the annual meeting of the Metropolitan Electric Supply Co., and commented at some length upon the satisfactory progress of the company on the one hand, and the extraordinary attitude of the chairman, Mr. W. H. Cripps, and his colleague, Mr. F. L. Harris, towards the development of the power load at low prices on the other. Elsewhere in this issue will be found the report of the committee of shareholders that was appointed at the annual meeting to investigate the company's affairs and to consider questions of past and future policy, from which it will be found that the committee has implicitly endorsed every word of our criticism, that Mr. Cripps has resigned the office of chairman, and that the value of Mr. Highfield's services to the company has been cordially recognised, while his policy of development has been strongly recommended to the shareholders.

No other conclusion could have been attained by any body of business men who were acquainted with the circumstances and conditions appertaining to the supply of electricity on commercial lines, and the tendencies of engineering practice at this time, which clearly point to the continued adoption of electricity for motive power and allied purposes at an increasing rate. The committee had the assistance of experts of the highest standing in engineering and finance, whose reports were doubtless of very great interest; it is to be regretted that these are not to be published, though of course we have no fault to find with the decision of the committee in a matter so intimately affecting the company's interests.

The new board of directors, strengthened by the addition of men in the front rank of the electrical industries, and provided with full information as to the position and prospects of the company, will have

a first-class opportunity of guiding its affairs on sound lines towards the goal of prosperity, and it only remains for the shareholders, at the meeting which has been called, to express their approval of the arrangement which has been made on their behalf by the committee, and to authorise the director to "carry on" in accordance with its recommendations; we trust that this course will be followed, and that under enlightened control, and the able management of Mr. Highfield, who has done so much already to improve the company's position, the future of this great undertaking will present a record of unbroken progress and success.

Pig Lead.

THERE has not been a great deal of activity in pig lead in the last few weeks, nor has this been possible, for the simple reason that the market has been unusually bare of sellers. It is rather difficult to understand that buyers were, until towards the end of August, constantly bidding up prices against each other, seeing that parcels were systematically withheld in the absence of offers from the authorities, who have the market entirely under their control. Certain dealers were apparently short, and, therefore, rather fidgety, and prices eventually rose to about £31 10s. for immediate delivery, although no business was done over £31 for near shipment.

In the course of this month there has been a distinct change of attitude on the part of consumers since the reappearance of offers from controlled sources, which has been anxiously awaited. Fair quantities have been already released in that direction, and probably more lead will come on the market, while the arrivals have been on a more liberal scale. That the authorities are now in a better position to afford relief may be attributed to the fact that the heavy extra requirements for Russia have been met. The market has already yielded considerably, prices for near positions now being in the neighbourhood of £30, though there is still a fair demand going on, which, however, is chiefly confined to near arrivals. Forward positions have not attracted quite so much attention, though there is no pressure to sell. The position was a few weeks ago complicated by the fact that some desilverisers were caught somewhat short against outstanding contracts entered into with smaller European producers, whose operations were suspended through lack of fuel. American metal is free from Government control, but no American or Mexican metal is being shipped to this side. America, of course, has been competing in other directions, very considerable quantities having been sold and shipped by that country to Russia *via* Archangel.

There is apparently not much surplus available for export on the other side at present, inasmuch as a good tonnage was also diverted to Canada. Domestic consumers were short, and bought freely lately, which, coupled with a scarcity of prompt stuffs, accounts for the firmness of the trans-Atlantic market. Our total imports, as officially returned for August, were only 14,960 tons, making an aggregate of 108,804 tons for the eight months, this showing a deficit of 78,000 tons against the same period last year, but these figures are very misleading, for they do not include the lead that has come in on Government account. Similarly, it is probable that the considerable quantities of Government metal diverted to Russia are not included in the re-export returns, so that the statistical position cannot be gauged. Yet, there is good reason for believing that the total supplies that have reached this country so far this year are not anything like so large as in the previous year, when the United States contributions were abnormally heavy.

The French imports have been maintained on a heavy scale, chiefly from Spain, the total for the first half of this year being roughly 42,500 tons, or

some 17,000 tons in excess of the previous year, this being, of course, explained by France's huge munition requirements. The Spanish exports for the same period were, too, very big, an indication that production has not suffered very severely from the scarcity of fuel. Consumers of red and white lead continue to find great difficulty in obtaining supplies owing to an acute scarcity, partly attributed to labour shortcomings.

The Wire-Drawing Industries.

THE need for a closer co-operation of interests among the leading British wire manufacturers, as regards the retention of trade previously done in these markets, and the acquisition of new business which has been allowed to go elsewhere, has been fairly well exemplified in one or two instances during the past twelve months. The shutting-out of German wire manufactures, which, in the copper section, shared far too large a proportion of the home trade in this country, and the continued difficulties experienced in obtaining shipments from America, have presented favourable opportunities for the creation of new wire manufacturing businesses on a small scale, which, in some cases, have been backed up, guaranteed, and partly financed by leading houses in the electrical trades, as a result of the continued failure to obtain sufficient supplies elsewhere.

In one or two cases the entire output of small firms drawing the finer sizes has been, we understand, bought up by one or more important electrical houses, in order to guarantee the latter a continued supply of copper wire. The demands made upon these comparatively new firms have, in some cases, exceeded their output capacity by two or three times, whereas complaints have been heard from one or two of the largest wire manufacturers in this country of a distinct tendency to slackness in the fine-wire department.

There are, doubtless, other causes responsible for this position, but the success of the small firms has been attributed, to a large extent, to the fact that they have laid themselves out systematically to inquire for new business previously done by the German firms and others, with the satisfactory results mentioned.

The Supply Monopoly Question in Germany.

THE German and Prussian Municipal Council has at last felt constrained to assume an attitude of opposition towards any scheme of Government domination of the supply of electricity, such as has been suggested during the course of the past two or three years. It is pointed out that the efforts of various Federal States and of Government authorities in Prussian provinces are being directed so as to secure the control of the entire system of supply. Under these circumstances the Council, representing the municipal and communal authorities, considers that these must come forward in defence of an important component part of their local government and financial interests in electricity supply works. It is held that the aims of the States, if accomplished, would lead to an artificial over-straining of the idea of centralisation, would be technically objectionable on the ground of accidental or malevolent interruption in the supply from a few large works, and would cause financial disaster to numerous existing works which are in a prosperous condition. It is further contended that a State monopoly would be prejudicial to the interests of consumers, as it would abolish the present advantage of dealing directly with individual consumers, and that the sale prices, instead of being lower, would probably be higher under a system of State domination.

THE FULLER ELECTRICAL MANUFACTURING WORKS, CHADWELL HEATH.

The firm of John C. Fuller & Son has been in existence for nearly half a century, the first bank pass-book of their presence in bankers, the National Bank of Scotland, dating back to 1865. Mr. John Crisp Fuller, the senior partner, who died in 1911 at the age of over 90, was contemporary with many of the early eminent electricians. He was associated with the Electric and International Telegraph Co., the forerunner of the present Post Office telegraphs, in its earliest days, and was thus a fellow-worker in electrical matters with Mr. Latimer Clark, Mr. Edwin Clark, Mr. Varley, Mr. Colby, Sir William Preece, and many other well-known men.

His energy and capability brought him into contact with many scientific men, amongst them Michael Faraday, whom he had the privilege of assisting in some of his experiments; he often spoke of the simple, unaffected modesty of that great man.

He was of an inventive turn of mind, and, commencing his career as he did, in the early days of practical electric telegraphy, he was able to plan and invent many things which were very useful, though they have now ceased to be identified with his name. His first patent for batteries was taken out in 1853, and this branch of electrical work has remained a speciality of the firm up to the present time. He had the management for some years, in its early days (about 1858), of the India-Rubber, Gutta-Percha and Telegraph Works Co., at Silvertown, first

Later, he and his son, Mr. George Fuller, who is now the senior partner, joined in forming the present firm of John C. Fuller & Son. At Mr. Fuller's death, the business

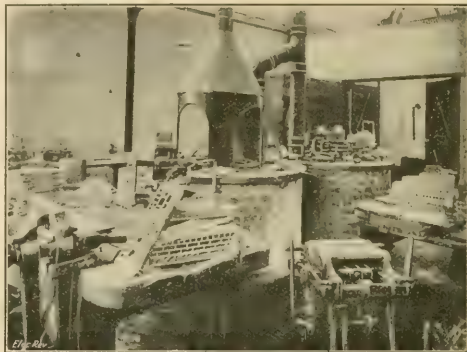


FIG. 3. LEAD CASTING SHOP.

was, for family reasons, made into a private limited company. There are few English-speaking electrical engineers



FIG. 1.—EXTERIOR OF WORKS.

known as Messrs. S. W. Silver & Co. At that time, when the system of electric telegraphy was so new, there were very few sources of supply of telegraphic apparatus or material; hence it fell very largely to him to design and

who are not familiar with the name of Fuller—Fuller's insulators, Fuller's bichromate batteries, Fuller's dry cells, Fuller's block accumulators, and Fuller's wire have penetrated nearly all over the world.

Owing to the development of the business, their old factory at Bow has become too small, and they are now installed on about 12 acres of land at Chadwell Heath. There the firm have built an up-to-date factory and offices, the former comprising the Fuller Battery and Telegraph Works, the Fuller Accumulator Works, the Fuller Wire and Cable Works, and (in course of erection) the Fuller Carbon and Electrical Works.

The Fuller Accumulator Co., Ltd., was formed four years ago to develop the manufacture on broader commercial lines of the "Block" and plate accumulators, which was formerly a department of the parent company, J. C. Fuller and Son. The new company has been very successful, and the accumulators manufactured in its works are very widely used.

The "Block" cell, which has been described in our columns, is especially adapted to replace primary cells, particularly in connection with Post Office and railway telegraphs, and all other signalling installations in which a small current is required, as it retains its charge (when

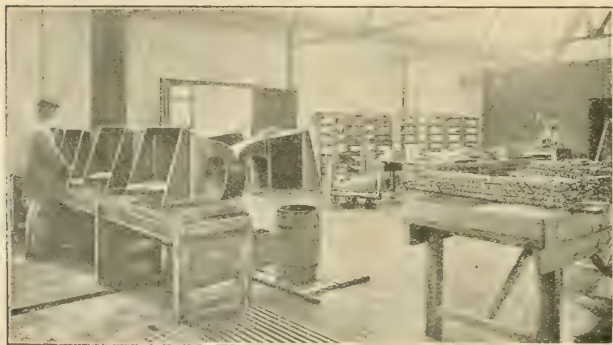


FIG. 2. PASTING SHOP.

manufacture apparatus, insulated wire, cable, &c., and he took part in the installation of their submarine cables. He afterwards joined Mr. W. T. Henley, and was connected with the North Woolwich works for some years.

lightly drawn upon) for two years or more, and, under ordinary conditions, requires charging only twice a year. Large numbers have already been installed by Government departments and railways, both at home and abroad, in substitution for primary cells, over which they show a great saving in maintenance and depreciation.

Messrs. Fuller's were one of the first firms to realise the possibilities of the accumulator for service in connection with motor-cars, and their batteries are well known to motorists everywhere. Quite recently the advent of the American car has brought a further development in the shape of the "Sparta" battery for starting and lighting. This battery, which was described in our issue of August 11th, is now effectively replacing the American accumulator on cars running in this country and in the Colonies. Messrs. Fuller's have branches and agencies in all the Dominions and Colonies, and on the Continent, and are continually extending their activities in fresh markets.

We give herewith some views in their new accumulator shops, which

to guard against injury to the health of the workmen. Fig. 3 shows the casting shop, where the lead grids for "Block" and plate cells are cast. In fig. 2, the pasting

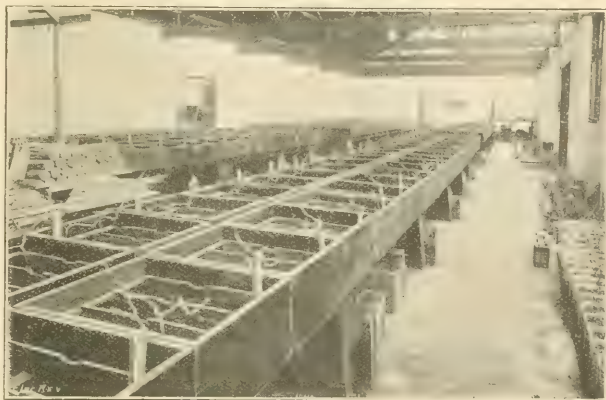


FIG. 4. FORMING SHOP.

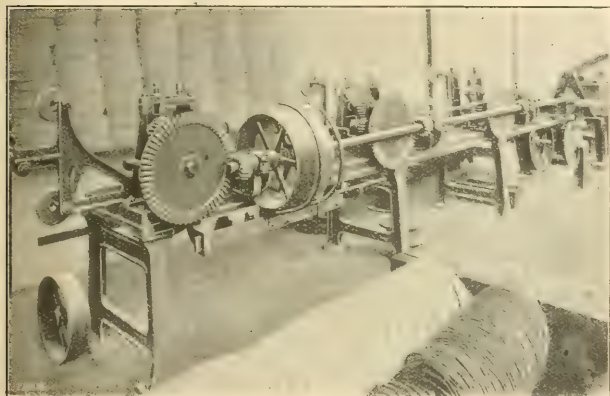


FIG. 5. RUBBER COVERING MACHINE.

shop, the iron hoods which almost surround the bowls of paste, and are connected to air trunks which lead to an exhaust fan, are prominent features; the grids are pasted by hand, pressed in machines, and dried on racks, before passing to the forming shop, shown in fig. 1. This long room is noticeably free from the discomfort sometimes attending the liberation of gas and acid spray from so large a number of forming benches. The acid can be run off from each compartment into large vats, whence it is pumped up into elevated tanks, and gravitates to the benches without handling.

The Fuller's Wire and Cable Co., Ltd., was formed comparatively recently to develop the wire and cable business of the parent company, and is now established in a separate factory, which is fitted up on the most modern lines and equipped with the latest machinery, from the earliest stages of washing, mixing, and calendaring india-rubber

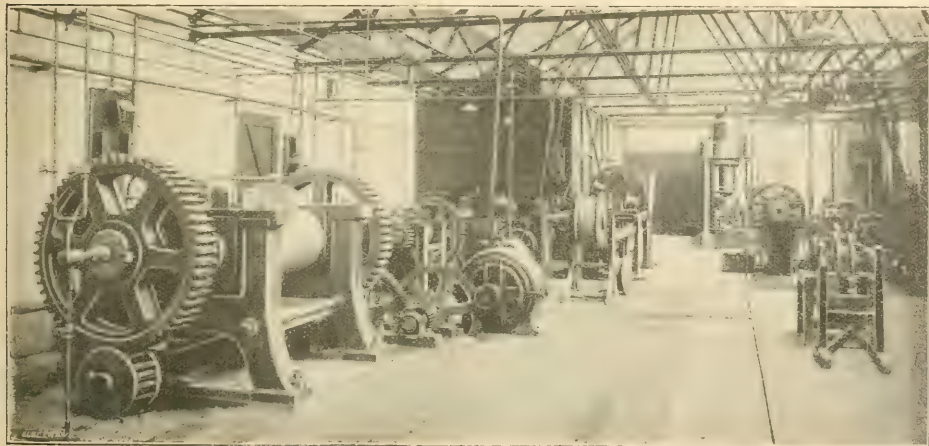


FIG. 6. RUBBER MACHINES AND LEAD PRESS.

are exceptionally well lighted and ventilated, and provided with the most up-to-date sanitary precautions

to the final braiding or lead covering. Every description of electric-light wire and cable is being manufactured

here, and the new factory is already working at full pressure on orders which are coming in from all parts of the world.

In fig. 5 we illustrate a new machine for covering wires with rubber on the longitudinal lapping system, for the highest class of insulation; fig. 6 shows rubber grinding, washing, and mixing machines on the left, a new lead press in the background, and on the right two machines for covering wires with rubber by extrusion—a comparatively new process, but well adapted to the production of thick coatings of rubber, such as are used for motor-car wiring, and for the second grade of insulated flexible. Each machine can turn out four miles of flexible

carpenters' shops are also provided. In another department Mansbridge condensers for telephone work are manufactured.

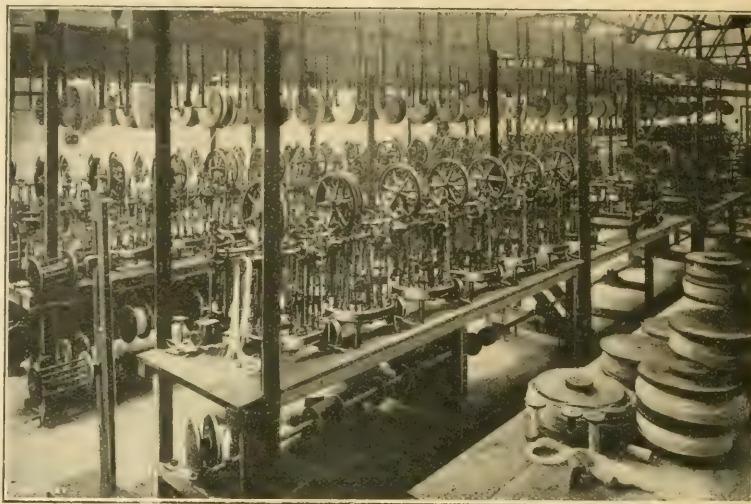


FIG. 7. BRAIDING MACHINES.

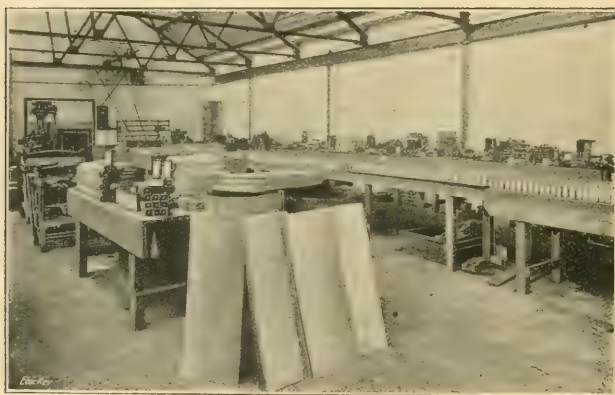


FIG. 8. ZINC SHOP.

(single) a day. There is a great demand in this department, both at home and abroad, owing to the elimination of German goods from the market. Machines for brass-armouring motor-car wires, laying-up flexible cords, insulating bell wires, &c., are installed in other shops, and we give in fig. 7 a view of the braiding machinery, which includes a proportion of the latest pattern of high-speed braiders.

Figs 8 and 9 are views in the primary battery shops of Messrs. John C. Fuller and Son, Ltd., the former showing the zinc shop, where the outer cases are made up, and the latter the assembling shop, where ordinary types of dry cells and the "Inert" pattern (which can be kept in stock indefinitely, only becoming active when water is poured into it) are manufactured. The firm make their own carbons for these batteries, and carry out every process in their manufacture on the premises, where they also have a well-equipped chemical laboratory. Fig. 10 shows



FIG. 9. PRIMARY BATTERY SHOP.

Fig. 10 shows &c., are made :

merate block electrodes. Although they have found it advisable to form separate organisations to deal with the

rapidly-growing business in the products above mentioned, the parent company have also, in order to cope with the increasing demand for primary batteries, condensers, and telephone equipment and electrical apparatus, erected a new works, which is now fully occupied in turning out



FIG. 10. MACHINE SHOP.

enormous quantities of dry cells and other primary batteries and telephone equipment.

The factories are substantially built, well lighted and ventilated, and provision has been made for extension in the near future. The power is electric throughout. A motor garage has been provided, and we are pleased to add that an electric vehicle, propelled by Fuller accumulators, is included in the equipment.

NATIONAL INSURANCE ACT, 1911.

Extension of Unemployment Insurance.

By JOS. J. H. STANSFIELD F.C.I.S.

The following Order was on September 1st issued by the Board of Trade:—

UNEMPLOYMENT INSURANCE.

By the National Insurance (Part II) (Munition Workers) Act, 1916, which comes into force on September 4th, 1916, the compulsory scheme of unemployment insurance is extended to certain scheduled trades and to all workpeople engaged in munitions work. Under power conferred by the Act, the Board of Trade have now, by Order, excluded the following classes of munitions work from insurance:—

1. The classes of work defined in paragraphs (b) (c) (d) and (e) of Section 9 of the Munitions of War Act, 1916.
2. The manufacture of food, drink, and tobacco.
3. The manufacture or repair of garments to individual order.
4. The manufacture of constructional glass.
5. The manufacture or repair of materials wholly or partly manufactured from wool.
6. The weaving of cotton articles and subsequent processes allied thereto.

It should be noted that if any class of work is insurable otherwise than as munitions work, the Order does not have the effect of excluding it from insurance.

Although the purpose of the National Insurance (Part II) (Munitions Workers) Act, 1916, is mainly to extend the unemployment insurance provisions of the National Insurance Act, 1911, to those who are engaged in munitions work in the generally accepted meaning of the term, it will to a certain extent also affect electricity, gas, water, and tramway undertakings.

Section 1 (1) of the new Act extends the provisions of the Act of 1911 to a workman within the meaning of that Act who (a) is engaged on or in connection with munitions work as defined by the Munitions of War Acts, 1915 and 1916, except such classes of such work as the Board of Trade may by Order exclude, or (b) is employed in a trade mentioned in the first schedule to the new Act, and also to his employer as if the work on which he is engaged or such trade were an insured trade within the meaning of the Act passed in 1911.

In Section 9 (d) of the Munitions of War Amendment Act, 1916, munitions work was defined as—

The supply of light, heat, water, or power, or the supply of tramways facilities in cases where the Minister of Munitions certifies that such supply is of importance for the purpose of carrying on munitions work and the erection of buildings, machinery, and plant required for such supply.

A number of electricity and tramway undertakings have been certified by the Ministry of Munitions, but the Order excludes certified undertakings as such from the provisions of the new Act.

It will be noted, however, that the new Act extends to certain trades mentioned in the first schedule, and under this schedule unemployment insurance will now have to be paid by and in respect of workmen who were formerly exempt. It may here be pointed out (particularly in view of the conditions brought about by the war) that "workman" includes female as well as male labour.

The list of trades mentioned in the first schedule is as follows:—

1. The manufacture of ammunition, fireworks, and explosives.
2. The manufacture of chemicals, including oils, lubricants, soap, candles, paints, colours, and varnish.
3. The manufacture of metals and the manufacture or repair of metal goods.
4. The manufacture of rubber and goods made therefrom.
5. The manufacture of leather and leather goods.
6. The manufacture of bricks, cement, and artificial stone and other artificial building materials.
7. Saw millings, including machine woodwork, and the manufacture of wooden cases.

The insured trades mentioned in the Act passed in 1911, which principally affected electricity and tramway undertakings, were: (1) Building (construction, alteration, repair, decoration, and demolition of buildings, including the manufacture of wood fittings, commonly made in builders' workshops or yards), (2) construction of works, and (4) mechanical engineering.

Electricity and tramway undertakings are mainly affected by the new Act in consequence of the list of insured trades now including those engaged in (1) the manufacture of metals and the manufacture or repair of metal goods, and (2) the manufacture of rubber and goods made therefrom.

To some extent the decisions of the Umpire which have been published from time to time will be altered. The principal decisions of the Umpire affecting the electrical and tramway industries will be found in articles of the writer published in this journal in the issues of August 16th and October 4th, 1912, and January 10th, 1913.

Contributions will apparently now be payable in respect of the following operations which were formerly exempt:—

MECHANICAL ENGINEERING.

1. Manufacture of flexible metallic tubing in cold rolling process or cold galvanising under electric process, in joining up lengths of india-rubber and picking out foreign matter from asbestos thread, and in corrugating ribbon metal and forming it into metallic tubing.
2. Rolling, drawing, annealing, and pickling seamless steel tubes.
3. Manufacture of tubes from strips and solids, and wholly or mainly engaged in grinding.
4. Making steel welded barrels, drums, and tanks not forming part of the structure of buildings, vehicles, machinery or works.
5. Making picks, hammers, shovels, &c.
6. Workmen engaged in making metal patterns (other than cast-iron patterns) not being for the use of iron, steel, brass or other foundries, who are engaged wholly or mainly in making castings for use as parts of the products of a mechanical engineering establishment.

ELECTRICAL ENGINEERING.

1. Casting and finishing electric light fittings in brass or other copper alloy in connection with buildings, ships, and vehicles.
2. Joinery, sawmilling, and wood-turning in connection with electric light fittings and accessories.
3. Metal enamellers and lacquerers of brass or other metals in connection with electric light fittings.
4. Dismantling electric meters.
5. Manufacture of telephone and telegraphic instruments and apparatus.

9. Repairing and assembling cable electric stoves.
7. Making and assembling electric meters and arc lamps.
8. Making and assembling electric fittings, including the assembling and repairing of electric street and collectors.
9. Repairing electric stoves and lamps.
10. Making parts and assembling magnetos and repairing same; making switches and cut-outs for motors.
11. Making scientific instruments.
12. Making movable electrical cooking and heating appliances.
13. Making lead accumulator boxes or lead linings for such boxes.

CABLES, OVERHEAD LINES, AND STREET LIGHTING.

1. Manufacture of electric cables.
2. Repairing overhead, third-rail, conduit, surface contact, or cable equipments of railroads, tramways, light railways or electric power supply, the cost of which is usually chargeable to revenue account.
3. Making lamp irons and bolts for erection of lamp pillars.
4. Repairing electric controllers for lighting and extinguishing lamps.
5. Joining cables for repairing or taking branches from mains in consumers' premises.

GENERATION AND SUPPLY OF ELECTRICAL ENERGY.

1. Repairing railway sidings.
2. Repairing electric meters.

TRAMWAYS.

1. Repairing tramway lines and repairing a working tramway line.

This list is not exhaustive, but is given to show the general effect of the new Act.

The application of the Schedule will depend on the meanings of the words "workman" and "manual labour."

A workman is defined as "any person of the age of 16 or upwards employed wholly or mainly by way of manual labour," but does not include (1) persons under 16, (2) indentured apprentices, and (3) foremen or gangers who are not wholly or mainly employed by way of manual labour.

It will presumably exclude those workmen who are not wholly or mainly engaged in the trades now to be insured. For instance, a linesman who is principally engaged in patrolling and inspecting overhead lines and equipment would not be insurable, but if he were wholly or mainly engaged in repairing the lines, insurance would apparently be payable.

Arising out of the war, the Act has been passed without much attention having been paid to it, but the provisions are such that those engaged in the electrical and tramway industries will again find it necessary to go through their wages sheets to note its effect.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Crompton Half-watt Lanterns.

To meet the demand for lanterns for use with single high candle-power lamps, MESSRS. CROMPTON & CO., LTD., of Chelmsford, have introduced a series of special designs. Various patterns can be



FIG. 1. CROMPTON HALF-WATT LANTERN.

supplied, but for industrial installations the type shown in fig. 1 is generally recommended. This is a modified form of the well-tried design adopted with the Crompton Biocel arc lamp: all the light is thrown downwards, and the renewal cost of glass is small.

Clear, fluted or murano-glass can be used, and reduces the high methane fertility without serious absorption, as in the case of opalescent glass. Standard Goliath screw lampholders and anti-vibration brackets are fitted, provision being usually made to take 1-in. diameter screwed conduit for suspension.

Where full lighting is not always required, a second small C.P. holder can be provided below the larger one.

The fittings, illustrated, will take lamps up to 1,500 watts, while the other fittings are designed for up to 1,000-watt lamps.

Totally Enclosed Brake Solenoids.

MR. GEORGE ELLISON, of Victoria Works, Warstone Lane, Birmingham, recently issued a list of totally enclosed brake solenoids, which embodies novel and interesting features. These solenoids are suitable for operating the mechanical brakes on cranes and winches and are of massive construction, as shown in fig. 2; they are provided with adjustable dash-pot action, to apply the brake gradually and release it freely. The frame consists of heavy iron castings, bolted together to form an outer yoke, which encloses the coil: a box-shaped casting bolted to one side of the frame encloses the terminals. The plunger is of polished steel, and acts both as the moving core of the solenoid and as a piston to give an adequate dash-pot effect. The coils are very carefully insulated in such a way

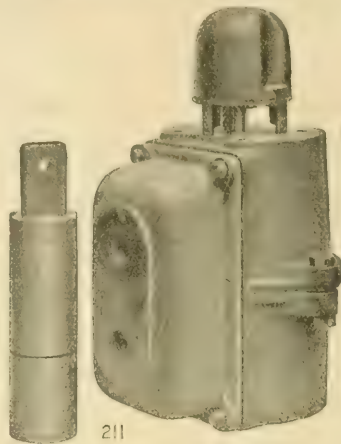


FIG. 2.—DOUBLE-WOUND MAGNET AND SWITCH.

as to prevent any possibility of breakdown due to pressure rises on the interruption of the circuit, and severe tests have been applied to prove their immunity from injury due to damp and overload. A small automatic valve, which can be adjusted, regulates the dash-pot effect in applying the brake, and affords free movement when releasing it. In the firm's list No. 327 the characteristics of series and shunt windings, temperature rise, ratings, &c., are very fully discussed, and "cycle curves" showing precisely the ratios of time "on" and "off" to maintain various temperature rises for each magnet are given, as well as full details of stroke and maximum weight lifted, &c., the whole constituting an admirable technical treatise in small compass on this little-known subject. Not least important is a set of typical specifications for series and shunt magnets, to guide the purchaser in stating precisely his requirements, so that the makers will be in a position to satisfy them.

Electrical "Outboard" Boat Motor.

THE JEWEL ELECTRIC CO., of 112, North Fifth Avenue, Chicago, U.S.A., has placed on the market a neat little electrical outboard motor equipment for boat propulsion. The arrangement of the motor and propeller is similar to that of the usual petrol motor equipment, clamped on outside the stern of the boat. The propeller is driven by gearing from the lower end of the shaft, while the motor is mounted on the upper end, and above it is the tiller, by means of which the propeller can be swivelled round the shaft for steering or reversing the direction of the boat. The motor weighs 50 lb., and runs at a speed of some 3,000 R.P.M., the propeller being coupled through speed-reducing gear.

Two 6-volt, 120-ampere batteries are supplied with the equipment, but the firm have a range of suitable 6-12-volt accumulators of 60 to 120 ampere-hours' output.

The charging of small accumulators is not a matter of great difficulty at the present day, and the electrical outboard equipment has great advantages in the matter of cleanliness and noiselessness and freedom from vibration over the usual petrol motor equipment.

Men Wanted for the R.E.—Men with a knowledge of internal-combustion engines or any branch of electrical engineering are urgently required for the Corps of Royal Engineers, Territorial Force, aged 41 to 47. Personal application should be made to the Chief Recruiting Staff Officer, Great Scotland Yard, Whitehall, S.W., where all further particulars can be obtained.

SWISS RAILWAY ELECTRIFICATION.

THE ST. GOTTHARD LINE.

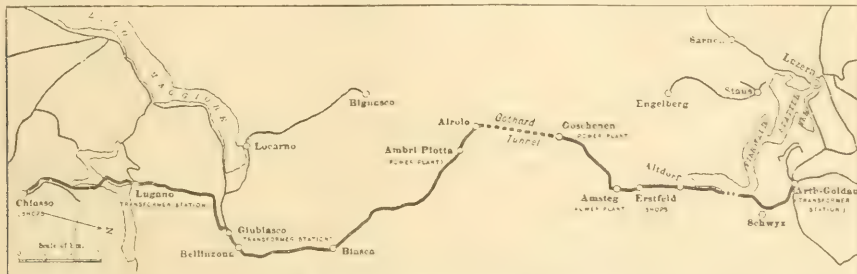
DURING the early part of the present year, the Board of General Managers of the Swiss Federal Railways reported to the Board of Directors on the choice of system to be adopted for the St. Gotthard line, this matter being referred to in our "Railway Notes" on February 18th last.

Previous reports had favoured the single-phase system, and they were finally confirmed, after considering the progress made in direct current and three-phase railway work. According to the *Electric Railway Journal*, it was not considered possible to obtain sufficient information at an early date regarding the use of direct-current for heavy traction.

The three-phase system was not considered applicable, on account of the impossibility of securing satisfactory speed control, and of the necessity for using two contact conductors.

The results obtained with single-phase working on the Loetschberg line, according to the report, are such that this system can be

attention being called to the fact that after experimenting with a 3,300-volt line, a 1,200-volt third-rail system was adopted on a later section of the same system. The Michigan Railway installation at 2,400 volts was also mentioned. In referring to experiments on the last-named railway with voltages higher than 3,000, the managers state that these did not appear to be of great interest. They point out that in their previous report they called attention to the necessity of using at least 3,000 volts with direct current, as applied to heavy trains moving at high velocity. They state that the partisans of the direct-current system, in citing the great increase in the length of line electrified with high-tension direct current, or on the point of being electrified, have principally in mind cases where light trains are used, or where the voltage is less than 3,000. These cases have little bearing upon the present one. In Europe there is not a single line of this kind which justifies a decision based on immediate experience. At the time of the completion of the report, the Chicago, Milwaukee and St. Paul, electrification had not developed far enough to furnish data of value in connection with the St. Gotthard line. Further, there has been no opportunity in Europe to experiment with simple direct-current locomotives, which would be particularly necessary, as the



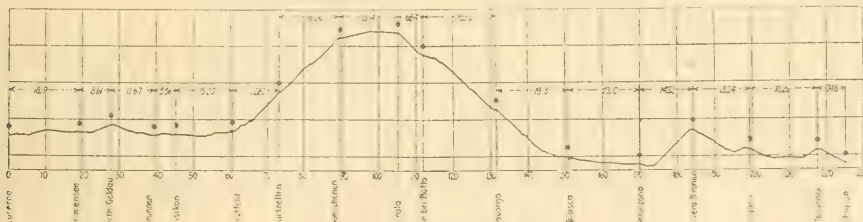
THE ST. GOTTHARD LINE, NOW BEING ELECTRIFIED.

recommended without reserve. This opinion is confirmed by the developments on the New York, New Haven, Westchester and Boston, Boston and Maine, Pennsylvania, and Norfolk and Western electrifications in North America. These developments have furnished the solution of all technical problems which have presented themselves on the federal railway system. The adaptability and elasticity of the single-phase current have been well demonstrated, and it has been applied for a considerable time and on a large scale successfully. In addition, nearly all of the manufacturers have participated in the single-phase development.

In order to show that the difficulties encountered in single-phase development had not been overlooked, the managers give a number of examples of difficulties encountered in several installations, namely, on the Loetschberg line, the New York, New Haven, and Hartford Railroad, the Midi Railway in France, and the Wiesen-thal line in the Grand Duchy of Baden. In the case of the

manufacturers have not had the occasion to construct locomotives which could serve as models. At the same time, generators suitable for heavy direct-current traction, with large capacity at high voltage, have never been built in Europe. Hence, it was not considered possible to use the direct-current system for the St. Gotthard line, because it is not sufficiently perfected in the form necessary, and because the line between Erstfeld and Bellinzona could not be of an experimental nature, nor could it be partially equipped.

While stating the above convictions in regard to the single-phase system, the report of the board of managers points out that the experience with high-tension direct-current traction in America and Europe justifies the hope that in the near future it will have a value nearer that of the single-phase system. If the latter had not been available, experiments with the direct-current system for the St. Gotthard line would have been recommended. The possibility of using the mercury vapour converter increases the



PROFILE OF ST. GOTTHARD LINE.

Loetschberg Railway, one of the difficult problems was the design of the locomotives. Even the New Haven Railroad had, until within a few years ago, a struggle with various technical difficulties. The experience thus gained no doubt influenced the Pennsylvania Railroad to adopt single-phase on the Philadelphia electrification in spite of the good results obtained on three lines of the first importance with low-tension direct current with the third-rail system. In spite of difficulties on the Midi Railway with inductive interference, there is no thought of changing the system. The mechanical difficulties on the Wiesen-thal line in connection with the locomotive have long since been overcome. The results obtained by the Swedish State Railway on the Kiruna-Riksgränsen line cannot yet be considered definite, on account of the interference with its traffic by the present war, but the experience has been sufficiently satisfactory to warrant the equipment of a much longer line between Kiruna and Lulea.

The report reviews the progress which has been made in increasing the voltage on direct-current lines. The managers had followed with great interest the Butte, Anaconda and Pacific Railway electrification, and the Canadian Northern Railway electrification at 2,400 volts. The former was only of general interest, because the capacity of the single locomotive was small and the speed low. The Lancashire and Yorkshire electrification was also mentioned.

chances of success of the direct-current system, because this apparatus can be properly considered as a means of rendering this system more useful in combination with the alternating-current, which tends more and more to be produced in three-phase form at 50 cycles. This result would be important in the present case, because it is probable that in the near future mercury vapour converters may be constructed for voltages and of capacities to permit substituting them for motor-generators in sub-stations for heavy direct-current traction. Two of these converters, of small capacity and for 600 volts, had been used on a railway in Switzerland with good results.

After taking into account all the advantages of three-phase, 50-cycle current, the decision was reached to generate single-phase current in the Amsteg and Ritom power stations. The influence that the choice of system by the federal railways would have on the relation of the power plants of the country to the railways was not overlooked. The railways could, of course, use standard primary power with the single-phase system, and even with the direct-current system, by the use of sub-stations. However, the desire to avoid the transformation of the power from three-phase to single-phase form finally led to the conclusion already mentioned.

It was decided also to plan the two power stations so that when fully equipped they can supply power for the entire line from

Labour to achieve. It is expected that means will be found to secure the superior use of these points in spite of its form and frequency, even if it is necessary at first to transform the greater part of the power. Later the entire single-phase capacity at low frequency will be available for traction purposes.

We are indebted to the *London Review Journal* for our two diagrams.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

To Go Or Not to Go?

In your issue of the 1st inst. I was much interested in a communication by "Unsettled." His case being almost a parallel with my own, I should like to express an opinion on this important matter.

An unsettled state of mind is our common lot just now, and anxiety with regard to one's future is justified by the problem of "Labour after the War." Like "Unsettled," I can claim a good all-round experience, both mechanical and electrical, and have seriously thought of going further afield in search of better conditions and pay.

This war has certainly upset numerous calculations, and nipped in the bud many promising careers. In my own case, though electrical engineering (generation and distribution) is my legitimate calling, I now find myself, through the exigencies of war, a millwright in a "Controlled Establishment."

My problem now is, which is the best course to follow—mechanical or electrical?—many positions require a combination of both. A further course of technical training, commenced before the opening of hostilities, has to remain dormant for the period of the war, owing to lack of time for study.

Undoubtedly, there will be a great demand for engineers, particularly in constructional work, on the Continent after the war.

Taking into consideration the slow pace of our Government departments, and dim recollections of pre-war rates of pay for station engineers—also the present introduction of female labour—it is evident that radical changes in economic conditions are probable, and between Capital and Labour essential. Patriotism is a laudable quality (when not abused by profiteers): then why "starve it?"

If sufficient inducement were offered, most men would prefer to stay in the "Old Country."

Another point calling for attention is a paragraph appearing under "War Items" in your current issue (8th inst.), entitled "A Labour Exchange Proposal." If that is any criterion of the official attitude towards Labour after the war, then "Go" would be my advice. It is nothing less than a determined attempt at "Conscription of Labour." Our industries are not likely to expand at the expense of the liberty of the individual.

My answer to "Unsettled's" query is the well-worn "Wait and see." Perhaps, by the time peace is declared, Government pledges may be worth more than ink and paper, or the wood comprising platforms.

Nonplussed.

In reply to your correspondent "Unsettled," my advice to him is to clear out at once if he is free to do so. The future does not seem to hold much in this country as regards either status or pay for the coming engineer. Even at the present time (leaving out the dilution of labour) it seems as if the future electrical engineer is doomed. As things are at present some of our labourers are getting wages which would make the station engineer's eyes dance with joy. As for pre-war rates, a good mechanic would run him close.

I will give your correspondent my own experience, which has much in common with his own. After a liberal education and some mechanical experience in the workshops, to my great joy (now sorrow) I found myself in a power station, and hence regarded my fortune as made. This delusion, however, was soon dispelled, as, after serving an apprenticeship and learning the outs and ins of a system of from one volt to 20,000, I find my wages are to be increased by 5s. (pre-war) on my last year's apprenticeship money, with an annual increase of 5s. until a certain figure is reached which is not too high, I can assure you.

Well, this, together with the status which I see some have reached after a service of from 10 to 15 years, has made me determined to clear out as soon as possible. I might also state that the system is one of the largest in England, representing some millions of capital. In conclusion, I wish your correspondent every success should he try his venture "neath foreign skies."

Balanced Up.

The Rewards of Industry.

One hears and reads from time to time advice from various well-known men to those who desire to succeed. One favourite piece of advice is "Make yourself valuable to your employer, and your reward is certain." This, on the face of it, sounds alluring, but the fly in the ointment is—what is likely to be the quality of the

reward? I wonder if many of your readers have had an experience similar to mine.

I was the only electrical engineer on the staff of a firm of mechanical engineers. My principal asked me to undertake the design of a certain piece of electrically-operated machinery, for which he wanted to obtain orders. This embodied automatic motor control of a frightfully complicated nature. It was a huge undertaking, as I had no data to work upon, previous attempts by other firms to obtain the same results, up to then, not having succeeded. However, I tackled the work, although inventing did not come within the scope of my duties.

I was occupied on this work, from first to last, for eight years. My worries were multiplied a hundred-fold by the firm foolishly taking orders before the invention was completed. Worse still, they took further orders for more complicated gears, necessitating further inventing work, while I was yet wrestling with the earlier orders already overdue for delivery. And to complete my miseries, they took the later orders, against my advice, on short delivery, with heavy time penalties.

Now, as to the advice "Make yourself valuable, &c., &c." I was so valuable at this juncture that I had left or died—a not unlikely contingency, as I was nearly driven insane—the firm would have been let in for huge penalties, because, there being no time to make drawings, a newcomer could not have taken up the threads. I carried the whole scheme in my head.

What I went through cannot be imagined or described. For four years I only worked and slept, nothing else, day or night, holidays and workdays alike. I worked while I ate, and thought out details in church on Sundays. I dreamt about "polarised relays," "auxiliary motors," "self-replacing circuit breakers," "contactor switches," and a hundred other things, until my brain reeled. But the gears were delivered, though overdue, and they satisfactorily ran their guarantees. I finished up with racked nerves, injured health, and ruined eyesight. Now about the reward.

My principal offered me the choice of a lump sum or an increase of salary. I chose the latter. Now will it be believed that, on the death of my principal, the business being carried on for the benefit of the widow, I was actually deprived of this increase. I dare not protest at the time, because I knew, from certain information coming to me by a roundabout way, that I would be dismissed if I did so. But, after trying for some time, I secured another post, and then put in a claim for arrears of salary wrongfully taken from me.

The executors, prompted by the person who engineered this injustice, pleaded various thin excuses, all of which I easily disposed of, and they had to admit, in the face of my late principal's offer and award in writing, that I had some moral claim to redress, but, knowing that I was not in a position to take legal action, they turned down my claim on the miserable, petty quibble that I had no legal claim, as I did not court certain dismissal by protesting at first. The executors refuse to say why I was reduced, presumably they cannot say. To every question I put the answer was, "I refuse to reply," or "I decline to discuss it," and I was told that I had no right to know anything, or to demand any explanation.

Finally, I drove the executors into a corner with such an awkward question that the only reply I could get was a refusal to answer any more letters. There the matter stands. I am barefacedly done out of, to me, a goodly sum which I worked very very hard for, I am treated like a felon and refused any explanation whatsoever. Such is my reward.

Now, Sir, can you match this for low-down contemptible meanness? Had I been a "Trade Unionist" my society would have taken the matter up and seen it through, but as it is I am merely an

A.M.I.E.E.

[If the facts are as stated, the writer has our sympathy.—EDS. *ELEC. REV.*]

SCIENTIFIC AND INDUSTRIAL RESEARCH.

(Continued from page 261.)

At the present time activity is as marked in the field of ideas as it is in the field of war. The action of the Government in setting up the new machinery for the encouragement of research was accompanied, if not instigated, by vigorous discussion and debate in the public Press and the learned societies. The useful work which the Royal Society has done for the Government during the war by means of a series of special committees, and the attempts of societies such as the Chemical Society and the Society of Chemical Industry, to arouse an interest in the application of science to industry and the importance of organised effort, led the Royal Society to establish a Board of Scientific Societies. Such a scheme cannot fail to be of value both to science and to the Council's labours.

The British Science Guild has put forth an emphatic manifesto on the importance of science and the need of educational reform. The Teachers' Guild has appointed an Education Reform Council, including representatives of science, industry, and commerce, while Sir Ray Lankester formed a Committee on the Neglect of Science to deal with the science in the public schools, the older universities, and the examinations for the Civil Service. The professors of the Imperial College have presented to the Lord President, as

Chairman of their Governors, a memorial dealing comprehensively with the need for a national policy and for a larger output of trained men of science, and at a recent meeting of the Governors of the College he announced that it was the intention of the Government to appoint a special committee under his chairmanship to inquire into the position of natural science in our educational system. At a later date Mr. Henderson made the further announcement in the House of Commons that there would be a reviewing committee which would consider the recommendations of the proposed special committee on science and any other similar committees which might be established to deal with particular aspects of education.

The Advisory Council has been able to assist in the production of special glasses, the making of porcelain for chemical ware and pyrometer tubes, and the erection of research laboratories and workshops in connection with the Stoke School of Pottery. Before the war both earthenware and the cheaper kinds of "bone china" were being driven out of the world markets by the hard continental porcelain, and in June last year the Staffordshire potters appealed to the Board of Trade for assistance in developing the manufacture of hard porcelain to compete with the German and Austrian wares, with the result that the Advisory Council, after full investigation, recommended a capital grant, as well as an annual grant of £2,000 a year for this purpose.

Another industry which has suffered much from foreign competition is that of silk. The Silk Association formed a strong representative Research Committee, and the first of a long list of problems is now to be attacked at the Imperial College.

There is growing evidence that many of the most enlightened firms engaged in prosperous industries are alive to the need for long views. The engineering trades have always been able to hold their own, yet they had become convinced before the war that association was necessary, especially in the markets of China and Russia, if they were to compete successfully with Germany. The Council understands that the British Engineers' Association, like the British Electrical and Allied Manufacturers' Association, intends to include the prosecution of research among its activities. The so-called price associations are likely in many cases to extend their functions in this way. In other cases special organisation may be necessary. Representatives of over 100 firms engaged in chemical industries have resolved "that it is desirable that British firms engaged in the chemical and allied trades should form an association to promote closer co-operation, and to place before the Government the views of the chemical trade generally; to further industrial research; and to facilitate closer co-operation between chemical manufacturers and various universities and technical schools." A Council for organising the British engineering industry formed in Manchester last year has recently combined with the British Engineers' Association; it appointed a committee to consider engineering education and research which has declared it to be one of its functions "to develop co-operation between engineering firms on the one hand and universities and technical colleges on the other, so as to establish such 'schools of thought' as exist in the research departments of great continental and American engineering firms, but cannot be fostered in the comparatively small establishments (and smaller research departments) of most British engineering concerns." This sentence strikes a new note, for it bases the need for co-operation upon the comparatively small scale of British commercial enterprises.

The Council has found that many scientific industries are completely without any effective trade associations through which their common manufacturing interests and difficulties can be approached. It is evident, however, that the difficulties of tradition, trade organisation, and national temperament which stand in the way of combination must be squarely faced if progress is to be made. Even those trade associations which exist have hitherto shown but a moderate appreciation of the necessity for research as a means of keeping command of the market, unless they see their trade in actual danger. So long as an industry was prosperous it was apt to take short views and feel little enthusiasm for systematic research, especially if the firms it comprised were small, or if the capital engaged had a speculative value on the Stock Exchange.

The Council has sometimes found that manufacturers were unwilling to try new developments because they appeared to lack any ambition for extension so long as their existing plant was fully occupied. A good deal of the inertia which British manufacturers have shown towards research may have been due to a realisation, partly instinctive perhaps, but partly based on experience, that research on the small scale they could afford was at best a doubtful proposition. This is one of the principal impediments in the way of the organisation of research, with a view to the conduct of those long and complicated investigations which are necessary for the solution of the fundamental problems lying at the basis of our staple industries.

The Council is aware, however, that there are substantial considerations in the minds of many manufacturers which lead them to hesitate in expending large sums for research of a comprehensive kind. They have complained that the recent substitution of the joint stock bank for private banks has hampered enterprise, because the modern bank authorities are not acquainted with the personnel and policy of local

firms and are not prepared to finance new undertakings and developments in the same way that the private banks did. It has been said that it is no longer possible for a man to raise money on his character, and that the conservatism of English banking, for which there is good reason and justification, makes it peculiarly difficult for any but the largest British manufacturing firms to compete successfully for contracts in foreign markets where long credit is often customary. This difficulty led the British Engineers' Association shortly before the war to take steps to form an Engineers' Trust, which would be supported by the firms belonging to the Association and furnish the necessary credit, and the Board of Trade has established a Committee "to consider the best means of meeting the needs of British firms after the war as regards financial facilities for trade, particularly with reference to the financing of large overseas contracts, and to prepare a detailed scheme for the purpose."

Great businesses can afford a run of unsuccessful trials, because in the end a solution will pay all the costs and put them ahead of their competitors. Powerful joint stock companies generally look forward to a distant future, and pursue a far-seeing policy. "They are seldom willing to sacrifice their reputation for the sake of a temporary gain; they are not inclined to drive such extremely hard bargains with their employees as will make their service unpopular." This last point is of great importance, for the assistance and goodwill of the worker are essential to the promotion of industrial research.

The Council has repeatedly been told, when it has urged the necessity for expenditure upon research with a view to improvements and developments, that there is no security that new ventures will not be left, when peace comes, to shift for themselves as best they may in face of the highly organised competition of our enemies. Organisation can only be fought by counter organisation, and so long as the Englishman treats his business house as his business castle, adding to its original plan here and there as necessity or inclination directs, with his hand against the hand of every other baron in his trade and no personal interest in the foreign politics of his industry as a whole, it will be as impossible for the State to save him, whether by research or other means, as it would have been for King Stephen to conduct a campaign abroad. In the main the State can only effectively help those who help themselves.

It appears to be incontrovertible, however, that for those industries at least which are essential to the conduct of other important national activities and which are both scientific in their character and relatively small in bulk, there is very little chance of survival unless special means are taken by the State to safeguard them. These are the scientific industries—sometimes called key or pivotal or master industries—which can never employ a large proportion of the population because the bulk of their products needed for the world trade is inconsiderable; and yet without them many other trades would languish or die. If a particular product is essential to the national safety the case for State action will be stronger than if it is not. If the trade to which the product is a "key" is relatively unimportant the case will be relatively weak. It may be desirable for the State to take special pains to encourage those scientific industries which are recognised to be essential to the national well-being, and to assume a greater responsibility for the cost of the necessary research for these industries than would in ordinary cases be admissible.

(To be concluded.)

LEGAL.

ACCEPTING PART OF AN ORDER

IN the City of London Court on September 7th, before his Honour Judge Rentoul, K.C., a claim was made by Mr. W. Schonfeld, trading as Schonfeld & Co. London, iron merchant, against Messrs. Waters & Burgess, motor body builders, St. John Street, E.C., to recover £16 6s. 9d. for 22 gross of nuts and bolts supplied for use in motor ambulances.

MR. GREENWOOD, plaintiffs' solicitor, said that as the defendants did not get all the goods which they ordered, they thought they ought not to pay for those which they had received and used in motor ambulances. Under Sec. 30 of the Sale of Goods Act, where the seller delivered to the buyer a quantity of goods less than he contracted to sell, the buyer might reject them, but if the buyer accepted the goods so delivered, he must pay for them at the contract rate. He would assume that that was what happened, although he did not admit it, for it was not so. The nuts and bolts were delivered in December. Seven or eight applications were made in writing for payment. Defendants never replied to them and never set up any defence until applied to before the summons was issued by a trade protection society. Sec. 35 provided that the buyer was deemed to have accepted the goods when he intimated to the seller that he had accepted them, or when the goods had been delivered to him, and he did not act in relation to them which was inconsistent with the ownership of the seller, or when, after the lapse of a reasonable time, he retained the goods without intimating to the seller that he had rejected them.

MR. WATERS, one of the defendants, told the Court that plaintiffs' representative compelled them to order more nuts and bolts than they

really repaired. When the goods were sent they were less in quantity than the original and at the bottom of the plaintiffs' motion was stated "We are temporarily out of items omitted." It had to be proved by the facts which plaintiffs had not supplied at a greatly increased cost as they were for motor wagons wanted in the ambulance service. Surely plaintiffs ought to bear some of that extra expense?

JUDGE HENDERSON said that was not so. Defendants could have rejected the goods which were delivered without any difficulty, and obtained the whole order by buying elsewhere against the plaintiffs. Defendants chose to take part of them; they should have said they would have none of them. They could have bought all the goods against the plaintiffs and sued them for the difference, judgment for the plaintiffs with costs.

MUNITIONS COURT CASES

THE Oldham Munitions Tribunal last week had before it a case in which an electrical fitter applied for a leaving certificate from his employers, a local firm of engineers, because he had been debadged by the firm. He had another situation to go to at a controlled works, and he submitted that the action of his present employers in debadging him showed that they considered he was no longer on war work. A representative of the firm said they did not wish to part with this man until the Army claimed him, but he had been debadged by order of the Ministry of Munitions. The leaving certificate was refused. Mr. James Hodgson (chairman) stating that if they were to grant certificates to all men who were debadged, the Army authorities would have trouble in finding them.

WORKMEN'S COMPENSATION.

JUDGE SPENCER HOGG, sitting at the Wigan County Court last week, heard an application by Minnie Eastmead, widow, whose husband, Chas. E. Eastmead, an electrical worker, had been killed and whose employers had paid into Court £300. The widow was left with three children, and his Honour made an order for the payment of £20 down, £2 10s. a month for two years, and for £100 to be invested in the War Loan.

WAR ITEMS.

Exports to China.—The "London Gazette" for September 8th contains a further list of names of persons to whom articles may be exported in China.

Export Prohibitions.—The "London Gazette" for September 8th contains additions, removals, and variations of the lists of persons or bodies of persons with whom trading is prohibited in Argentina, Bolivia, Brazil, Japan, Netherlands, Norway, United States, and other countries.

X-ray Scientist's Sacrifice.—A young scientist who has distinguished himself by his fruitful research work in connection with X-rays, M. Maxime Ménard, has had one of his fingers amputated as the result of injuries caused by the rays. M. Ménard had already lost a finger from the same cause before the war. His studies have greatly facilitated the rapid discovery of bullets and shell splinters embedded in the bodies of wounded soldiers.

Patent Rights in Austria-Hungary.—According to the *Neue Freie Presse* (Vienna), an Austrian Government Order of August 16th empowers the Minister of Trade to limit or cancel the patent rights and the rights in registered designs and trade-marks of British and French subjects, on proof that such a course is for the public interest, and the rights of Russian subjects without such proof. Royalties for the use of patent rights will be charged, and the sums obtained disposed of by the Minister of Trade—probably on the same principle as in the United Kingdom.—*Financier*.

Russian Government to Regulate Electric Concerns.—The Minister of Trade and Industry has submitted a project of regulations to the Council of Ministers on the construction and maintenance of electric transmission plant. The object of the project is to provide encouragement for the formation of Russian electrotechnical enterprises. The Minister of the Interior has also submitted a project to the Council of Ministers embracing rules for the organisation of the control of electrotechnical equipment in the Empire.

The Ministry of Munitions.—The following changes in the office organisation of the Ministry of Munitions are announced:—

Sir Glynn West will in future be directly responsible to the Minister for the conduct of his department, which deals with the manufacture of shells and their components. His title will be Controller of Shell Manufacture. Mr. H. Fowler will accordingly be designated Deputy Controller.

The branches dealing respectively with the supply of metals, coal, and other materials, and with machine tools, will work immediately under the Director General of Munitions Supply. Mr. Leonard Llewellyn and Mr. Alfred Herbert thus become Deputy Directors-General. Mr. John Hunter has become responsible for the branch which deals with the production of steel.

Enemy Goods in Australia.—Reuter reports from Melbourne that the Government recently decided that enemy goods imported before the war must not be sold by wholesale houses after September 30th nor retail houses after November 30th. The dates have now been extended in the one case to October 31st, and in the other to December 31st.

To be Wound Up.—The Board of Trade has ordered the following companies to be wound up:—
Switchgear Construction Co., Ltd., Park Street, Southwark, S.E., electrical engineers. Controller: J. H. Stephens, 6, Clement's Lane, E.C.

Turner & Burger, 149, Farringdon Road, E.C., electrical accessories merchants. Controller: J. E. Percival, 6, Old Jewry, E.C.

Enemy Firms in Italy.—Enormous amounts of German and Austrian property in Italy are affected by the Decrees regarding the sequestration of enemy concerns. Amongst the latter are the firm of Röckling, with a stock of iron and steel valued at £40,000, the Milan Krupp Works, and the Austrian firm of Ganz & Co., which, under the guise of an Italian company, held a very important contract for the supply of electricity to Rome from the River Anio.

Employment of Aliens.—An Order in Council makes the following addition to the articles under the Aliens Restriction (Consolidation) Order, 1916:—

As from and after October 1st, 1916, a person shall not take steps to obtain the services for work other than munitions work in the United Kingdom of aliens or any alien not in the United Kingdom except with the permission in writing of the Board of Trade, and subject to such special or general conditions as the Board of Trade may impose.

British Property in Germany.—British subjects who own property in enemy territory, or have claims to prefer against enemy Governments or persons, are called upon by a recent Royal proclamation to submit details of such interests or claims at once to the authorities, unless they have already voluntarily made such returns. The officers appointed to receive such returns are:—

(a) In the case of property in enemy territory and of claims against enemy persons, the Public Trustee, Kingsway, London, W.C.

(b) In the case of claims against enemy Governments, the Directors of the Foreign Claims Office, Foreign Office, London, S.W.

Foreign Capital in Spain.—An interesting survey of the magnitude of foreign financial interests in Spain from the standpoint of the industrial development of the country has just been published in Madrid. It refers to joint stock companies domiciled abroad and carrying on industrial works in Spain, and shows the astonishing fact that out of the total amount of £73,400,000 invested by foreign companies for these purposes, the shares held by Germany does not reach £1,000,000. The following figures are worthy of note as indicating the amounts invested by the nations concerned in the industries mentioned:—

		ELECTRIC LIGHTING.	£
Belgium	160,000
France	372,000
England	5,062,000
Total	£5,594,000
		RAILWAYS AND TRAMWAYS.	
Belgium	2,939,000
France	4,136,000
England	365,000
Total	£7,440,000
		METALLURGICAL INDUSTRIES.	
Belgium	240,000
France	240,000
England	25,000
Total	£505,000
		MINING UNDERTAKINGS.	
England	14,459,000
France	7,014,000
Belgium	2,766,000
Germany	800,000
Switzerland	104,000
Total	£25,143,000

We leave out of consideration other industries in which foreign capital is interested, but sufficient has been shown to demonstrate the enormous preponderance of the Allied nations in the industrial development of Spain. Under these circumstances, it is scarcely surprising to find the Madrid *Mundo* asking what would happen if through Spanish hostility towards the Allies the latter were to withdraw from the country such an immense sum as is cited, and which has so largely contributed towards the economic advancement of the country. The newspaper states that, after reading the figures and meditating on them, no one who has the welfare of the country at heart could possibly believe in the adoption by Spain of a Germanophile policy at the present time.

The Russian A.E.G.—The Russian A.E.G., whose works until the beginning of the war were situated at Riga, whence the machinery and plant were subsequently removed into the interior, is reported to have experienced a satisfactory period in 1915 as a result of the work carried out at the new site, where operations are exclusively devoted to Army requirements. A new war department, at a cost of £150,000, was established last year, together with a special artillery department. The import of foreign materials and parts, the lack of which formerly interfered with the activity of the works, has now assumed a regular course, the company for this purpose having entered into relations with the United States General Electric Co. and the British Thomson-Houston Co. After allocating £47,000 to the depreciation fund, the accounts for 1915 show net profits amounting to £223,000, as compared with £206,000 in 1914, and it is proposed to pay a dividend of 10 per cent. on the share capital of £1,200,000, being the same rate as in the preceding year. It has been decided to increase the share capital by £1,200,000 to £2,400,000, although the first instalment of the new emission will comprise £800,000. An addition has been made to the company's statutes in the sense that only directors who are Russian subjects will be entitled to be present at general meetings. The German banks, which formerly issued Russian A.E.G. shares in Berlin, are watching developments in connection with the new issue of shares with a view to safeguarding, as far as possible, the interests of present Teutonic shareholders.

The South African Siemens Company.—According to several newspaper reports which have been sent to us, the directors of Siemens, Ltd., applied in July, to Judge-President de Villiers in the Rand Division of the Supreme Court, for an order to place the company in liquidation. They declared that they were not prepared, in view of the fact that all the shares were registered in the names of enemy subjects, or were in the possession of the Deutsche Bank, to accept the responsibility of continuing in office. The directors further declared that it was found, in the circumstances, impossible to carry on the business of the company. They, therefore, had resolved to petition the Court to put the company in liquidation, considering that it was just and equitable that the company should be extinguished.

Mr. MacWilliam, who appeared in support of the company's petition, stated that although there was no necessity to do so, the directors had notified the Treasury that the application to the Court was being made, and the Treasury had replied that the Department would not object to the liquidation provided that all moneys realised on behalf of enemy shareholders should be paid to the Treasury.

The Court granted a provisional order of liquidation, the Judge-President observing that as the nature of the application was without precedent, he thought the Court should name a fairly distant return date. The rule was made returnable on October 26th. Mr. J. V. Stanton was appointed provisional liquidator. Mr. Stanton was appointed manager of the company when Mr. E. G. Weyhausen, then manager, retired, on being placed in internment at the Maritzburg prisoner-of-war camp, from active participation in the affairs of the company.

Mr. J. V. Stanton, the provisional liquidator, writing to one of the newspapers referred to, says:—

"The resolution that an endeavour be made to place the company in liquidation was passed on February 5th last, i.e., prior to the introduction of the Trading with the Enemy Bill. The delay in filing the petition was due to the necessity of bringing certain existing contracts to a stage which would allow of liquidation. Further, this resolution was passed at the first meeting after the local directors received their first intimation from Messrs. Siemens Bros. Dynamo Works, Ltd., London, that Siemens, Ltd., had ceased to be a branch of the former company. Up to that date Siemens, Ltd., had always been in the position of a branch of Siemens Bros. Dynamo Works, Ltd., by whom the local management had been appointed, and by whom the business of Siemens, Ltd., had been controlled.

The local directors have not been endeavouring to lengthen out the business for the benefit of enemy shareholders, but have taken the first possible opportunity—since they became aware of the true position of the company—to apply to the Court to relieve them of their false position and to allow them to place their assets at the disposal of the Treasury.

A Colliery Plant Shut-down.—Captain R. G.—n, who is in France, writes us as follows:—"This area absolutely teems with items of engineering interest, and I really think that if I survive the war I shall have to conduct an Institution Summer Meeting round the various places. For instance, yesterday, my professional instinct being (for the nonce) superior to that of personal safety, I crawled into the engine-room of a colliery which had adopted electrical winding, about 600 yd. from the Bosch. Meter cases and oil switchgear lay all over the floor, a 25-panel grey marble switchboard had a shell-hole through the middle, leaving meters, synchroniser, and feeder switches at all angles, and a tangled mass of bus-bars behind. The motor of a large induction motor-driven pumping set had left hurriedly, half of the magnet case, and some of the shaft, remaining more or less in place. The stator-winding of the main winding set had received a fragment of H.E. into its bosom, while 12 in.

and 18 in. cast-iron pipes were well ventilated. Stewart, who was with the Westinghouse, naively remarked: 'I suppose it's all dead'! This week the French have installed static transformer gear in a dug-out on the lee side of a railway cutting, about 6,000 yd. from the Bosch, and intend operating an old 6,000-volt pole line to another colliery almost immediately—a definite proof of their optimism."

Moscow and the 1886 Co.—The "Nouvelles Visions" says that the Moscow Chief, M. B. Chelnokoff, has returned there from Petrograd, where he had been to consult with the competent authorities on the town's relations with the 1886 company. The President of the Council of Ministers, B. V. Sturmer, said that he had not changed his attitude towards this company, and he considered its liquidation a matter of the near future. The Ministers of the Interior and of Justice expressed themselves as quite sympathetic to the town. Important conferences took place with other interested bodies, and M. B. Chelnokoff received everywhere assurances that the matter would be settled soon in a way favourable to the town of Moscow.

Exemption Applications.—At Warrington, an electrician at the Star Cinema House, aged 28, and married, who was appealed for by his employers, was allowed a further two months' exemption. He was prepared to work part time on munitions.

At Wigan, a firm of electrical engineers, appealing for a man aged 21 years, said that 23 of their employees had joined the Colours, and Mr. H. Brierley (Military representative) said the firm had done very well in this respect. The firm's representative said they had advertised for electricians, but without success, and they had work held up now. It would be difficult to manage without this man. One month's conditional exemption was allowed. Conditional exemption was granted to three other employees of the firm, aged 28 years, 38, and 39 respectively.

The Rochdale Tribunal granted conditional exemption to Mr. J. K. Cotton (34), electrical contractor, and exemption until October 31st to Mr. Harry Jones (32), electrician at a local place of amusement, who was appealed for by his employers.

The Mossley Tribunal exempted Wilfred Kershaw, electrician at the Royal Pavilion, until October 31st.

At the Oxford Local Tribunal, Elizabeth Storey, Oxford, applied for the renewal of the certificate granted to Stanley A. Stook (24), electrical engineer; he had been granted exemption in June to September 1st. The applicant was still unable to get a substitute in order to release the man for service. Mrs. Storey depended on the business for her means of livelihood, and if the man were taken it would mean closing down, and her means of livelihood would be absolutely gone. Temporary exemption granted for two months, no further application to be made without leave of the Tribunal.

An appeal was made at Bedford by the Igranic Electric Co. for F. Morris, a time-expired soldier, who became 41 on September 4th. The Clerk asked if the military wanted a man who had served 22 years with the Colours and was 41 years of age, and the Military representative replied that they wanted all the men they could get, or they would have to raise the age. The firm said theirs was a controlled one, and the man's work was beyond a woman's physical capacity. Exemption was granted until December 1st.

At Woking, the Electric Supply Co. appealed for the chief clerk, A. M. Dallen (29), and the only meter tester and repairer left, A. J. Jamieson (34). The secretary, Mr. Nicholson, said the chief clerk had technical knowledge which it would take any substitute a long time to acquire. Exemption was refused in the case of Dallen, and notice of appeal was given; Jamieson was conditionally exempted.

Barnsley Tribunal, on September 5th, gave conditional exemption to a number of employees appealed for by the Barnsley & District Traction Co., Ltd., but refused appeals for a driver, aged 28, and another employee aged 34. The same Tribunal gave three months' temporary exemption to Guy P. Dearden, electric wireman with Mr. E. Broley, who is engaged on public contract work, and to Harry Brown, electric wireman with Messrs. S. Rushworth & Son.

Bath Tribunal has given conditional exemption to A. C. Brackstone (39), electrical fitter with Messrs. Kendall, on condition that he obtains munition work within 14 days.

An appeal at Reigate for the retention of E. C. Reynolds (38), the only electrician left at the Redhill Kinema Royal, resulted in a fortnight being allowed to find a substitute. The appeal was based on the fact that the kinema paid £2,000 a year in excise duty, taxes, &c.

At Carlisle, Fred Bell (32), electric fitter, was appealed for by the Electric Illuminating Co., who stated that the man was at present engaged on important work for the Control Board. The staff before the war numbered 10, now there were only two. Exemption was granted until December 1st to enable the Control Board work to be proceeded with.

At Marlow, on September 4th, the Military representative asked for the removal from the certified list of Mr. A. E. Plumridge, electrical engineer. Mr. J. G. Meakes, the employer, said that Mr. Plumridge was indispensable. His staff had been reduced from 15 to five, and he was the only one appealed for. It was admitted by the Military that Mr. Plumridge was clearly in a certified occupation, but he con-

stated that in the national interests he should not remain in civil life. The Tribunal refused the request.

At Coventry, Mr. E. B. Bridger, electrician, who had been in the Flying Corps, appealed as a conscientious objector. He admitted that it would be his duty to defend his wife with a rifle if it was necessary, and, in dismissing the appeal, the Chairman said that by defending his country Mr. Bridger would be defending his wife.

At Coventry, the Corporation Tramway Department appealed for a number of employees. In each case two months' exemption was conceded, with the suggestion that men above military age capable of doing the work should, if possible, replace all single men.

At Bishopham Tribunal, Mr. J. Cameron, general manager of the Blackpool and Fleetwood Tramroad, applied for the exemption of 11 employés, including an inspector. He had not appealed for the exemption of any summer man. Conditional exemption granted.

An electrician applied to Burnley Tribunal for temporary exemption for an electrical wireman. He was the only qualified man left, three having joined the Flying Corps. His foreman had gone working in a coal mine as an electrician. This man was doing contract work at Sheffield. Captain Smith said that men of this description could be got any day. They were only labourers. The appeal was put in on May 6th. Exemption until the end of September was granted.

Deal Tribunal has given two months' exemption to Chas. Henry J. Graves (24), who has the care of the electric plant, &c., at the South-Eastern Hotel, and who does electrical repairs for private residents, and for the X-ray apparatus at the Royal Marine Infirmary.

At Coventry, Mr. J. Hutt (32), electrical engineer and contractor, stated that he now carried on the business by himself, and was doing work for munition factories. It was stated that there was a scarcity of skilled electricians in the city. Three months were granted. Mr. Hutt to put in weekly 19 hours' duty as a Special Constable.

Maidenhead Tribunal has refused extended exemption to Frank Burdett Burnham (36), electrician with Mr. H. Rose, who said that he had contracts to last until October.

Three months' exemption has been allowed to Thos. White (31), electrician, appealed for by Messrs. Page & Bloomer, of Stourbridge, as being in a certified occupation.

A final month has been granted to Coalville to an electric operator at a picture theatre at Whitwick.

The Crawley Electrical Co. appealed for an electrician and fitter, previously medically rejected, and now passed for general service, but exemption was refused.

Buntingford Tribunal has given exemption until the end of September, to allow him to complete electrical work in hand, to Mr. P. J. Mac Kay.

At Malvern, the U.D.C. electrical engineer (Mr. S. Trow Smith) appealed for Wm. Thos. Powell, fireman, previously temporarily exempted. Conditional exemption was now granted.

The Blackburn Tribunal has granted conditional exemption to a married motorman employed by an electrical engineer, and said to be in charge of special electrical equipment at a large works at Dawen.

At Tunbridge Wells, Mr. Strange and Mr. Featherstone appealed for R. J. Spittles and R. F. Lack, working foreman and electrical wireman. It was stated that the electrical contractors for the town loaned the men one to another in order to keep as few men as possible in the town to carry out the work of maintaining the supply. They also had increased work at country houses owing to the calling-up of electricians. Each was given two months on the men joining the Volunteer Training Corps.

Ensom Rural Tribunal has granted two months' exemption to Mr. F. W. Morris, electrical engineer, of Barnett Wood Lane, Ashstead.

Extended exemption was sought at Leatherhead, on September 1st, by Mr. M. Morris (33), manager for Messrs. Buchanan & Curwen, electrical engineers. Appellant is usually for ordinary work only and the Military representative (Mr. H. J. Rivington) said he did not object to exemption until the new year. Mr. Morris stated that he had been passed for home service only. One of the partners, Mr. Curwen, was taking up a commission in the Royal Flying Corps, and wished him (appellant) to take his place continuing his work as well as at Leatherhead. The Tribunal granted until the new year on appellant joining the Volunteers.

The Burgess Hill Sanitary Tribunal has granted six months' exemption to a member of the staff at the electric light works on condition that he remains in the same occupation and joins the Volunteers.

At Blackpool Tribunal, in the case of a foreman electrician employed at the Pleasure Beach, his employers stated that he was the only electrician they had left. He had been rejected at Lancaster, and then called up. Conditionally exempted.

At Crompton (Lancs.), an electrician at a local cinema hall appealed for exemption, and said he had served 13 years in the Army, and was in the regiment from May. He was exempted until January 1st.

At the Shoreham Tribunal, on Thursday, Messrs. E. & C. Whitney, of City Road, N., electrical engineers, asked for

exemption on business grounds for James Green (37), electrical fitter. Mr. Whitney said they had one other electrical fitter in their employ, aged 40 years, and they were doing a lot of installing and fitting for the Government. As he was an electrician doing power work, they applied to the Ministry of Munitions for a badge, but it was not granted, a certificate being considered sufficient. The Chairman: So it is; it is a certified occupation. The only thing is, does Green do the same class of work? Mr. Whitney: Identical work. Green appeared and said that he had been engaged for a long time in installing power in Government factories and premises. Mr. Parry said that the firm did not seem to understand that this man was in a certified occupation.—Exemption was granted till December 31st, conditional on joining the V.T.C.

At Orsett, an electrical engineer at Little Thurrock claimed exemption as owner of a one-man business. The appeal was rejected, and the calling-up delayed for a month.

The Blackpool Tribunal has disallowed an appeal by an electric motor builder (36), now engaged as a mechanic, who said he was the sole support of his aged mother.

BUSINESS NOTES.

Patent Restoration.—An order has been made restoring Letters Patent No. 25,363 of 1907, granted to Arthur Greenwood and Konrad Andersson for "Improvements in ejectors and compressors for air gases and vapours."

Mazda Telephone Directory Cover.—We have received from the BRITISH THOMSON-HOUSTON CO. LTD. of Mazda House, a telephone directory cover devised on an ingenious principle, so as to hold the directory firmly without tearing the binding. The senders claim that it is as big an advance over previous covers as Mazda drawn-wire lamps are over previous types, and certainly it is an excellent and easily-applied protection to that indispensable and long-suffering volume.

Irish Battery Industry.—Referring to the note on p. 237 of our issue of September 1st, regarding the opening of a large factory in Dublin for the manufacture of electric dry cells and batteries, we are informed that Mr. Leon Cornelis, of 15, D'Olier Street, Dublin, will be pleased to give further particulars to inquirers.

Electrical Imports of Venezuela.—The imports of electrical appliances into the Republic of Venezuela during the fiscal year 1914-15 only attained a value of £16,999, as contrasted with £39,989 in the preceding 12 months.

Italy.—A new company has lately been formed in Turin, with the title *La Società per la Fabbricazione di Batterie Elettriche Brevetto Bonora* to manufacture electric batteries under the Bonora patents.

Catalogues and Lists.—MESSRS. HERBERT MORRIS, LTD., Empress Works, Loughborough, Leicestershire. Book 95, describing the "2240 pulley-block"—an American type, made at the Empress Works to carry British tons (the American ton is 2,000 lb.). Travelling blocks and the H.M.B. pulley-blocks are also described.

MESSRS. S. G. LEACH & CO., LTD., 26-30, Artillery Lane, E.C.—Leaflet describing and illustrating the "Selec" shen, which is electrically operated and designed for use in factories, workshops, yards, quarries, lightships, &c.

WHOLESALE ELECTRICAL CO., LTD., 54-56, Oxford Street, London, W.—Circular giving illustrations of a number of electrical accessories, switch plugs, cut-outs, ceiling roses, adaptors, lamp-holders, &c.

MESSRS. DOWNES & DAVIES, 1 and 3, Stanley Street, Liverpool. Preliminary list of ships' electrical fittings—bulkhead, portable, cargo lamps and sockets, &c.

HOLOPHANE, LTD., 12, Cateret Street, S.W.—Booklet relating to Holophane special reflectors for the scientific illumination of railway platforms, offices, sidings, rolling stock, &c., with illustrations of important installations on this system.

Trade with Russia.—The Yorkshire effort for the stimulation of trading with Russia is making excellent progress. For students in the scheme of the Leeds University who make good progress, scholarships are to be provided of about £200 each for a year's residence in Russia for studies under the direction of the Russian Minister of Education at the Universities of Petrograd, Moscow, and Odessa, and for the practical experience to be derived from contact with the populations of those centres.

E.C.C. Hospital Fund.—The employés of the Electric Construction Co., Ltd., Wolverhampton, have made allocations from their hospital fund to local and other hospitals to the tune of £173.

Norway.—An amalgamation has been arranged between the Norwegian Motor and Dynamo Factory, Hasle, near Christiania, and the firm of Per Kure, and the combined establishment will in future trade as Per Kure, Norwegian Motor and Dynamo Factory. The capital of the company, which has taken over the Norwegian agency of the Swedish General Electric Co., is approximately 2,000,000 kr. —*Anglo-Norwegian Trade Journal.*

Book Notices.—"The Principles of Electrical Engineering." Vol. I. By G. Kapp. London: Edward Arnold. Price 15s. net.

"Directory and Chronicle for China, Japan, Corea, Indo-China, Straits Settlements, Philippines, &c., for 1916." London: *Hongkong Daily Press*. Price 30s. net.

"Telegraph and Telephone Journal." Vol. II. No. 24. September, 1916. London: Editing Committee, G.P.O. North. Price 3d.

"British and German Industrial Conditions." By A. Stewart. London: S. Rentell & Co. Price 6d.

"Alternating Currents." By W. H. N. James. Cambridge University Press. Price 10s. 6d. net.

Australia.—A business man in Sydney recently in charge of the Sydney Office of H.M. Trade Commissioner, wishes to represent United Kingdom manufacturers for the sale of their goods in Victoria, New South Wales, and Queensland. The inquirer desires to secure agencies for small oil engines of the Diesel type, small electric motors ($\frac{1}{2}$ h.p. and upwards), small dynamos, and new hardware lines and patented specialities.

United Kingdom manufacturers may obtain the name and address of the inquirer on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C. (Reference No. 283.)—*Board of Trade Journal*

Liquidation.—MECHANICAL TRANSPORT, LTD.—Creditors should send particulars of their debts, &c., to the liquidators, Messrs. G. W. Askew & H. W. Philpott, by September 28th.

Munition Workers' Holiday.—MESSRS. E. BROOK, LTD., of Huddersfield, announce that their works will be closed both for the receiving and dispatching of goods on September 25th and 26th. They will be open all other working days up to Christmas.

LIGHTING AND POWER NOTES.

Aberdeen.—The city electrical engineer recommended that a new five-years' contract be entered into with the North of Scotland Fish Guano Co. for a supply of power, with a guarantee of 100,000 units per annum. The result of the new charges proposed was that the company would pay, with coal at its present rate, an increase of 18 per cent. on the existing charges. At a meeting of the Council the recommendation was sent back to the Electricity Committee for further consideration.

Accrington.—At a meeting of the T.C. last week, Councillor Tough referred to the increasing cost of electricity; he remarked, that with less than half the production of Accrington, the average cost last year at Rawtenstall was '6d. per unit, for 3,000,000 units, compared with an average of '81d. for $7\frac{1}{2}$ million units at Accrington. It was pointed out that a strict comparison could not be made, and that coal cost '18s. 10d. now as against 8s. 4d. per ton before the war.

Australia.—The Electric Lighting Committee of the Sydney City Council recommends that an agreement be entered into with Messrs. Norton, Griffiths & Co., contractors for the city railway construction, to supply them with electricity at the various shafts at '7d. per unit for two-shift working and '85d. per unit when one shift only is worked. The estimated cost of providing the supply is £4,335.

The Sydney city electrical engineer recommends that an order be placed with Messrs. Willans & Robinson for a geared turbine to couple with the alternator and condenser of the existing 4,000 kw. set (No. 8), at a cost of £8,100; the cost of freight, insurance, and erection of buildings, &c., will amount to an additional £1,900.

The city electrical engineer has informed the Hurstville Council that under existing circumstances it was unlikely his Council would entertain the proposal to supply electricity to the suburb, and he recommended a renewal of the application in about 12 months.

The formal inauguration of the electric lighting system at Albany, N.S.W., took place last month.

With a view to improving the lighting of St. Kilda's Road, the Melbourne City Council has decided to erect 49 arc lamps or half-watt lamps of equal C.P.; the additional cost on the system will be £777, making a total cost of £1,267.—*Tenders.*

Bath.—YEAR'S WORKING. — The accounts of the electricity undertaking for the year ended March 31st last, show that instead of the anticipated loss of about £2,000, the deficit for the year was only £151, as compared with £1,767 in the previous year. The total revenue was £26,490, as compared with £24,135 in 1914-15, and the gross profit £12,961 as against £11,436. Coal cost was increased by £845, due to price not tonnage.

Bishop's Stortford.—E.L. SCHEME.—At the annual meeting recently of the Bishop's Stortford, Harlow, and Epping Gas and Electricity Co., the chairman stated that the electricity plant was now in complete working order.

Bradford.—NEW PLANT.—The Electricity Committee has authorised the chairman and deputy-chairman to purchase coal-crushing plant.

Bristol.—YEAR'S WORKING.—The report of the year's working of the electricity department to March 25th last, shows gross receipts amounting to £132,928, an expenditure of £72,292.

and a gross profit of £57,636, which, with the amount transferred from redemption and sinking fund (No. 2) account, makes a total of £58,184. After repayment of loans and interest, £50,273, there was a net profit on the year's working of £7,911, which, with the balance from last account, makes a total surplus of £15,721. Of this, £2,391 has been expended on allowances to men on active service, and £4,038 on work not chargeable to loan account, leaving a balance carried forward of £9,292. The total indebtedness of the undertaking is stated to be £899,062. Loans repaid or accumulated in the stock and loan redemption funds, £382,139; balance outstanding, £516,923. The total number of consumers was 5,608, a net increase of 338 during the year. The number of units sold was 21,665,968, an increase of 3,463,812 units for the year.

The general manager, Mr. H. Faraday Proctor, in his report, states that war conditions curtailed considerably the number of new consumers which would otherwise have been connected to the system, but a large amount of work had been carried out in connection with the supply of power. The number of units sold to private consumers (excluding public street lighting) had increased about 21½ per cent., or, after allowing for the reduced consumption for public lighting, a net increase of 3,462,812 units, being the largest annual increase on record.

Owing to confusion having arisen due to the similarity of the names Avonbank and Avonmouth, it has been decided to alter the name of the Avonbank generating station to "Feeder Road Electricity Works." The L.G.B. refused its sanction to a loan for a 6,000-kw. set, which it was proposed to lay down owing to the increasing demand, and authorised the purchase of a 3,000-kw. set only, the manufacture of which plant was placed on a war basis; the steam turbine, which was in a forward state at the manufacturers, has since been taken over by the Government, and a new one put in hand. Both stations have been running loaded to their full capacity, and it has been necessary to postpone the connection of one large consumer requiring 800 kw. immediately, until the new plant is in commission.

The question of the true depreciation of the assets of the undertaking has been carefully gone into, and the results show that the amount shown in last year's accounts is in excess of the statutory provision for the repayment of debt by £76,338.

Castlebar.—PUBLIC LIGHTING.—The Urban Council accepted the tender of Messrs. Burke & Sons, at £90, for the lighting of the town during the winter by electricity. The local gas company had tendered at £130.

Clacton-on-Sea.—The L.G.B. has sanctioned a loan of £124 to meet excess expenditure on mains, but has informed the U.D.C. that no further loans for mains extension will be allowed until the war is over.

Continental.—RUSSIA.—Data published by the Statistical Bureau of the Congressional Council in regard to the electrical equipment at the coal and anthracite mines in the Donetz basin in 1914, shows that 1,300 motors of 46,200-kw. capacity were in use, by 48 concerns which produced 888,910,000 pounds of mineral, while 33,910 incandescent and 427 arc lamps were also in use by 31 concerns. Twenty-five generating stations had a total capacity of 31,719 kw. of plant and supplied 100,500,000 kw.-hours per annum.

Crompton.—The U.D.C. has been asked to receive a deputation on the question of supplying electrical power in the district. The railway company, which has been urged to effect an improvement in the handling and transit of goods, has agreed to facilitate matters by providing an electrical crane if power can be supplied.

Dawlish. ELECTRIC LIGHT CHARGES.—After considering correspondence from the gas company and the electricity company relative to the difference in their respective charges, the U.D.C. has informed the latter that it is unable to see any reason for an alteration of the charges already agreed to.

Dromore (County Down).—STREET LIGHTING.—The U.D.C. has executed an agreement with the Dromore Electric Lighting Co. for the lighting of the town for three years. It provides for 81 lamps, of not less than an average minimum C.P. of 56 or more than 200, the annual cost to be £134.

Dublin.—The Electricity Committee recommended an increase in the remuneration of the shift engineers and switchboard attendants at Fleet Street and Pigeon House stations. The Council decided to postpone the matter until after the end of the financial year.—*Dublin Express*

Dudley.—The town clerk reported that he had obtained the insertion of a provision in the Shropshire, Worcestershire, and Staffordshire Electric Power Bill, 1916, protecting the rights of the Corporation.

Kirkcaldy.—PLANT CAPACITY.—Mr. Francis, the burgh electrical engineer, has submitted to the T.C. a report on the capacity of the present works and the recent application for a large supply of power by one of the firms in the town—Messrs. Barry, Ostlere & Shepherd. The Fife Power Co. is willing to enter the burgh and supply the power, but is prevented by a clause in the private Act of Parliament. The town clerk, in a statement, observes that the company practically asks that the section referred to be abandoned by the Corporation; this demand, he considers, foreshadows the promotion by the company of a provisional order. He urged that the T.C. should be able to show that it had done all that was reasonable.

Maidstone.—**YEAR'S WORKING.**—The report of Mr. E. E. Hoadley, electrical engineer, on the working of the Corporation electricity works for the year ended March 31st last shows that notwithstanding the various restrictions and despite considerable expansion in power supply, the output sold fell from 2,887,857 units in 1914-15 to 2,758,582 last year. Power units, however, increased from 1,858,582 to 1,970,582, and heating and cooking supply as shown in Table I. The total revenue was £19,771, or rather less than in 1914-15, while the total costs at £13,542 showed a considerable increase, leaving a gross profit of £6,229 as against £7,900 in 1914-15. After deducting capital charges there was a net loss on the year of £256 as against a profit of £1,553 in 1914-15.

Increased coal cost accounted for over £2,000, while other items of expenditure were larger than usual. We note with interest that Mr. Hoadley experimented in mixing coke breeze with the coal, which was of bad quality, and came to the conclusion that after allowing for extra labour in mixing, extra wear and tear on mechanical stokers, additional coal and clinker to be dealt with and lowered steaming capacity of boilers, there was no advantage with the particular type of mechanical stoker and under the conditions obtaining, in the admixture of coke breeze; in this conclusion he states that he is confirmed by other engineers. The supply of coal caused much trouble and for some weeks, says Mr. Hoadley, they did well to get over the peak of the load without dropping the steam pressure by more than 40 lb.

A new turbine set which it was hoped to start up in January was not completed by the end of March; all the pipework and electrical connections in connection with it have been carried out by the department owing to the difficulty in obtaining outside assistance. The maximum load was 1,142 kw. and the load factor 274 per cent.

The Corporation electricity works has been certified as a controlled establishment under the recent Act.

New Zealand.—The Whangarei electrical undertaking, owned by the T.C., is supplied in bulk from the Dominion Portland Cement Co.'s plant at Wairua Falls, 25 miles away, over duplicate aluminium three-phase transmissions carried on a single pole line. The transmission pressure is 22,000 volts, and the service pressure to consumers 230 volts lighting and 400 volts (50 cycles) power. A series street lighting system has been installed with 100 lamps of 600, 250 and 100 C.P. The transformer capacity is 400 K.V.A., and the cost of the Council's installation has been about £13,000.

Plymouth.—**RESTRICTED LIGHTING.**—A Joint Committee of the Watch and Street Lighting Committees of the T.C. is considering what arrangements shall be made as regards street lighting, having regard to the reversion to ordinary time on October 1st, and the danger to pedestrians and other traffic through unlit streets.

Royton.—The D.C. has decided that arrangements be made for the General Purposes Committee to interview the Oldham Electricity Committee to discuss the question of supply of electricity to the Royton district.

Southampton.—**PRICE INCREASE.**—The T.C. has further increased the price of current for lighting, power and heating by 10 per cent. from the September reading of the meters. This makes an advance of 20 per cent. since the war started.

Stretford.—The Electricity Committee, in view of continued shortage of supplies of coal, recommends the Council to authorise the chairman and clerk to take such action, legal or otherwise, as may be necessary to secure its rights under the coal contract.

Swansea.—**PROPOSED PLANT EXTENSION.**—The Electric Lighting Committee has received a report from Mr. Burr, the borough electrical engineer, giving details of the existing plant and suggesting that if it were possible to raise the money, a 3,000-kw. turbine, together with two boilers and all auxiliaries should be installed. He estimated the cost of the complete installation at £30,000, and said that the expenditure of this money would have the effect of still further reducing the cost of production, whilst the scheme would enable the Committee to generate electricity as cheaply as any other generating station working under similar conditions. The report was adopted, and steps are to be taken to see if the necessary capital can be raised.

The Committee has also received a report from Mr. J. W. Burr on tariffs for motive power, in which he said that a reduction in revenue would immediately follow a reduction in price, and he could not recommend it at the moment. The Electric Lighting Committee has decided to hire out electrical apparatus at an annual charge arrived at by taking cost of apparatus plus 5 per cent. per annum and cost of maintenance.

Tasmania.—The Councils of St. Leonards, Longford and Beaconsfield, have decided to ask the Launceston City Council to join them in a deputation to the Premier, with a view to discussing the best means of obtaining a hydro-electric power scheme for Northern Tasmania.

Wakefield.—**ELECTRIC PUMPING.**—The R.D.C. has decided to supply water to Crigglestone, by means of an electrical pumping plant. The cost of the scheme is estimated at £650, which will be spread over four years, and the current will be supplied by the Crigglestone Collieries, Ltd., if terms can be arranged.

Walsall.—The Electricity Committee has decided not to increase the existing charges for electricity. The Committee recommends that a fresh agreement be entered into with the Talbot-Sead Tube Co., Ltd., for the supply of electricity to their

works and for an additional supply for a term of three years, commencing when the E.H.T. supply from the new station is available; also that a supply of energy be given to the Electrical Conduits, Ltd., and Rylands & Sons, Ltd., on terms and conditions approved by the Committee.

The new sub-station at Wolverhampton Street has been connected up with the generating station.

Warrington.—**YEAR'S WORKING.**—In our last issue we gave the financial details of the year's working of the electricity undertaking to March 31st last. Mr. Mathias, the engineer, in his report mentions that 6,630,062 units were generated and 5,129,214 units sold (as compared with 4,274,897 units sold in 1914-15). Power units numbered 4,092,736, the remainder being for traction and lighting. The plant capacity was 3,150 kw., representing a capital outlay per kw. of £26; the maximum load was 2702 kw. The total working cost was '782d. per unit, as compared with '729d. in 1914-15, and despite the coal cost increasing from '291d. to '382d. per unit. An additional water-tube boiler, economiser, and coal-handling plant were being erected to meet the growing demands on the plant.

Wigan.—**DELAYED EXTENSIONS.**—Alderman Grimshaw, speaking at the T.C. meeting, on the 7th inst., said the boilers for the electricity works were not expected to be erected in the specified time. So far as he could judge, they were likely to be held up by the L.G.B. for perhaps two years; and in view of that, he did not know that there was any limit to the time when the scheme recommended by the expert could be properly undertaken. A Sub-Committee had been appointed to enter into negotiations with an outside firm for the purpose of obtaining a supply, and these negotiations were not yet complete.

Wolverhampton.—**YEAR'S WORKING.**—The accounts of the Corporation electricity undertaking for the year ended March 31st show a gross profit of £25,588, as compared with £28,631 in the previous year; the net profit was £1,856, as compared with £7,444, and has been transferred to the reserve fund. The total income shows an increase of £8,228. The number of units sold was 15,280,697, an increase of 2,154,426 over the previous year. During the year, 940 H.P. of additional motors were added, the total H.P. of motors connected being 10,686 H.P. The total cost of production per unit was '651d., coal costing '355d. The maximum load was 6,919 kw. and the connected load about 14,062 kw. The balance of the reserve fund stands at £13,217, the reduction of £4,587 on last year's figure being due to expenditure on account of mains, services, meters, &c., for which borrowing powers could not be obtained.

TRAMWAY and RAILWAY NOTES.

Accrington.—**ACCIDENT.**—On Friday last, a car left the track in the Blackburn Road, and ran into a loop line in Ellison Street, knocking down two children, who were injured.

Audenshaw.—**TRAMWAY PURCHASE.**—The D.C. has decided to make application alone, or jointly with the other authorities interested, for an extension of time for the purchase of the Oldham, Ashton and Hyde Electric Tramways.

Birmingham.—**ACCIDENT.**—On Sunday night, two Corporation cars came into collision on a single track in Great Hampton Row; a great deal of glass was broken and many passengers shaken, but only five were treated at the hospital.

Bradford.—**ELECTRIC VEHICLES.**—The L.G.B. has sanctioned the borrowing of £3,700 for the purchase of three electric tipping wagons for the electricity department.

Continental.—**NORWAY.**—A proposal for the electrification of the Drammen Railway, at a cost of approximately 21,369,500 kr., has been sanctioned by the Railway Committee of the Storting.

Darlington.—Seats are being provided for women conductors, but the work has been delayed owing to the shortage of labour. The Committee is to consider the question of half fares for school children at its next meeting.

Doncaster.—Official consent has been given to the reconstruction of a portion of the Bentley tramways track by the T.C. and the work will be proceeded with as rapidly as possible.

Dover.—The T.C. has been granted by the B. of T. a further extension of time until November, 1916, for carrying out the Dover-St. Margaret's Light Railway Order.

Gateshead-on-Tyne.—**LINKING-UP PROPOSAL.**—The Town Improvement Committee having considered the proposed tramway across the High Level Bridge to Newcastle-on-Tyne, reported against the proposal until the proposed Bill had been considered by the Gateshead Council.

Ilkeston.—**SALE OF UNDERTAKING.**—A special meeting of the T.C. by 14 votes to 3, approved the transfer of the Corporation tramways and electricity undertakings to the Derbyshire and Nottingham Tramways Co., Ltd., for the sum of £28,150.

Keighley.—**TRAMWAY FARES.**—From October 1st the present halfpenny fares during the working week on the Corporation tramways are to be abolished, but there will be penny tickets entitling the passenger to travel any distance in one direction in a similar manner to what has been done at week-ends for some time past. Prepaid tickets, however, entitling the passenger to the privileges hitherto granted by the halfpenny tickets, are to be issued at the prices of five for 3d., 10 for 6d., or 20 for 1s. Arrangements are being made to supply quantities of these tickets to factories for sale at the works.

London.—**L. & N.-W. ELECTRIFICATION.** It was recently announced that the North-Western electrical train service between Broad Street and Kew Bridge and Richmond would commence on Sunday, October 1st. The new trains will comprise first and third class only.

Newcastle-on-Tyne.—During a recent fog at Killingworth Crossing near Benton station, five horses strayed on to the N.-E. railway track, and coming into contact with the live rail, were killed.

Oldham.—**YEAR'S WORKING.** The annual report on the working of the Corporation tramways during the year ended March 31st last shows that the car-mileage, 1,983,607, was less than in any of the last three years, but the passengers carried, 23,477,066, constituted a record. The total receipts were £121,129 and the gross profit £39,538 (as compared with £28,730 in the previous year), while the net surplus was £4,112, which compares with a deficit of £5,218 in 1914-15, when the revenue fell off considerably and working expenses were abnormally large.

Plymouth.—The chairman, in commenting on the report of the Tramways Committee, said they had hoped that through running of the tramways, with a uniform penny fare, might have been effected by now, but owing to difficulty in obtaining materials, this would not be possible before the second week in October.

Rochdale.—**WIND SCREENS, &c.**—The tramway manager having reported on replies received from 71 municipalities owning tramways on the question of adopting wind screens or vestibules on the cars for the protection of motormen, the Tramways Committee has decided to invite a deputation of motormen to meet a Sub-Committee on the matter.

Various points in dispute in the draft lease of the Milnrow tramways are to be referred by the town clerk to the B. of T. for decision, at the request of the Milnrow D.C. It is proposed to purchase a sand spreader for attachment to the tramway watering-car.

Salford.—**INCREASED WAGES.**—The proposed further war bonuses recommended by the Tramways Committee for payment to male tramway workers, were confirmed by the T.C. last week. The effect of the additions is that youths under 18 years will receive 2s. per week instead of 1s.; male employees over 18, who are not householders, will receive 3s. instead of 1s. 6d., and male householders, whose wages do not exceed 37s. 6d. per week, will receive 4s. 6d. per week, instead of 2s. 6d., as at present, and those receiving over 37s. 6d. will receive total wages, including war bonus, of 42s. per week, which is exclusive of the war bonus payments to skilled artisans. Councillor P. Hampson said it appeared to him to be a waste of public money to add to the already generous treatment of those who had gone to the Front.

YEAR'S WORKING.—The annual report of Mr. G. W. Holford, general manager of the Corporation tramways, shows a gross profit on the year's working of £88,502, and a net profit of £18,475; this amount, with £3,526 taken from the depreciation and renewals fund, has been transferred to the relief of rates, being the £22,000 promised. The balance of the renewals fund now stands at £21,266. During the year 56,458,266 passengers were carried, being 2,114,358 more than in the previous year, and the total amount received in fares amounted to £270,350, an increase of £11,524; the miles run were 5,495,295, and the average earnings 11.8d. per car-mile; 41,163,325 penny tickets were sold being 75.362 per cent. of the total number issued, and £13,135 was paid in war allowances. The total route mileage worked is 42, rather more than half representing leased lines.

Stalybridge.—**ACCIDENT.**—A curious tramway accident occurred at Mottram, on Saturday last. In the absence of the driver, a Stalybridge car commenced to run down a hill at Mottram, and the few passengers on had an exciting time; they and the woman conductor jumped off before the car had gained a great speed, but one man was slightly injured. After running nearly a mile, the car crashed into a wall at Bower Fold.

Stockport.—**INCREASED WAGES.**—The Employees and Car-Shed Sub-Committee has recommended the Tramways Committee to grant a gratuity of 5 per cent. on the wages to all employees of the department who have not participated in the gratuity granted by the Committee last November.

U.S.A.—A general strike of labour, involving 800,000 Trade Unionists, is threatened in New York City, in consequence of the failure of the employees of the tramway companies, who are on strike, to hold up local transit facilities. —*Daily Telegraph.*

Walsall.—The South Staffordshire Tramways (Lessee) Co., Ltd., and the Wolverhampton District Electric Tramways, Ltd., have agreed to pay the Corporation, as from July 12th last, an increased rate per car mile in respect of the excess mileage of the Corporation cars on the company's lines.

Whitefield.—**THROUGH CARS.**—The clerk to the D.C. has been in communication with the Salford Corporation Tramways Committee on the subject of through cars between Manchester and Bury, and the Salford tramway manager has replied that his Committee does not consider the time opportune for any arrangement of the kind suggested, but will be prepared to reconsider the matter at the end of the war. He adds that the present service, with the restricted number of drivers, can only be maintained under very serious difficulties. The D.C. is apparently not satisfied with the promise that the matter will be reconsidered after the war, and has decided to reply to Salford that the matter is capable of arrangement between the Salford and Bury Corporations, and that the D.C. does not consider that any increase of drivers would be necessary.

Wigan.—**INCREASED WAGES.**—The local branch of the Tramway Workers' Association has decided to accept the advance of 3d. per hour, provided that the increase be a distinct advance apart from the existing war bonus. The Special Committee on Wages has resolved that the increases of wages granted to the various classes of workmen recently be considered as an additional war bonus until the end of the war, and that the additional war bonus shall then become a permanent advance of wages.

TELEGRAPH and TELEPHONE NOTES.

New Fire Alarm System in New York.—Mr. Robert Adamson, fire commissioner of New York, has awarded six contracts for the construction of as many sections of this system, and active work on these is in progress. One contract has been completed. The system will cost \$3,000,000. —*T. and T. Age.*

Brazil and Bolivia.—Radio-telegraphic communication has been experimentally established between Belem, Brazil, and Riberlata, Bolivia. —*T. and T. Age.*

Japan.—The third and final series of tests for trans-oceanic radio service between Honolulu and Japan has just been completed. Telegraphic reports indicate that these tests are by far the most successful of any so far made. Communication has been maintained in both directions, night and day. —*T. and T. Age.*

Wireless Station Dismantled.—The Allies have removed the appliances of the wireless station at Syra (Greece), and deposited them with the French Consulate there.

Wireless Telegraphy on Aeroplanes.—What is claimed to be a record in wireless telegraphy from aeroplanes was recently established by Captain Culver, of the U.S. Army Aviation Corps. During a flight from San Diego to Santa Monica, 114 miles away, he is stated to have kept in touch with his station by sending wireless messages every three minutes. The power for the transmission set is derived from a generator placed on the lower wing section of the aeroplane, and driven by a two-bladed propeller. Aerial wires are suspended from the "fuselage" of the machine, with an insulated counterpoise hung from the wings to the tail of the aeroplane. The complete transmission set is stated to weigh less than 40 lb.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—**SYDNEY.**—September 20th. N.S.W. Government Railways. One 50-ton electrically-operated overhead travelling crane for Zara Street power house, Newcastle.—October 11th. One motor-driven air compressor for Zara Street power house. Electrical Engineer, 61, Hunter Street.

January 22nd, 1917. Electrical plant for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.—*Australian Mining Standard.*

ADELAIDE.—September 27th. Deputy P.M.G. Telephones, telephone material, instruments and parts. Schedule Nos. 429 to 437.*

PERTH.—October 4th. Deputy P.M.G. Telegraph and telephone measuring instruments and parts. Schedule 501 W.A.*

MELBOURNE.—September 29th. City Council. Insulated and H.D. copper cables. See "Official Notices" September 8th.

October 17th. For the Deputy P.M.G. (1) Sleeves and tapes (Sched. No. 1,355), and (2) 3,100 stay-roads, with low tighteners (Sched. No. 1,359).

October 18th. Victorian Government Railways. Electric time releasing mechanisms for automatic signalling (Cont. No. 30,343).*

November 1st. 50,000 yellow flame arc carbons.*

December 11th. City Council. Supply and erection of coal transporter plant. See "Official Notices" to-day.

SOUTH AUSTRALIA.—November 15th. P.M.G.'s Department. Automatic switchboards and all associated apparatus, for telephone exchanges, Brighton and Glenelg.

Burnley.—September 19th. The B. of G. invites tenders for electrical goods. Tender forms from J. S. Horn, Clerk.

Edmonton.—September 20th. Electric lamps for six months. Mr. F. Shelton, Clerk, B. of G., Lower Tottenham.

Keighley.—September 21st. Corporation Electricity Department. Best coal and small slack coal, about 12,000 tons. Prices are on a basis for a six-monthly and twelve-monthly period. Mr. H. Webber, Borough Electrical Engineer.

Liverpool.—September 18th. Electrical supplies for three months. For Toxteth Park R. of G. Mr. R. A. James, Clerk, 15, High Park Street.

London.—Supply of electric light fittings for Australia House, Kingsway, W.C. Particulars from Mr. H. H. Turner, 48, Broadway, Westminster, S.W.

CITY OF WESTMINSTER UNION. September 20th. B. of G. Six months' supply of electric lamps, fittings &c. Mr. W. J. Lickley, Clerk, Gardens Offices, Princes Row, Buckingham Palace Road, S.W.

KENSINGTON.—September 20th. B. of G. Six months' supply of electric fittings and electric lamps. Mr. W. R. Stephens, Clerk Guardians' Offices, Martoes Road.

Manchester.—September 22nd. Electricity Committee. Fuse boxes for 12 months. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

New Zealand.—WELLINGTON. October 11th. Public Service Stores Tender Board. 1,000 magneto extension bells, 1,000 ohms.*

Warrington.—September 20th. Electrical goods (not of German or Austrian origin) for the B. of G. for six months. Mr. A. Bottomley, Clerk, Bewsey Chambers.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The Hawthorn Tramway Trust, Victoria, has accepted the following tenders:—

15 car-bodies.—Duncan & Fraser.

Cross-overs.—Horrocks, Roxburgh Pty., Ltd.

Motor equipment.—Asst. General Electric Co. and British Westinghouse Electric & Mfg. Co.

N.S.W. Public Works Department:—

Pumping machinery for Wagga Wagga water supply, with special electric type engine, £6,997.—A. Leplastrier & Co. Tenders.

Blackpool.—The borough electrical engineer has reported to the Electricity Committee that the B.T.H. Co. have withdrawn their tender for a new 1,500-KW. turbo-alternator.

Wakefield.—Council Electricity Works:—

Sturtevant Co.—Steel chimney, fan, motor, &c., £570.

E. Green & Son, Ltd.—Economiser and accessories, £2,675.

FORTHCOMING EVENTS.

Institute of Metals.—Wednesday, September 20th. At 4 p.m. At Burlington House, Piccadilly, W. Annual autumn meeting.

Iron and Steel Institute.—Thursday and Friday, September 21st and 22nd. At 10.30 a.m. At the Institution of Civil Engineers, Great George Street, S.W. Annual meeting.

NOTES.

Foreign Trade.—THE AUGUST FIGURES.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	August, 1916.	Inc. or dec.	Eight months, 1916. Inc. or dec.
IMPORTS:—			
Electrical goods, &c.	£109,455	+ £4,152	+ £399,455
Machinery ...	618,435	- 175,468	- 366,789
EXPORTS:—			
Electrical goods ...	409,509	+ 150,379	+ 789,429
Machinery ...	1,933,710	+ 449,776	+ 100,863

A High-Speed Squirrel-Cage Winding.—Referring to the high-speed squirrel-cage winding described on page 263 of our issue of September 8th, in which copper strips are split and expanded into loops to form rotor conductors, Mr. W. C. Kennett, of Eltham, writes to point out that although this method may be new to Americans, it is quite an old idea in this country, having been used many years ago by Messrs. Johnson & Phillips, Ltd., and no doubt by others.

Scientific Research.—Mr. Arthur Henderson has been appointed a member of the Committee of the Privy Council for the purpose of the organisation and development of scientific and industrial research.

Electro-deposition of Zinc.—A correspondent asks for information as to the best method of depositing a coating of pure zinc on metal sheets, the chemicals used for the electrolyte, and the voltage and current density required.

Inquiry.—A correspondent asks for information regarding an electric burner for removing old paint and varnish from railway rolling stock.

C.M.A. Standard Specification.—A slight alteration has been made in the specification of C.M.A. flexible cords. These are now made to comply with the standards for vulcanised rubber flexibles laid down in the latest edition of the I.E.E. Wiring Rules, revised March, 1916. The only alteration is that the insulation resistance is 1.250 megohms per mile, instead of 600.

Fatalities.—An inquiry was held, on the 9th inst., by Deputy Coroner Shepherd, at Hebburn-on-Tyne, into the circumstances attending the death of George Dickson, who was killed by a shock from an electric lamp standard. Owing to pressure on our space, we are obliged to defer the report to our next issue.

According to a Glasgow paper, Hugh McKinlay (28), Glasgow, was instantaneously killed in a Cardonald factory, on September 7th. He accidentally put one of his feet on a rail charged with electricity, and was unable to release himself until the current was switched off. He then fell 30 ft., and alighted on the top of some machinery. He died from fracture of the skull.

The Trade Union Congress.—The Congress held last week did not fail to present, as we anticipated, some remarkable features. Of these, one of the most striking was the adoption, by a majority of 7 to 2, of a resolution advocating the restriction or prevention of the importation of cheap manufactured goods which have been produced at lower rates of wages, or under worse labour conditions, than those prevailing in this country, which has been generally regarded as a declaration of the abandonment of the traditional Trade Union policy of free imports, and certainly should strengthen the hands of the Government in devising measures to shut out enemy goods from British markets. Other clauses of this resolution urged the necessity of educational reform, improvement in working conditions and in housing accommodation, and the abolition of any monopoly of natural resources which provides income without service.

An important item in the proceedings was a resolution demanding the restoration of the *status quo ante bellum* when peace is declared, in accordance with the firm promises of the Government. That this bond must be redeemed without reserve will be admitted by all parties, but we very much doubt whether the workers, on reflection, will desire it, for it cuts both ways, and more to the disadvantage of the workers than of any other party in the State. Restriction of output inevitably implies low wages—otherwise successful competition after the war will be impossible; the workers have experienced the benefits of high wages, which have added to their comfort and raised the standard of living even in a period of exceptionally high prices—is it conceivable that they will wish to return to the former conditions? By maintaining a high output, they can retain their high wages, and we are confident that, when confronted with the alternatives, they will have no hesitation in making the choice. But a concurrent reorganisation of industry is essential, and we trust that some means will be found whereby masters and men can come together and amicably resolve the numerous problems with which they are confronted.

Overhead Lines and the Board of Trade.—We are informed by the Board of Trade that a considerable number of applications have been made for the consent of the Department to the erection of temporary overhead lines for the transmission of electrical energy. Attention is drawn to the accompanying memorandum relating to the particulars required by the Department in connection with such applications.

"Every application for the consent of the Board of Trade to the placing of electric lines above ground should be accompanied by the following particulars:—

"1. Where the undertakers are a company, or a local authority supplying outside their own area, evidence of consent of the local authority for the district.

"2. The local authorities are:—

"(a) In England and Ireland:—Borough Councils, Urban District Councils, Rural District Councils.

"(b) In Scotland:—Police Commissioners, Gas Commissioners, Town Councils, County Councils.

"3. A statement showing commercial or other considerations why underground cables should not be used.

"4. A brief description of the proposed system, whether by continuous or by alternating current; the working voltage; the kind of wire, whether copper or aluminium; whether solid or stranded; the total sectional area; the tensile strength and elongation; average and maximum length of span; minimum height of wires from the ground; name or description of automatic protective device, if any.

"5. A statement whether the supply is to form (1) an extension of an existing system of underground cables, or (2) of an existing traction system, or (3) an independent system.

"6. An Ordnance map on a scale of 6 in. to the mile, showing the proposed route of the overhead lines and any existing overhead lines. The sheets of these maps must be fastened together.

"7. In the case of high and extra high pressure, plans of construction of poles, &c., on a scale of about 1 in. to the ft., or a reference to previously deposited plans where these are identical with the proposed work.

"NOTES.—Codes of Regulations have been made (1) for overhead lines for low-pressure and medium-pressure continuous-current supply, and for low-pressure alternating current supply, and (2) for pressure exceeding low or medium pressure continuous-current and low-pressure alternating current. Regulations will be made for each case separately, following these codes unless special alterations are sanctioned.

"Attention is called to the necessity for obtaining the approval by the Postmaster-General of plans and works under Sec. 14 of the Schedule to the Electric Lighting (Clauses) Act, 1899."

The A.S.E. Secretaryship.—As a result of the ballot of members of the Amalgamated Society of Engineers, Mr. Robert Young has been appointed secretary. He polled 4,196 votes more than Mr. Tom Mann. Mr. W. Gennie is to be assistant general secretary.

Appointments Vacant.—Assistant master in electrical engineering for the Regent Street, Polytechnic, working in-prior, for temporary electrical installations in the Northern Command; assistant electrical engineer (35s.) for the Ascot Electricity Works; shift engineer (45s.) fitter-driver (40s.) and substation attendants (30s. to 35s.) for the Rhondda Tramway Electricity Works. See our advertisement pages today.

Hard Paste Porcelain.—At the British Association meetings held at Newcastle-upon-Tyne last week, an extremely interesting exhibit was shown in the chemistry laboratory comprising a display, in white hard paste porcelain, of various pieces used in the electrical trade.

These articles were manufactured by Messrs. Taylor, Tunnickliff and Co., of Eastwood, Hanley, in conjunction with Mr. C. H. Thompson, F.C.S., of Amblecote, who have been generally congratulated upon successfully carrying out an important achievement in a department that has always been considered a Continental monopoly. The actual samples exhibited will shortly be available for inspection by those interested, at Messrs. Taylor, Tunnickliff's London office at 23, Holborn Viaduct, and the company's London director, Mr. M. J. Dark, will be pleased to give every facility for such inspection. This exhibition is the more interesting in view of the fact that, as mentioned on p. 291 of this issue, the Government have allotted a considerable sum of money to the governing body of the Pottery and Mining Schools, Stoke-on-Trent, for the establishment of research work in this particular direction.

Engineering Trade Policy.—We are informed that in view of the national prominence of the engineering industry, the Lord Mayor is convening a public meeting at the Mansion House, at 3 p.m. on Wednesday next, September 20th, to discuss future trade policy, with special reference to the economic utilisation of the engineering works of the nation, which have been so largely expanded in capacity and equipment during the past two years. The organisation of the meeting is being undertaken by the British Electrical and Allied Manufacturers' Association, with the support of the British Engineers' Association, the British Empire Producers' Organisation, and the Engineering and Electrical Sections of the London Chamber of Commerce. Applications for tickets of admission should be sent to Mr. T. C. Elder, Organising Secretary for the Meeting, B.E.A.M.A. Offices, 36, Kingsway, London, W.C., or to the Secretaries of any of the above organisations.

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place, S.W.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, September 18th.—Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill. Platoon No. 10. Signalling Class. Recruits' Drill, 6.25—8.25.

Tuesday, September 19th.—Range Practice.

Wednesday, September 20th.—Lecture, 7.15. Lecture, W. Eyles Esq. (late R.E.), 7.15. "Demolitions." Platoon Drill, Platoon No. 1, Range Practice.

Thursday, September 21st.—Instruction Class, 5.45. Platoon Drill, Platoon No. 5. Range Practice.

Friday, September 22nd.—Technical for Platoon No. 10. Rosemary Street. Squad and Platoon Drill No. 9. Signalling Class. Recruits' Drill, 6.25—8.25.

Saturday, September 23rd.—Instruction Class, 2.30. Company Commander Fleming.

Sunday, September 24th.—Entrenching.—Parade Victoria Station (S.E. & C. Railway). Booking-office, 8.45 a.m.

MACLEOD YEARSLEY, *Adjutant*

3RD BATT. (OLD BOYS') COUNTY OF LONDON VOLUNTEER REGIMENT.—Battalion Orders by Major R. J. C. Eastwood (Commandant). Thursday, September 14th, 1916:—

Week-end Parade.—*Saturday.*—Parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 8.40 a.m., for Entrenching duties. Those who cannot take the early train will parade at 1.20 p.m.

Sunday.—Parade at Liverpool Street Station, 9.30 a.m., for Entrenching duties.

Route March.—It is intended to hold a Route March on Saturday, 23rd inst. G. H. F. DUNCAN, *Acting Adjutant*.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway engineers, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station Officials.—The staff of the Heywood Corporation electricity works have presented Mr. R. B. LEACH, chief engineer and manager, with a smoking outfit and testimonial on the occasion of his leaving to take up his duties as borough electrical engineer at Loughborough.

The South Shields T.C. has increased the salary of the borough electrical engineer (Mr. H. S. ELLIS) from £450 to £500 per annum. Mr. Ellis applied for an advance of £100.

General.—Upon the occasion of his marriage, Mr. HAROLD WRIGHT was last week presented by the office staff of the British Insulated & Helsby Cables, Ltd., with a set of cutlery and spoons.

Lieutenant GEORGE EDWARD PRICE, Royal Engineers, who was married at Bradford, on Friday, to Miss Dorothy Mary Beresford Mitchell, daughter of Mr. and Mrs. J. G. Mitchell,

of Nab Wood, is by profession an electrical and mining engineer. He came home on short leave from the Front.

At Stoke-on-Trent Parish Church, on September 5th, the marriage took place of Mr. FRANK HATCH, assistant general manager of the Potteries Electric Traction Co., and Miss Clara Booth, of Stoke.

Mr. E. J. NALLY, vice-president and general manager of the Marconi Wireless Telegraph Co. of America, sailed for England on September 1st on business.

Mr. H. W. LEONARD, who for the past six years has held an important position in the G.E.C. publicity department, has recently joined up for service with the London Electrical Engineers.

Roll of Honour.—Rifleman JOSEPH CORFIELD, of the Rifle Brigade, whose death in action is reported, had twice previously been wounded. He was formerly employed in the electrical department of Messrs. A. Knowles & Sons, colliery proprietors, Pendleton, and was 19 years of age.

Private W. CLEMS, of the South Lancs. Regiment, who is in hospital at Birmingham, suffering from wounds and shell shock, was employed before the war in the electricity department at the works of Messrs. Joseph Crosfield & Sons, Ltd., soap manufacturers, Warrington.

Lance-Corporal LEONARD P. BEECH, of the King's (Liverpool) Regiment, formerly on the office staff of the British Insulated & Helsby Cables, Ltd., has been wounded, as has also Private ARTHUR HULME, of the Cheshire Regiment, employed by the same company.

Sapper C. E. WHITTLE, Royal Engineers, is in hospital in Aberdeen suffering from wounds. Prior to enlisting he worked in the Bolton Corporation electrical fittings department.

Trooper B. BROWNING, Royal East Kent Mounted Rifles, who was on the Faversham Corporation electricity staff, is in hospital at Addington Park, Croydon.

Sergeant VICTOR JOHNSON, Queen's Royal West Surrey Regiment, who enlisted whilst a wireman with the Godalming Electricity Co., has gained the Military Medal for gallant conduct in rescuing an officer from between the British and German lines.

Private CHARLES LITTLE, King's (Liverpool) Regiment, who belongs to Douglas (I.O.M.), and left a position as electrical engineer in America to join the Forces, is reported from France to be missing.

Lance-Corporal E. G. PRICE, Sutton, who has fallen in action in France, was, on his enlistment, engaged with the South Metropolitan Electric Tramways & Lighting Co.

The Military Medal has been granted to Corporal J. W. RICHARDSON, West Yorkshire Regiment, for gallant service in the field. He was engaged in the offices of the York municipal electricity undertaking.

Private THOMAS BENNETT, Loyal North Lancashire Regiment, reported from France to be missing since July 23rd last, enlisted whilst with Messrs. Dick, Kerr & Co., Ltd., of Preston.

Private M. CORRIGAN, of the Manchester Regiment, formerly employed at the British Westinghouse Works, Trafford Park, is missing.

Private S. ROY HOLMES, West Yorkshire Regiment, an apprentice with Mr. Reginald Falshaw, electrical engineer, of Harrogate, who enlisted at the outbreak of war, has died of wounds received in action. He was 22 years of age.

We regret to note that THOMAS FRANCIS PHILLIPS, Mortar Battery, younger son of Mr. and Mrs. C. J. Phillips, of Ashcroft, Orpington, was killed in action on September 2nd. We tender to Mr. C. J. Phillips, who was the provincial superintendent of the Southern Provinces of the late National Telephone Co., our deep sympathy in his bereavement.

Private ERNEST JOB FARNSWORTH, Suffolk Regiment, who has died of wounds received in action in France, enlisted whilst with Messrs. Siemens, Stafford.

Private ERNEST WILLIAMS, North Staffs. Regiment, who enlisted at the outbreak of war whilst with Messrs. Siemens, Stafford, and who has been missing since October 13th, 1915, is now presumed to have fallen in action on that date.

Acting Quartermaster-Sergeant Geo. KENDALL, Royal Field Artillery, wounded in action in France, was formerly manager of the Reading Corporation tramways parcels office.

Private R. C. WHEWELL, of the Royal Scots, has been awarded the D.C.M. for gallant conduct in France. He was employed at the L. & Y. Railway Co.'s electrical power station.

Acting-Corporal W. SANDERS, Rifle Brigade, officially reported killed, was employed by the Lancashire Dynamo and Motor Co.

Private FRED LOONEY, King's (Liverpool) Regiment, killed in action, was employed at the British Westinghouse Co.'s works.

Lance-Corporal FRANK CRESSALL, Royal Warwickshire Regiment, was killed in action on the 4th inst., aged 24. Mr. Cressall was in the employment of Messrs. Mavor & Coulson, Ltd., at the time of the outbreak of war, and it was arranged about that time that he should join the Cressall Manufacturing Co., of Birmingham, as junior partner, but instead of so doing he joined the Colours soon after leaving Messrs. Mavor & Coulson, Ltd. Prior to being with that firm he had been with the Electrical Apparatus Co., Ltd., London, the Electric & Ordnance Accessories Co., Ltd., Aston, and the General Electric Co., Ltd., Witton, where he commenced his training.

Captain JAMES HENDRY, of the Royal Scots, an electrical engineer who served at Glasgow and Pittsburg, and was later a consulting engineer at Rochdale, has died of wounds received in action.

Bombardier G. A. BAILEY, Royal Field Artillery, formerly an electrician on the engineer's staff at the Liverpool Post Office, has been killed, aged 35 years.

Private CECIL DODD, of the Manchester Regiment, killed in action, was a former employee of the British Westinghouse Co., Trafford Park; and Private HARRY CROSSLEY, of the Manchester Regiment, another employee of the same firm, has been wounded while fetching stretcher-bearers to assist a wounded comrade.

We regret to learn that the younger son of Mr. James McMillan (James McMillan & Co., formerly the Ericsson Bell Telephone Co.) was killed in action in France on September 2nd. He joined the London Rifle Brigade, but was transferred to the London Regiment. He was 19 years of age, and had only been in France three weeks. He was educated at Highfield School and Hanover.

Mr. R. M. BISHOP, formerly associated with the accounts department staff of Siemens Bros. Dynamo Works, Ltd., at Upper Thames Street, E.C., has been promoted while on active service to the rank of sergeant. He was also awarded the Military Service Medal for conspicuous bravery at Pozieres.

Private J. W. COTTON, of the King's (Liverpool) Regiment, whose death from wounds is announced, was employed by Messrs. Ferranti, Ltd.

Private WALTER OFFIELD, of the Scottish Borderers, previously reported missing, and now officially reported killed, was employed prior to his enlistment at the British Westinghouse Works, Trafford Park. He was 19. Another employee of the British Westinghouse, Lance-Corporal E. W. ICKE, aged 22, is now reported killed after having been posted as missing. Private J. WYLLIE, aged 26, another former employee of the firm, has been killed while acting as stretcher-bearer. He had served at Gallipoli and in France.

Private ERNEST LAND, of the Cheshire Regiment, now reported killed after having been previously reported missing, was 27 years of age, and was formerly employed at the British Westinghouse Works, Trafford Park. Sapper P. HARRIS, of the Royal Engineers, also formerly of the Westinghouse Works, has been killed, aged 22 years.

Private L. STREELE, of Crewe, formerly employed in the electric shop at Crewe Railway Works, has been wounded.

Private DOMENAS GIBSON, of the Royal Welsh Fusiliers, who has been wounded, and is now in hospital in France, was employed prior to the war in the electricity department at Blackpool Tower.

Obituary.—SIR JAMES SIVEWRIGHT, C.M.G.—We regret to learn that Sir James Sivewright passed away on September 10th, at the age of 68 years. He was born at Fochabers, Scotland, and was educated in that country, taking a degree of M.A. at the Aberdeen University. Originally it was intended that he should enter the Government Telegraph Service in India, and, having passed the examination for this purpose, he underwent practical training for the Indian service under the late Sir W. H. Preece, at the Hartley Institution, Southampton. At that time Sir W. H. Preece (then Mr. Preece) was telegraph divisional engineer of the southern district of England, with headquarters at Southampton. At the organization which followed on the transfer of the telegraph systems of the United Kingdom to the State (under Post Office control), Mr. Sivewright was offered by Mr. Preece the position of engineer-superintendent of that portion of the southern division which had its chief office at Southampton (other superintendents being located at Exeter and Bristol). This position of superintendent was accepted, and was held by Mr. Sivewright for a number of years, until, at the request of the South African Government, an expert was asked for the purpose of reporting upon the position of the whole telegraph system in South Africa; on the recommendation of Mr. Preece, Mr. Sivewright was nominated for this work. As a result of the visit to South Africa, Mr. Sivewright became chief of telegraphs in that country, and under his administration great improvements were made in the service; for his services in this connection Mr. Sivewright was given the honour of C.M.G. Being brought into close contact with the various South African governmental and industrial authorities, Mr. Sivewright's abilities resulted in his becoming a sort of a member of the Government Cabinet, whilst his commercial abilities enabled him to make a considerable fortune. During the Boer War he offered his large estate for the purposes of a home for the British wounded. On the conclusion of the war he returned to England, and settled down in his native Scotland, on an estate which he had acquired. Sir James will perhaps be best known as the joint author with Sir W. H. Preece of the well-known book on "Telegraphy," published by Longmans, a book which has acquired a name as a standard work, and which has gone through very numerous editions. He was secretary of the Society of Telegraph Engineers (now the Institution of Electrical Engineers) for just over a year (1876-77). Sir James, who had been ill for some time, passed away at a nursing home in Shropshire.

MR. SAMUEL CHARLES SPARKS.—Mr. S. C. Sparks, who has died at Leeds, was formerly the telegraph superintendent in the city. He was 73 years of age.

CITY NOTES.

The Metropolitan Electric Supply Co., Ltd. An extraordinary general meeting of the Metropolitan Electric Supply Co., Ltd., will be held on Thursday, September 28th, at 2.30 p.m., at Salisbury House, to consider the report of the

committee appointed at the ordinary general meeting held on March 22nd, and, if approved, to pass the following resolutions:

1. That the report dated August 16th, 1916, of the committee appointed by the general meeting held on March 22nd last, and issued to the shareholders with the notice convening this meeting be, and the same is, hereby approved and adopted, and that the arrangements thereby recommended be carried into effect.

2. That Mr. Andrew Wilson Tait, Mr. George Balfour, and Mr. George Verity who are recommended by the committee and by the board for election be, and they are, hereby elected directors of the company.

3. That the committee be directed to place at the disposal of the board the reports of the experts employed by them, together with all such information as the board may consider to be of service to the company.

At the conclusion of the business of the extraordinary meeting the consideration of the business left unfinished at the ordinary general meeting held on March 22nd will be resumed, and Mr. Geoffrey Blackwell and the Rt. Hon. F. Leverton Harris, M.P., two of the directors retiring by rotation, will be proposed for re-election, Mr. G. A. Moncrieff, the third director retiring by rotation, having resigned his seat at the board.

The following is the report of the shareholders' committee referred to above:—

We have proceeded upon the reference made at the general meeting of the company held on March 22nd, and have examined into the affairs of the company and the past and future conduct of the business.

We have held upwards of 30 meetings and have interviewed all the present directors, except Mr. Moncrieff, also the three directors who have retired, and Mr. Highfield and the company's other chief officials.

We have also had placed before us numerous reports and minutes, and in particular the reports recently prepared at the instance of the board by Sir John Snell, the well-known consulting electrical engineer, and by Messrs. Jackson, Pixley and Co., chartered accountants.

We instructed Mr. Charles P. Sparks, president of the Institution of Electrical Engineers, and Mr. David H. Allen, of Messrs. Harris, Allen & Co., chartered accountants, to assist us, and they have acted as our assessors and have made their written reports to us. We are much indebted to them and also to Mr. Furnival Jones, who has acted as our secretary, for the valuable assistance they have rendered us throughout this inquiry.

Having considered our inquiry, and having carefully considered the evidence, it seemed to us desirable that if possible some arrangement with the present board should be come to, so as to avoid the necessity of publishing a report dealing with various matters intimately connected with the company's business and affairs, which if made public might seriously interfere with the trading and future prosperity of the company.

With this end in view we approached the directors, and are pleased to report that an arrangement has been arrived at, which we believe will be satisfactory to all sections of shareholders and ensure harmony on the board.

Mr. Harrison Cripps has placed his resignation of the chairmanship in the hands of the board. Mr. Andrew Wilson Tait, a member of the firm of Messrs. George A. Touche & Co., and Mr. George Balfour, of Messrs. Balfour, Beatty & Co., Ltd., and Mr. George Verity, chairman of Veritys, Ltd., whom we have suggested as suitable persons (the first-named as chairman) will be added to the board, the number of which is for the present, at all events, to be limited to seven. The board as reconstituted will be as follows:—Mr. Andrew Wilson Tait (chairman), Mr. George Balfour, Mr. Geoffrey Blackwell, Mr. W. Harrison Cripps, Rt. Hon. F. Leverton Harris, M.P., Mr. J. Carr Saunders, and Mr. George Verity.

In view of this arrangement we feel that no useful purpose can be served by referring to the matters of controversy raised at the last meeting of the shareholders. At the same time, we feel it right to express regret that personal imputations should have been made on that occasion which in our opinion were not justified.

We also wish to record our opinion, that the services of Mr. Highfield, as engineer, have been most valuable to the company and should be retained.

We would further add that in our opinion the board should direct their special attention to the energetic development of business in the western area.

Under all the circumstances we confidently recommend the shareholders to accept the arrangement indicated above, and if desired we shall be prepared to place before the new board such information as we have acquired, including the reports which have been put before us, and to give to the company any other assistance in our power.

The report is signed by the members of the shareholders'

committee, namely, Messrs. Roger Gregory (chairman), R. Melville Beachcroft, and W. S. Poole.

The report of the directors for the year ended December 31st, 1915, states that the issued share capital amounted to £3,000,000 and the debenture capital to £1,400,000, a further £75,000 of the 5½ per cent. second mortgage debentures having been purchased during the year 1915. The year's business has resulted in a profit of £729,662, which, with the £106,447 at the credit of profit and loss account as at December 31st, 1914, remaining after payment of the dividends on January 6th and June 21st, 1915, and an adjustment of income-tax, makes a gross total of £845,649. After providing for interest on debentures for the year, 1915, amounting to £232,557, and for depreciation, income-tax, excess profits duty, &c., amounting to £274,025, the balance remaining is £339,068. A dividend was declared last December of 6 per cent. per annum, less income-tax, for the ten months ended February 28th, 1915, on the preference shares, and a further dividend on the preference shares also of 6 per cent., less income-tax, for the ten months ended December 31st, 1915, was declared in May, 1916. These dividends were paid in January and June, 1916, respectively, and absorbed £177,499, leaving £161,568 to be carried forward to the current year's accounts. Since the last report, the second large turbo-generator at the Brakpan power station has been brought into commission, and the whole of the plant for all the power stations of the combined undertakings is now installed. Sir Henry Birchenough, K.C.M.G., and Sir Charles Metcalfe, Bart., retire, and, being eligible, submit themselves for re-election. Since the last meeting Mr. Luebeck has resigned his seat on the board. General meeting: September 22nd.

Manaos Tramways and Light Co.

The report for the year ended April 30th states that the adverse influences which caused a decrease in the earnings during the preceding year, have still been operative, although to a somewhat lesser extent, and indications of better trading conditions in the Amazon valley are not lacking. Brazilian exchange declined slightly in the course of the year, but is showing signs of greater steadiness during the last few months. This depreciation of currency has resulted in a loss of £13,093 on remittances from Manaos during the year. The gross earnings were £110,524, as compared with £110,420, and operating expenses £76,172, against £82,240; as a result the net operating revenue carried to profit and loss account increased from £26,180 to £34,352. After providing for debenture interest, sinking fund, interest on loan, London office expenses, sundry charges and the loss in exchange already referred to, £1,661 is carried to the balance sheet. The indebtedness of the State Government has been slightly reduced, and every possible effort is being made with a view to avoiding a further accumulation of unpaid bills for public lighting. Meeting: 15th inst.—Financial Times.

Canadian General Electric Co.—The directors have declared a quarterly dividend of 1½ per cent. for the three months to September 30th, being at the rate of 7 per cent. per annum on the common stock.

Manila Electric Railroad & Lighting Corporation.—The directors have declared a dividend of 1½ per cent. for the quarter to September 30th on the common capital stock.

Globe Telegraph & Trust Co., Ltd.—The directors have declared a quarterly interim dividend of 3s. per share on the preferred shares, less income-tax, and 2s. per share on the ordinary shares, income-tax having already been deducted.

STOCKS AND SHARES.

TUESDAY EVENING.

Consols rose to 60½, producing a still more cheerful effect upon investment markets as a whole. The full extent of the rise was not held, but the price of the Funds kept steadily over 60. Except for Home Railway stocks, the demand is noticeably urgent for good securities of all kinds. Why Home Railway stocks should be dull it is difficult to say, except from the aspect of the labour world. There is no doubt but that apprehensions of industrial trouble after the war are checking purchases in this market. Meanwhile, in spite of hints of similar difficulties in other trades, shares in domestic industrial companies are increasing in value every day. The iron, coal, and steel group stands out with prominent strength.

The Mexican situation is declared to be better, in consequence of the reported withdrawal of 40,000 United States troops from the Mexican frontier and the further advances of General Carranza to President Wilson in the interests of peace. Nevertheless, definite news is so difficult to obtain that prices of Mexican issues have scarcely moved. Dealers in the various markets report that holders will not sell, but at the same time, there are only a few buyers. Therefore prices keep firm, and Mexico Tramway bonds of both classes have risen a point. The British Columbia group is excep-

tionally good, the preferred and deferred drawing together at 54½, the rises being 1½ and 3½ respectively. The preference is up at 72; and although the debentures have not changed quotably, they are extremely difficult to get hold of.

Anglo-Argentine Tramways remain a weak spot. Besides the recent commentaries on the perplexities that are troubling the Argentine Republic as a whole, the Railway and Tramways Companies are known to be handicapped by the high price of coal and by the difficulty of obtaining supplies. The Anglo-Argentine Tramways deferred the last dividend on its second preference shares, and there is just the fear lest the first preference may also have to go without their dividend in respect of the current six months.

The troubles of the Argentine Republic are only temporary, of course; and the purchases of various Argentine stocks which the Americans were making some few months ago point to the faith that United States investors have in the country. Evidently there is a difficult furrow to be got through before prosperity re-emerges, and some talk as if only the end of the war, bringing with it a release of shipping facilities, is likely to mend matters permanently in the country.

Brazilian Tractions are weak at 60½. Digestion of the report has not brought in buyers; and during the past week or so the milreis has shown signs of going back. Heaviness spreads over most stocks and shares connected with Brazil, the Railway shares going back with the rest. At their present price, Brazil Tractions show a fall of ½ on the week.

Canadian General Electric dipped to 120, but recovered to 123. Pennsylvania Waters are a good spot at 82, this being a rise of 2 points this week. Consolidated Electric Power of Baltimore was quoted ex dividend yesterday (Monday), the common and preferred being now 115 and 118 respectively. The company's 5 per cent. debenture stock has not yet appeared in any of the Treasury lists as being required by the Government for deposit under Scheme "B." The mild gamble in Cordoba Light, Power & Traction ordinary has given way to quietude, and the price of the shares is about 4s. 9d., the 5 per cent. debenture being quoted 75-80, but not having changed hands since February last.

The list of domestic electricity shares is very firm. City preference are ½ up at 10½. St. James's rose to 6½. Charing Cross ordinary and preference have both arrived at 3 9/16, showing a loss of 1/16 in the former case and a gain of the same amount in the latter. There is a fair demand for electricity supply shares, and, as we have pointed out before, the buyers are disregarding the war period. South Metropolitan ordinary are steady at 19s. A little business in Urban Electric resulted in the preference easing off to 2½. The ordinary changed hands a day or two ago at 4s., and the last price marked in the debenture stock is 73.

The report of the Shareholders' Committee of the Metropolitan Electric Supply Co. has now been published to the shareholders. In brief, the report suggests a slight re-arrangement of the board, and sets out the names of seven gentlemen recommended as suitable. The committee breathe conciliation and peace. They deprecate publication of any report dealing with matters intimately connected with the company's business and affairs which, if made public, might seriously interfere with its future prosperity; and they believe that the arrangement with the directors will be satisfactory to all sections of shareholders, and will ensure harmony on the board. An extraordinary general meeting is therefore convened to take place on Thursday fortnight, September 28th, and there seems to be no reason why this should not be an entirely amicable gathering. The great majority of shareholders will certainly be only too glad to feel that the company is once more proceeding harmoniously with its work, and that personal considerations no longer embarrass the proper business of the concern.

London United Tramways debenture stock has improved to 43. Potteries preference advanced to 11s., and the ordinary are better at 6s. 6d. Victoria Falls & Power preference jumped sharply to 19s. 9d. on the publication of the annual report, and the ordinary have hardened to 9s. 3d., the latter being now well within sight of a dividend. In the course of another year, it may be reasonably hoped that the ordinary will receive a modest distribution.

Telegraph stocks are steady on the whole, though the Eastern group is a little easier. Eastern ordinary receding 2 points and "China" shares falling ½. Marconis remain quiet. The recent flutter of excitement in Americans has subsided, though the price keeps firm at 19s. 6d.; while Canadians, which participated but little in the rise in Americans, hold to half-a-guinea.

The principal fall in Home Railway stocks is one of 3½ points in Central London non-assented ordinary, this dropping to 44½ on a little stock coming to market. The assented is also a point down at 73. Metropolitans weakened to 25, and Underground Electrics are also a trifle easier, the dullness being due to the prevailing sentiment in the market as a whole.

Amongst industrials, Babcock & Wilcox, after their recent strength, have gone back a trifle to 3 1/16, and Castner-Kellners fell ½ to 3½. British Aluminium at 26s. 3d. are the pence higher, though they have been better during the past few days. Dick, Kerr dropped to 16s. 9d. Callenders are again 5s. up at 12½, and the rest of the list keeps very steady. The rubber market, too, is firm. Raw Rubber fluctuates.

tuates narrowly around 2s. 3d. per lb., the changes having little effect upon the share market. For the moment, Borneo rubber shares are popular; but the general tone of the market is robust, and buying orders come in steadily from all parts of the provinces.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend	Price	Rise or fall	Yield
	1914. 1915.	Sept. 12, 1916.	this week.	per cent.
Brompton Ordinary ..	10 10	67	—	27 18 4
Charing Cross Ordinary ..	5 5	32 1/2	—	7 1 4
do. do. do. 4 1/2 Pref. ..	4 1/2 4 1/2	32 1/2	+	6 6 4
Chelsea ..	5 4	38	—	6 13 4
City of London ..	9 8	124 1/2	—	6 10 8
do. do. 6 per cent. Pref. ..	6 6	10 1/2	+	6 15 8
County of London ..	7 7	11	—	6 7 3
do. do. 4 per cent. Pref. ..	6 6	10 1/2	—	6 13 0
Kensington Ordinary ..	9 7	34	—	6 7 3
London Electric ..	12 3	132	—	6 10 6
do. do. 6 per cent. Pref. ..	6 6	48 1/2	—	6 13 4
Metropolitan ..	34 3	32	—	9 1 0
do. do. 4 1/2 per cent. Pref. ..	4 1/2 4 1/2	32	—	6 5 6
St. James's and Pall Mall ..	12 2	132	+	6 5 6
South London ..	5 5	24	—	8 13 10
South Metropolitan Pref. ..	7 7	135	—	6 7 3
Westminster Ordinary ..	9 7	62	—	6 12 0

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref. ..	6 6	103	— 1/2	6 16 8
do. Def. ..	30 30 1/2	234	—	7 8 9
Chile Telephone ..	6 5	84	—	6 14 5
Ents. Sub. Ord. ..	6 5	84	—	6 8 6
Eastern Extension ..	7 8	112	— 1/2	6 8 6
Eastern Tel. Ord. ..	7 8	147	— 3/4	6 8 10
Globe Tel. and T. Ord. ..	6 6	121	—	6 13 8
do. Pref. ..	6 6	106	—	5 10 4
Great Northern Tel. ..	22 22	42	—	6 4 9
Indo-European ..	13 13	49	—	6 13 4
Marconi ..	10 11	85 1/2	—	8 3 9
New York Tel. 4 1/2 ..	4 1/2 4 1/2	100	—	4 10 0
Oriental Telephone Ord. ..	10 10	24	—	4 8 11
United R. Plate Tel. ..	8 8	15	—	5 16 5
West India and Pan. ..	7 7	15 1/2	—	5 6 8
Western Telegraph ..	7 8	15	—	5 6 8

HOME RAILS.

Central London, Ord. Assented	4 4	78	— 1	5 9 7
Metropolitan ..	12 1	25	— 1/2	4 0 0
do. District ..	Nil Nil	131	—	Nil
Underground Electric Ordinary	Nil Nil	134	—	Nil
do. do. "A" ..	Nil Nil	6 1/2	—	Nil
do. do. Income ..	6 6	89 1/2	+	6 14 10

FOREIGN TRAMS, &c.

Adelaide Sup. 6 per cent. Pref.	6 6	6	—	6 0 0
Anglo-Arg. Trams, First Pref.	5 1/2 5 1/2	8 1/2	— 1 1/2	7 9 2
do. do. 2nd Pref. ..	5 1/2 5 1/2	8 1/2	—	6 13 4
do. do. 5 Deb. ..	5 5	76	— 1/2	6 11 8
Brazil Tractions ..	4 4	60 1/2	—	6 14 8
Bombay Electric Pref. ..	6 6	72	—	6 13 0
British Columbia Elec. Ry. Pref.	5 5	64 1/2	+ 1 1/2	Nil
do. do. Deferred ..	Nil Nil	64 1/2	+ 1 1/2	Nil
do. do. Deb. ..	4 1/2 4 1/2	68	—	6 5 0
Mexico Trams 5 per cent. Bonds	Nil Nil	41	+ 1	Nil
do. do. 6 per cent. Bonds	Nil Nil	39	—	Nil
Mexican Light Common ..	Nil Nil	84	—	Nil
do. Pref. ..	Nil Nil	84	—	Nil
do. 1st Bonds ..	Nil Nil	43	—	Nil

MANUFACTURING COMPANIES.

Babcock & Wilcox ..	14 15	20 1/2	+ 3/4	4 18 0
British Aluminium Ord. ..	6 7	20 1/2	+ 3/4	6 0 8
British Insulated Ord. ..	15 17 1/2	124	+ 1/2	7 0 0
British Westinghouse Pref. ..	7 7 1/2	49 1/2	+ 6 1/2	6 1 2 0
Callenders ..	15 20	124	+ 2	6 17 8
do. 5 Pref. ..	6 6	48	— 1/2	6 6 8
Casimer-Kellner ..	20	6 1/2	—	Nil
Edison & Swan, 23 paid	Nil Nil	10 1/2	—	Nil
do. do. fully paid ..	Nil Nil	12	—	8 0 0
do. do. 5 per cent. Deb. ..	6 5	12 1/2	—	8 11 6
Electric Construction ..	6 7 1/2	17 1/2	—	6 0 0
Gen. Elec. Pref. ..	6 6	10	—	7 2 10
do. Ord. ..	20 25	18 1/2	+ 1	7 9 2
Hendley ..	4 1/2 4 1/2	4 1/2	—	5 6 0
India-Rubber ..	10 10	12 1/2	—	7 8 4
Telegraph Con. ..	20 20	89	—	7 6 4 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 13th.

	Latest Price.	Fortnight's Inc. or Dec.
CHEMICALS, &c.		
a Acid, Oxalic ..	per lb. 1/8	..
a Ammoniac Sal ..	per ton 175	..
a Ammonia. Murate (large crystal)	.. 470	..
a Bauxilide of Carbon ..	.. 228	..
a Bones ..	.. 434	..
a Copper Sulphate ..	.. 451	..
a Potash, Chlorate ..	per lb. 2/6	..
a " Perchlorate ..	.. 2/6	..
a Shalac ..	per cwt. 128	..
a Sulphate of Magnesia ..	per ton 218	..
a Sulphur, Sublimed Flowers ..	.. 13 10	21 inc.
a " Lump ..	.. 13 10	21 inc.
a Soda, Chlorate ..	per lb. 1/1	..
a " Crystals ..	per ton 120/	..
a Sodium Bichromate, casks ..	per lb. ..	..
METALS, &c.		
c Brass (rolled metal 2 to 12" basis)	per lb. 1/23 to 1/8	..
c " Tubes (solid drawn) ..	.. 1/21 to 1/24	..
c " Wire, basis ..	.. 1/21 to 1/24	..
c Copper Tubes (solid drawn) ..	.. 1/21 to 1/24	..
c Bars (best selected) ..	per ton 2150	..
c " Sheet ..	.. 2150	..
c " Rod ..	.. 2150	23 inc.
c " (Electrolytic) Bars ..	.. 2150	24 inc.
c " Sheets ..	.. 2150	24 inc.
c " Rods ..	.. 2140	24 inc.
d " H.C. Wire ..	per lb. 1/45	24 inc.
f Ebonite Rod ..	.. 3/6	..
f " Sheet ..	.. 2/6	..
n German Silver Wire ..	.. 2/3	..
h Gutta-percha, fine ..	.. 6 10	3d. inc.
h India-rubber, Para fine ..	.. 3/8	..
i Iron Pig (Cleveland warrants) ..	per ton Nom.	..
l " Wire, galv. No. 8, P.O. qual. ..	.. 436	16/ dec.
g Lead, English Pig ..	.. 217 12 to 217 15	..
g Mercury ..	per pot. 64. to 6/	..
e Mica (in original cases) small ..	.. 8/6 to 6/	..
e " " medium ..	.. 7/8 to 14/	3d. inc.
e " " large ..	.. 2/8	..
r Silicon Bronze Wire ..	per lb. 1/4	..
r Steel, Magnet, in bars ..	per ton 280	..
r Tin, Block (English) ..	.. 2171 to 2172	44 to 45 dec.
n " Wire, Nos. 1 to 16 ..	per lb. 2 10	..

Quotations supplied by—

a G. Boor & Co.	g James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Tilt & Co.
d Frederick Smith & Co.	i Bolling & Love.
e F. Wiggins & Sons.	l Richard Johnson & Nephew, Ltd.
n India-Rubber, Gutta-Percha and	n P. Ormiston & Sons.
Telegraph Works Co., Ltd.	r W. F. Dennis & Co.

Official Announcements re Companies.—The following companies are to be struck off the register unless cause to the contrary is shown within three months:—

Commercial & Engineering Development Co.
Engineering & General Purposes Co.
Holmes Motor Speed Controller.
International Power & Light Trust.
Rochdale Electro-Plating Co.

Hong-Kong Tramway Co., Ltd.—The directors report a net profit, after writing off £6,625 off for depreciation, and including £6,897 brought forward, of £18,071. A dividend of 12 per cent. has been declared, and a further £2,000 has been written off the cost of the tramway undertaking, leaving £6,321 to be carried forward.

Dundee and Broughty Ferry Tramways Co., Ltd.—The net profit for the year ended July 31st was £2,595, including £100 brought forward, after providing for interest and £785 in redemption of debenture stock. After paying the dividend on the preference shares £165 is to be carried forward.

United Electric Car Co., Ltd., Preston.—In their report for the year ended June 30th, 1916, the directors state that the works have been efficiently maintained as regards building and machinery, the cost of which has been charged against revenue. After charging £5,229 for depreciation, including £4,500 added to reserve, the profit for the year is £6,563, plus £4,707 brought forward, making £11,270. After paying the preference dividend, less income-tax, requiring £6,000, £5,270 is to be carried forward. Annual meeting: September 20th.

Browett, Lindley & Co., Ltd.—According to the "Financial Times," an interim dividend at the rate of 6 per cent. has been declared.

Gandy Belt Manufacturing Co., Ltd.—Interim dividend, 8 per cent. actual, less tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.	No. of wgs.	Total to date.	Route miles open.	
		£	£	£	Inc.	
Blackpool-Fleetw'd ..	Sept. 2	10,036	+ 1,807	35	81,306 + 2,978	8 ..
Auckland (Trans) ..	Aug. 31	24,306	+ 8,009	36	170,604 + 5,419	80 1/2 ..
Cork ..	Aug. 31	2,444	+ 112	36	17,755 + 144	9 8 1/2 ..
Dublin ..	Sept. 1	28,740	+ 4,000	36	28,948 + 3,817	54 1/2 ..
Hastings ..	Aug. 31	7,544	+ 1,388	35	36,431 + 2,043	19 3/4 ..
Lancashire United	Aug. 30	4,422	+ 187	35	62,786 + 2,658	42 ..
Llandudno-Col. Bay	Sept. 1	3,570	+ 88	35	14,151 + 483	6 1/2 ..
Anglo-Argentine ..	Aug. 26	184,111	+ 6,394	35	1,771,989 + 11,483	..
Calcutta ..	Aug. 26	20,467	+ 294	8	41,974 + 56	26 1/2 ..
Calcutta ..	Aug. 26	18,494	+ 613	4	14,937 + 6,773	20 1/2 ..
Kalgoolie, W.A. ..	June	2,500	—	26	14,937 + 2,302	..
Madras ..	July	4,422	+ 187	35	292,632 + 19,366	..
Montevideo ..	August	26,044	+ 449	9	1,777 + 304	7 ..
Dublin-Lucan Ry.	Sept. 1	805	+ 127	9	1,777 + 304	7 ..

THE BRITISH ASSOCIATION.—II.

THE Engineering Section of the British Association, when it met in Newcastle-on-Tyne on Thursday, September 7th, had a very busy day in front of it, for the agenda was so full that practically no time was left for discussion. The programme originally was a heavy one, but it was made worse in consequence of the addition to the lists of papers to be read, of that of Dr. T. E. Stanton, F.R.S., on Principles of Similitude. Other subjects treated were: Standardisation and its Influence on the Engineering Industries, by Mr. C. le Maistre; Pressure Oil Film Lubrication, by Mr. H. T. Newbigin; The Influence of Pressure on Electrical Ignition, by Prof. W. M. Thornton; The Calculation of the Capacity of Aerials, including the Effects of Masts and Buildings, by Prof. G. W. O. Howe; and Some Characteristic Curves for a Poulsen Arc Generator, by Mr. N. W. McLachlan, as well as a report of the Committee on Complex Stress Distribution.

The Chemistry and Geology Sections joined hands on Thursday morning to consider the investigation of the chemical and geological characters of different varieties of coal, with a view to their most effective utilisation as fuel and to the extraction of by-products. This discussion, which formed a sort of prelude to the discussion of Friday between the Engineering and Chemical Sections on fuel economy, &c., was taken part in by Prof. G. A. Lebour, Prof. W. A. Bone, F.R.S., Dr. A. Strahan, F.R.S., Dr. J. T. Dunn, Dr. Marie C. Stopes, and others. At the same time the Economic Section was engaged in the discussion of a report of a Conference on the Replacement of Male by Female Labour.

The subject of fuel economy was one of the outstanding features of the Association's meetings on Friday, and, as mentioned, was jointly debated by the Engineering and Chemistry Sections. A long, but very interesting and practical, debate had for its basis, first, the First Report of the Committee (of which Prof. W. A. Bone was chairman) Appointed for the Investigation of Fuel Economy, the Utilisation of Coal, and Smoke Prevention. This report went over the ground very thoroughly, and in effect stated that there was practically as great a need for coal saving as ever. The Committee, so far, had been occupied by organisation and a survey of the ground which must be explored later on. The Committee recommended its re-appointment, in order that it might continue its investigations. In addition to this, there was a paper by Mr. R. P. Sloan on Fuel Economy on the North-East Coast as a Result of Electric Power Supply, and another subject that was broached was Electric Power Distribution, by Mr. Charles H. Merz. Amongst those taking part were:—Prof. W. A. Bone, Dr. J. T. Dunn, Mr. H. J. Yates, Sir Hugh Bell, Prof. Louis, Sir C. Parsons, Dr. Dugald Clerk, Prof. H. B. Dixon, Dr. Des Vaux, Mr. W. B. Woodhouse, Mr. McLaurin, Mr. Chamen, Mr. Chattock, and others. The discussion was of a very high character, and formed a very fitting close to the Section's proceedings.

Address to the Engineering Section.

By GERALD STONEY, F.R.S., PRESIDENT OF SECTION G.

(Abstract.)

At times such as these the mind naturally turns to problems to be considered both at the present time and after the war, and in considering such problems, a review of some of the errors committed in the past is most necessary. Such a review enables methods which should be adopted, both now and in the future, to be considered.

One thing which has handicapped the engineering and allied industries is the reluctance of firms to utilise highly educated labour or to adopt scientific methods. In looking round the industries of the district one is struck by the small number of men who have undergone a thorough scientific training at one of the universities or at one of the leading technical colleges, and who occupy a prominent place in the firms in this district.

The general complaint is that university and college men are too theoretical and not practical. It is the usual thing for a bad workman to blame his tools, and is it not because employers do not know how to make use of such labour that they utilise it to such a small and imperfect extent?

Things are very different in some other countries with which we have competed in the past, and with which there will be in all probability still fiercer competition in the future. There we find the fullest use made of highly educated scientific labour.

How many engineering firms in this district have a skilled chemist on their staff, and what percentage of these pay him a decent salary? And how many heads of firms have sufficient chemical knowledge to appreciate the work of and utilise the services of such a man?—because unless there is appreciation of the work done by such a man his services are useless and he becomes discouraged, and yet chemical problems are continually cropping up in engineering work. There is the question of the supply of materials; as a rule the manufacturer trusts to the name of the contractor and assumes that he gets materials of the composition and purity he ordered. Every now and then something goes wrong and the question arises, why? Without a chemist to analyse the material it is often most difficult to say. Apart from this question of the analysis of raw or partly manufactured materials received, there is the chronic question as to the mixtures of the metals in both the metal and brass foundry, and large economies can be effected by systematic analyses.

Another direction in which scientific labour is invaluable is in seeing that instruments are in proper order and that tests are accurately carried out. Tests carried out with inaccurate instruments and without proper scientific precautions to see that they are accurate and reliable are worse than useless, and, in fact, most misleading and dangerous, as entirely unreliable inferences may be drawn from them and far-reaching troubles caused in the future. How many tests of steam engines are unreliable because there is no standardisation of the pressure and vacuum gauges and thermometers used, and in how many cases is even the reading of the barometer omitted? An absolute pressure stated as so many inches of vacuum has no meaning unless the barometer reading is also given or the inches of vacuum is stated as reduced to "Bar. 30." How many firms using steam have any arrangements for testing vacuum and pressure gauges, and yet there are no instruments more liable to error than these gauges? Under scientific supervision arrangements are made to avoid such troubles and get reliable results which can be depended on for future designs.

What has been said about pressure gauges and the measurement of pressure applies, of course, to all other instruments and measurements. In most works, it may be said with sorrow, that the only moderately accurate measurements that can be made are those of dimensions and weight. It is only by accurate testing of existing plant that reliable deductions can be drawn enabling safe progress to be made in future designs.

One of the great things which helped forward the steam turbine in the early days was accurate and full testing of each plant as soon as it was completed and before it left the works. The late Mr. Willans was probably the first, or one of the first to recognise the importance of accurate testing of steam plant, and the success his well-known engine had was largely due to this. From the earliest days of the steam turbine, Sir Charles Parsons recognised the necessity of such testing, and the test house has always been a prominent feature of Heaton Works. And then in the higher ranks of an engineering works it requires a scientific mind to draw safe conclusions from tests carried out and to see in what directions progress can be safely made. Such methods have enabled the steam turbine during the writer's acquaintance with it, now extending over some 23 years, to grow from 50 H.P. to some 45,000 or more in each unit, and the steam consumption to be reduced from 40 lb. per H.P.-hour to about 7½ lb., or less than one-fifth.

Closely allied to such work in engineering works is the general question of scientific research, and here a trained scientific mind is of the utmost importance to see that reliable results are obtained and to make true logical deductions from those results. Without suitable training a man is liable to be unable to grasp all the conditions of an experiment, and to make deductions from the data obtained which are totally unjustified and often lead to most disastrous results in the future.

Such research is generally carried out in four places—engineering works, private laboratories, engineering colleges, and national laboratories.

The first has already been dealt with.

The second is of comparatively small importance in practice. As regards the third, a great deal of good work has been done in engineering colleges, often under great difficulties for want of plant and money, and it is greatly to the credit of our professors and others that they have succeeded in doing so much with the very inadequate appliances at their disposal, and handicapped for want of funds. How inadequate their income is can be understood when it is remembered that Leipzig University alone has an annual income from the German Government of £100,000, as against a total Government grant to all the universities here of about £45,000, or less than half.

Of national laboratories we have only one, the National Physical Laboratory at Teddington, and here again the support given to it is totally inadequate. The total income from all sources last year was only £40,000, and of this £23,000 was charges for work done, such as testing meters and other instruments and such commercial work; the Government grant is only £7,000 a year, and besides this £7,500 was

received for experiments in connection with aeronautics, which is really war work. The balance was made up of subscriptions, grants from technical societies and miscellaneous receipts. Compare this with the German equivalent, the Reichsanstalt, of Berlin, which has an income of £70,000 a year from the Government, or ten times that given to our N.P.L. The Bureau of Standards, the similar institution in U.S.A., has a Government grant of £140,000, or 20 times ours. In the Civil Service Estimates there is an allowance of £40,000 for research, an increase of £15,000 over that allotted last year. The total estimates are over £20,000,000, so that less than one-fifth per cent. is allotted to research.

It is difficult to realise what benefits might be gained by investigations which could be carried on by the N.P.L. if only sufficient funds were available, and of what importance they might be to industry at large. One example may suffice. Some time ago the Reichsanstalt carried out a most complete set of tests on a certain class of machine, an investigation which must have cost several thousands of pounds sterling, apart from the time it occupied. The results of this investigation are available to German manufacturers of this machine, and just before the war preparations were being made to take advantage of this, and from figures stated a large extra economy was expected. This, of course, would enable them, provided the cost of manufacture was not too high, to have an enormous advantage over such machines manufactured without this special knowledge. The Institution of Mechanical Engineers saw the importance of this problem and appointed a Research Committee to deal with the question, but the first question met with is that of finance. Should this be the case in a wealthy country such as this, that depends on its manufactures for its very existence? That such an investigation is required is obvious from the fact that the designs of no two independent manufacturers of this machine in this country agree among themselves. Of course, each claims that his is the best, but this cannot be so.

Investigations in engineering shops do not meet such a case. The question of finance has to be carefully watched, and as soon as results sufficiently good are obtained they are generally accepted; in any case the problem is rarely thrashed out to the bottom, an almost universal defect in commercial research work. Without the help of the National Physical Laboratory the position of the aeroplane in this country would be very different from what it is, and what has been done for the aeroplane requires to be done in many other directions.

But what firm here would do what has been done in the commercial synthesis of indigo, on which it is said that 17 years' work and over £1,000,000 has been spent by one firm alone abroad? Here in chemical investigations and manufactures the Government refuse even to help by allowing cheap alcohol to be obtainable, and much of such work is impossible in this country on this account, as in many cases methylated and denatured alcohol are not suitable. Recently, under pressure, the restrictions have been somewhat relaxed by the Government, but many manufacturers have found that the privileges granted are so tied up in red tape that the concessions are practically useless.

And it is not only on the scientific side that there is so much to be done in the way of putting our house in order; there is much to be done in the way of putting the management and commercial sides of engineering and other allied works in a position to compete.

The great growth of engineering works and their being formed into limited liability companies has not been without its drawbacks.

In the old days an engineering works was comparatively small and, as a rule, one man, generally a clever engineer, was at the head. After his death, and often before, the place was turned into a limited liability company, and gradually fell into the hands of a body of men, many of them not technical, who had no further interest in the firm than to draw their salaries as directors and managers, and who had no financial stake in the concern beyond the £500 or £1,000 in shares necessary to qualify them as directors. The result is that the place gradually degenerates, initiative ceases, and they finally get to a stage of not paying any dividends, and really being kept going, not for the sake of the shareholders, but of the directors and other officials.

Such a firm as a rule does not put enough aside for depreciation, and thus its machinery and buildings degenerate and become obsolete, which makes it still less able to compete with more modern firms. At the same time it is not able to afford the money necessary to carry on the experimental and research work which is a necessity for any progressive firm, and thus its manufactures cease to progress with the times. As Sir Charles Parsons truly said, a man or firm in the face of financial difficulties cannot carry on research work, and, further, the minimum spent on research work should be at least 1 per cent. of the turnover, and the amount it is advisable to spend is 3 per cent. Unless a firm makes good profits it cannot keep up-to-date, and will sooner or later go to the wall.

But the workman says that he should have his share. What is his share under the present state of things? The average capital expended in an engineering works per individual employed is about £200. An investigation the writer made some years ago gave this figure, and it was confirmed by an

investigation of shipbuilding yards, which gave £185, and of the census of production, which gives a capital of £1,500,000,000 for 7,000,000 workers, or £214 per man. An investigation of the dividends paid shows them to be about 4 per cent. on the capital employed. Here it must be remembered that firms paying 10 to 15 per cent. on their ordinary capital have often a large preference and debenture capital, on which a much lower rate of interest is paid, and also that often part of the ordinary capital was issued at a premium. Also, account has to be taken of the large number of companies that do not pay any dividend on their ordinary stock, and often none on their preference. Little is as a rule heard of the finances of such companies; it is the ones paying good dividends that public attention is drawn to.

It thus means that the shareholders get about £8 per year per individual employed.

On the other hand, the average wages for men and boys, skilled and unskilled, is about £70 per annum in normal times. This means that the worker gets between eight and nine times as much as the capitalist, and shows on what a very small margin the capitalist works. And without the capitalist, under our present system of individualism, there would be no factories erected and run, and therefore no work for the working man, a thing it is well for him to remember, and also that without profits the capitalist will not invest in engineering and other works in this country, but will seek a more profitable field for his capital elsewhere. Every £200 invested in this country in a factory means work and livelihood for one British workman.

At the same time, I am sorry to say the employer does not look after the welfare of his workmen as he might. In a small factory the head of the firm, as a rule, knows all the leading men among the workmen, many of them having been with him for years. As the place grows he loses touch with his men, and as an actual fact knows fewer of those under him when he has 1,000 or more employes than he did when he had 400 or under. This state of things gets worse when the place is turned into a limited liability company, as nearly all large places are at present. The result is that a most deplorable state of things has come to pass. The workman says, "Put not thy trust in employers"; the master says, "Put not thy trust in workmen"; and the official, who is between the master and the workman, says "Put not thy trust in either."

It is difficult to say what is to be done to remedy this state of things, but one cannot help feeling much might have been done in the past to prevent such a regrettable state of affairs as there is at present. Much of this trouble might have been avoided if employers had shown more consideration for the welfare of their workmen. Of course, there are some notable exceptions, but they are few and far between. An example is the necessity of the Factory Acts to ensure proper light and air and other arrangements necessary for the health of the workmen. But much more should be done. Why is it that canteens are being rushed up all over the country, and why were there so few before? In many works to this day the provisions for getting food and drink warmed are most primitive and inefficient, and as to getting anything to eat if one has to work overtime unexpectedly, it is in most works impossible. As a rule the only thing available was a drink at the public-house outside the gates, and even this is now closed at five o'clock. Why, if a man works overtime, should he also starve? And how can efficient work be expected under such conditions? Why also should there not be provision for drying clothes after walking to work on a wet morning, and each man be provided with a cupboard where he could keep a change of boots? Why are not sanitary arrangements decently private, and why are they not kept clean and wholesome: they are often in a disgraceful state? These are only a few samples of the directions in which much might be done.

The adjustment of the wages to be paid to the workman is a most difficult one. There are three principal ways of paying workmen: on time, on piece, and on bonus.

On time is the only way of paying a man who is on various classes of work, where the fair time required for each job is not known, and in many cases the most highly skilled men are on such work and as a result only make time wages. This results often in the highly skilled man making less money than the less skilled man who is on repetition work, and as a consequence is working on piece or bonus, and this is obviously unfair. For example, a man may have the setting up and adjusting of a number of machines on repetition work, and he often makes less money than the less skilled men under him who are on piece or bonus, although their nominal rate of wages is less than his.

Again, highly skilled erectors who go outside the works to erect machinery, often worth thousands of pounds, and set it to work, are only paid on time, and often make less money than their fellows who are on piece inside the works.

The adjusting of piece prices is a most difficult one. They should be adjusted so as to be fair both to master and man, but too often such fixing of prices is left to subordinate officials who have in many cases their own axe to grind. There should in every works be a special department for such fixing of prices, and once a price is fixed it should not be altered without good reason. The practice of cutting prices by the masters in the past is, in the opinion of the writer, largely responsible for the present limitation of output by

the men about which we hear so much. There is a rule that if a man makes more than time and half or time and third the price of the job is to be cut. If the price has been fairly fixed why should it be reduced because the man makes large wages due to his skill and industry? The larger the output from his vice or lathe the better for the master, as he is getting a larger output from his plant with a certain capital expenditure, and thereby establishment charges are reduced. This is especially the case in machine work, as the hourly value of the machine employed often far exceeds the wages of the workman employed.

A fair rating for machine tools is 4d. per hour per £100 value, and as the time rating of the man is generally about 9d., it is easily seen that if the average value of the machine tools exceed £225, machine charges exceed time wages, and the average value of machine tools is generally largely in excess of this figure, in fact often about double it. It is therefore obvious that it is much more important to get large output than to pay small wages.

The result of this "time and half" rule is that a good man by working up to the limit of his capacity "spoils the job" for the next man who comes along, and may not be of the same calibre as the first man. It has therefore been found advisable and necessary by the workmen to limit the output of all men to a certain standard, and this results in the end by the pace being set by the slowest man on a particular job.

A fair bonus system is perhaps the ideal way of paying men, but here, again, although the times for a job are supposed to be fixed and unalterable, in too many cases they have been altered by various devices, and as a result the system is looked on with suspicion by the workman.

Gradually, bit by bit, the pernicious doctrine that the less work done by a man the more employment there will be has grown up, he not seeing that the cheaper an article can be produced the larger will be the sale for it and the better it will be able to compete with the products, not only of other producers in this country, but of those abroad. And also that very cheapness, combined with good quality, induces the sale for such articles to be large.

Laziness is inherent in man, and on an average no man will work unless compelled to do so, and still less will work his best unless there is a great inducement. This is true not only of the working-man, but of all other classes. Therefore the policy of "ca' canny" has been only too readily adopted on the ground not only that it was pleasant for the man himself, but also he believed that it tended to the welfare of his fellow workmen.

The writer has very reluctantly come to the conclusion that the workman of to-day is not doing as much work as was done some 30 years ago, when he was in the shops, and not only this, but that timekeeping is not as good. In this connection, however, it must be remembered that excessive overtime inevitably leads to bad timekeeping.

Bad timekeeping causes much more loss than that due to the actual time lost, as not only does machinery and other plant lie idle, but the disorganisation caused in a works by lost time is most serious.

With the growth in strength of the trade unions, which at first were for the legitimate object of seeing that the workman got fair play, and providing out-of-work and old-age benefits, &c., has grown up a system of trade union officials who live by agitation, and whose job would be gone if there were no supposed grievances to agitate about. These men keep the Labour world in a constant state of agitation, and make the employers' and officials' existence a burden to them by constant demands of all sorts, many of them utterly impracticable and unfair. When they cannot agitate against the employer they agitate against another trade union, and thus endless disputes spring up on the demarcation of work. Some of the worst strikes in the past have been due to disputes between two trade unions.

Unless something can be done to bring master and man together and make both work for the common good, English trade must inevitably go down, and the supremacy that England has in the engineering of the world will come to an end.

Nothing ever was a truer statement than that recently made by Lord Joicey that this country, unless it produces as cheap or cheaper than other countries, cannot in the long run keep her trade, and this is true in spite of any tariff walls which may be set up. And if the present state of affairs is maintained of unscientific management and obsolete machinery, combined with limitation of output and high wages, or, in other words, high cost of production, we must, sooner or later, go to the wall.

What is really wanted is common honesty and common sense on both sides, for one side is as bad as the other at present.

And now about the official, who is in all grades from the manager down to the foreman, and who comes between the master and the man. Unless he is treated fairly by the master, and unless he treats his men fairly, there is sure to be friction and loss of efficiency. He must also work with his fellow-officials, who move in lines more or less parallel to his, and here, to prevent jealousies and to prevent the more unscrupulous among them taking unfair advantages, demarcation of each official's duties and work is most important. This is a point often omitted to be taken sufficiently into account in the organisation of a works, and often causes most disastrous results. The duties of each man should be

clearly defined by the master, and no interference with those of others tolerated. The master also should remember that the official has no trade union or similar organisation to protect him, and should act accordingly. Much more could be said about the relations of the official both with his fellow-official who is on the same level as himself, with his master who is above him, and the workman who is under him, but time forbids. On all three sides much improvement could be effected. The fact remains, however, that for success it is essential that all from the apprentice to the head of the firm should work as one homogeneous whole.

Apart from the considerations set out above, combinations among the firms employed in any one trade are most essential for the well-being of that trade. It is by such combination that much of the progress made of late years by our competitors has been effected. Some of these combinations have been international, and at least two such in the engineering trade before the war were so. These now, of course, are, and it is expected will be after the war, confined to the allied and possibly to neutral countries, but such combinations, whether among all the engineering firms in one district or among firms employed in one particular trade, to be successful must be worked fairly to all members, and the larger firms must not override the smaller, as it is regrettable to say, has been done in combinations of employers in some districts. For example, in a district where there is one firm very much larger than any of the others, it is not unknown for it to act the bully and insist on everything being done to suit its requirements, regardless of the rights of others. And, further, such combinations are, unless directed by men with broad minds and able to take a wide view of things, liable, especially in case of emergency, to do much harm.

If the Armament Ring in this country had taken such a view when it was found what an enormous supply of munitions was required, it is doubtful if there would have been such a shortage as there has been. Hundreds of firms were willing and anxious to help in the production of munitions, but when they offered their services they were met in many cases with a blank refusal, and in all cases with little encouragement. And when, under pressure from the Government, the Ring accepted outside help, in many cases the conditions imposed on the sub-contractors were unfair in the extreme, apparently the whole idea of the Ring being to make all the profit they could out of the troubles of the Empire. It has been just as difficult to persuade the Armament Ring to give up what they thought was their monopoly and to bring in outside works to help in the production of munitions as it has been to persuade the trade unions to forgo trade customs and to enable outside sources of labour to be employed, such as women and other unskilled labour. But both have had to do it. In other words, "dilution of works" has been as difficult to effect as "dilution of labour," and the position both of the Armament Ring and of the workman would have been very different if they had consented freely to it when it became obviously necessary for the safety of the Empire.

Combination among workmen is admittedly a necessity if they are to have fair play, but combination among employers has come later, and is equally a necessity.

At present most of the principal federations of employers deal only with wages questions and questions affecting labour, but they require to be extended so as to take in all branches of the business of engineering. Labour has long seen the importance of federation; it is now for Capital to do the same. One of the great difficulties has been that certain firms would not join, and a very small proportion acting thus weakens the whole to a much greater extent than the actual ratio of this small proportion to the whole. It is easy to see how alive Labour is to this by the constant trouble over the non-union question, and this is well put in the Mersey district: "To be outside a union is to be disloyal not only to your own class but to yourselves individually." What applies to Labour also applies to firms; for a firm to be outside the federation is to be disloyal, not only to its fellow-firms but to itself.

Such a state of affairs is not tolerated in some of the countries competing with us, and it is questionable whether action by the Government is not advisable.

An example of the mischief done by a few who would not fall into line with the many is seen by the necessity for the Act compelling the early closing of shops one day a week. The great majority were ready to close, but the action of a small minority prevented their doing so, and in the end compulsion had to be used on the minority. Legislation has not been necessary to prevent "black-legging" in the labour world, since other methods have been used which have been practically successful, but it is quite possible it may be necessary to use compulsion to make firms toe the line.

Such combinations are not only for labour questions, but also for all other subjects affecting the engineering industry at large, and more especially the special industries in which any one firm deals. Thus they resolve themselves into general federations of all engineering industries and minor ones dealing with particular trades. The former deal chiefly with labour questions and questions affecting the industry as a whole, the latter with those affecting any particular trade.

Among the questions coming up to be considered by the latter class is the standardisation of specifications and conditions of contracts, as well as in some cases the adjusting of prices to avoid unfair competition and to put the whole trade

on a paying basis. Much has been done in this direction with most advantageous results in certain cases, but much more remains to be done if this country is going to hold its place in the world.

The necessities of research work have already been dealt with, and by the pooling of such research work enormous advantages in any one trade could be obtained. Such pooling of information has been effected with most beneficial results, especially in the chemical trade abroad. Any workable scheme which would enable this to be done and get over the jealousies between one firm and another would be of enormous benefit to the trade in general.

Another thing that must not be lost sight of is the urgent need of improving our educational system. It is little short of a disgrace that the older universities are closed to those without a knowledge of Latin and Greek.

Languages are of the greatest importance to an engineer, but not dead languages but live ones. And these should be properly taught, so that the student should not only be able to read and write about them, but also to speak and understand them. It is quite a different knowledge of a language to be able to read, write, speak, or understand it. Many people can read a language without being able to write, speak, or understand it, and conversely it is not uncommon to meet people who can speak and understand a language without being able to any large extent to read or write it. And it is only in live languages that a man is trained to speak and understand a language.

Why is it that we are so wedded to the dead languages? There is, of course, the tradition that such are necessary for a liberal education, and there is the argument that modern languages are not as good a training for the mind. Granted that they are not quite so good from the point of view of learning to read and write them, does not the fact that they can also be taught as a live language to be spoken and understood, make them on the whole the best educationally for a man? This is entirely apart from the fact that modern languages are useful and ancient useless to the man in commercial work. There is, of course, bitter opposition from that most conservative man, the schoolmaster, and one great reason is that it is much easier and cheaper to get a man to teach Latin and Greek than modern languages which have to be taught orally. The teaching of Latin and Greek as it is usually taught has been standardised to the last degree, and as a result they can be taught by the "semi-skilled" man, and a "skilled" man is not necessary, to use engineers' phraseology. In fact, the teaching of Latin and Greek is a pure "repetition job." At the same time, no education is complete unless science is combined with languages and also literature, and here lies one great danger of modern technical education.

And after the boy has left school and enters the shops, more facilities should be given to enable him not only to keep up but to continue his education. In the shops and drawing office, too often the boy is left to pick up a knowledge of his trade as best he can. The apprentice who asks questions is often looked on as a nuisance, and requests for information are generally met by a blank refusal or worse. Often the foreman or chief draughtsman is afraid to answer questions for fear of being charged with giving away so-called "trade secrets," but an immense deal of information can be given to an apprentice without doing so.

Evening classes are all very good in their way, but more facilities should be given for the diligent apprentice to attend day classes, and this can be arranged in various ways if the employer has a will to do it. A thing that at present often prevents boys desirous of educating themselves from getting on is the fact that overtime is allowed as soon as a boy is 18, and often he is compelled to work overtime regardless of classes that he ought to be attending.

It is important to remember that the boy of to-day is the man of to-morrow.

One complaint is that after a lot of trouble is taken about a boy he leaves after a few years and goes to another employer. The good of the trade in general must be considered, and a man who has had experience of various classes of work is generally a much more valuable man than one whose knowledge is confined to one class only. In any case, the other employer gets the benefit of what has been done by the first, and thus the trade in general benefits.

It is felt that this is a very imperfect review of things as they are at present, but if this address induces all classes engaged in engineering to consider how things can be bettered the author feels that a part, at all events, of his object has been attained.

Electric Power Distribution.

By CHARLES H. MERZ.

(Abstract of contribution to the discussion on Fuel Economy.)

"It appears that . . . the coal should be converted . . . into a form in which it is most generally applicable to all purposes without exception, and in which it is most easily applied to all our wants, and is at the same time in a form in which it is most difficult to waste or use improperly. We are therefore forced to the conclusion that the only complete and final solution of the question is to be obtained by the conversion of the whole of the coal which we use for heat and power into electricity, and the recovery of its by-

products at a comparatively small number of great electricity producing stations. All our wants in the way of light, power, heat, and chemical action would then be met by a supply of electricity distributed all over the country."—[Extract from presidential address of Mr. S. Z. de Ferranti to the Institution of Electrical Engineers in 1910.]

The fuel and other economies and the industrial advantages of dealing with electricity supply for the country as a whole in a comprehensive manner—although appreciated and acted upon by many of those who are in the electric supply business—are not generally realised to-day by the industrial community or by the State.

The compact nature of our industrial districts and their proximity to each other as compared with those of other countries, such as the United States and Germany, make it economically possible and advantageous to deal with all the power requirements of the community in each industrial area from interconnected electrical power distribution systems tapping all sources of power, however scattered, and delivering electrical energy wherever required.

Power undertakings (electric power companies) have been started in most of the industrial areas of the country, and if these were developed throughout the country to the same extent as the system which has been for some time in operation on the North-East Coast, it is estimated that the resultant economies in coal consumption would, in the near future, amount to 25,000,000 tons per annum, and eventually to 50,000,000 or 60,000,000 tons per annum.

While on the North-East Coast and also in some other districts the generation and supply of electrical power is being developed on correct lines, it is still broadly true to say that, as regards the country as a whole, the requirements of each municipal area are dealt with separately, with the result that the average size of generating machine employed is certainly not more than a tenth—and probably not more than a twentieth—of what it ought to be. Under such conditions economical coal consumption is impossible. The result is cumulative because, on account of the small size of generating machine employed in public stations and the consequent low economy, manufacturers, railway companies, and other large power users in many districts are still compelled to run power plants of their own, and the use by many manufacturers of their own plant further reduces the average size of power generating machines, taking the country as a whole.

The only way in which public supply stations can secure the business of supplying all the manufactories in their neighbourhood is to have generating machines much larger than the largest individual manufacturer could find use for.

If instead of each municipal area being dealt with independently, there were one uniform interconnected electrical power distribution system throughout each industrial area, as we now have practically throughout the North-East Coast district, just as there is one railway system throughout the country with a uniform gauge, it is clear that, on account of the magnitude of the resultant load, it would be possible to secure the following results:—

1. The largest and most economical generating machines could be installed.

2. These could be located where large sites are available and land is cheap; where coal and water facilities are good; and in the best position having in view the probable eventual power requirements of the whole community, including factories, railways, and domestic users.

As regards reliability of supply—an essential condition—concentration of generating capacity in large units in conjunction with a main electrical power distribution system is not a source of danger, but the reverse, because by means of such an interconnected distribution system, one set of generating plant can act as spare to another, whereas, according to the present method of dealing with electricity supply by means of isolated networks, each supplied in general from one generating station, there is no duplication of generating stations or alternative ways of feeding a given area whatever.

Thus, if the community is to benefit by the electric supply industry being given the maximum chance of development, and if the erection of the most economical generating machines in the best possible positions for economical production is to be secured, and insisted upon, as it must be, by some central authority, the first thing to aim at is the establishment in each industrial district of a common interconnected electrical power distribution system.

As has already been indicated, such an ideal may be achieved in this country, on account of its compact nature, to an extent which is not possible in other countries. What is required is co-operation and joint working between the different company and municipal electric supply undertakings, and this, except in certain cases, has not been possible in the past, due largely to Parliamentary and municipal opposition. Many municipal undertakers are now as convinced as the power companies that this joint working is essential.

The erection of plants on roomy and efficient sites would materially facilitate the extraction of the by-products which can be obtained from the coal before it is consumed in the boiler furnace, wherever it is commercially possible to do so. Such by-products may be of as great a value to the community as the residue of fuel. It has been calculated that the requirements of the country in the way of manures, crude oils, oils for marine propulsion, and motor spirit for road traction can all be largely supplied as a by-product of our

own normal coal consumption, if only proper encouragement is given to the establishment of really economical electrical power distribution systems throughout the country.

An urgent matter for settlement is the standardisation and unification as rapidly as possible of the frequency and voltage adopted for distribution purposes in neighbouring localities. It is not proposed that uniformity of frequency and voltage should be established throughout the whole country, as this would entail the scrapping of a very large amount of valuable plant, but there would be no difficulty (and considering the issues at stake, comparatively little expense) in standardising a single frequency for each of the industrial areas of the country as follows:—

Midlands	25 cycles.
West of Scotland	25 "
North-East Coast	40 "
Lancashire	50 "
Yorkshire area	50 "

As regards the voltage, this will require careful consideration; on the North-East Coast we have standardised 20,000 volts, and in some of the other areas 10,000 volts have been adopted, but it is a question whether this is not too low for main trunk lines.

The Board of Trade already has a right to say what system (electrical) shall be adopted as regards all new undertakings or existing undertakings developing newly-acquired areas. As regards municipal undertakings which propose to adopt and/or extend electrical systems (plant or mains) of a type which would be inconsistent with development on uniform lines throughout the area in which they are situated, the Local Government Board could attach a condition to the loan to prevent this. The privately-owned concerns are not, of course, subject to Local Government Board control, but the powers of the Board of Trade as regards the sanction of systems to be adopted would probably be sufficient, and in any case the large power companies, who are the most important of the private concerns, operating as they do over large areas, are already fully alive to the necessity for standardisation and unification.

What is important is that a main interconnected electrical power distribution system should be established in each industrial area as soon as possible. To-day if a colliery owner has small and poor coal in his colliery which it does not pay him to bring up because it cannot stand the cost of transport, he cannot contemplate turning it into electricity at the pit mouth—extracting the by-product in doing so—because, except in certain areas where a trunk main system exists, there is no market for the electricity, there being no means of distributing or transmitting it. If a man has waste heat—or could, by improving his manufacturing or chemical process, combine it with the generation of power—there is no one to take his power.

In the above remarks I have considered the matter chiefly from the point of view of saving fuel; it is worthy of note, however, that interconnected electrical power distribution systems are essential if the capital charges and labour costs, which are very important items in the production of electricity, are to be kept to a minimum. This arises from the fact that it is only by supplying all the needs of the community from one system that the maximum use can be made of the plant. As a great many individuals in a given community do the same thing at the same time, what we must take advantage of is that the individual does not and cannot do half-a-dozen things at once. The economy of the combination of all requirements, power, traction, heating, and lighting is fundamental.

What is fundamentally and immediately necessary is the establishment of a national electrical trunk mains distribution system.

Proceeding on these lines we shall not be merely copying America or Germany—we shall be doing something that is right for England because it is England, and because England is radically different from other countries as regards the technical development and "lay out" necessary to secure cheap power. We have delayed making a start on right lines 15 years longer than was necessary; let us delay no longer.

The Production of Tungsten.—The tungsten production of the United States during the first six months of 1916 exceeded the production of that or any other country in any previous 12 months. Prices reached more than 10 times their ordinary level. The output was equivalent to about 3,290 short tons of concentrates carrying 60 per cent. WO₃ valued at \$9,113,000.

The total domestic output for the 12 months ended June 30th, 1916, probably amounted to about 5,000 tons.

The tremendous increase of prices caused by the need for "high speed" tools to cut war steel ordered by the governments of Europe caused the great increase in production.

The rapid increase in prices caused prospecting and consequent discoveries of new deposits, increase of development of known deposits, the operating at high pressure of old mills, and the hasty building of new mills. As a result, the production increased faster than the consumption and soon overran the demand that would absorb the output at the extremely high prices prevailing, so that a drop in prices was inevitable. June closed with the price around \$25 a unit. The normal price has been \$6 to \$7.—*Science.*

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

UNION OF SOUTH AFRICA.—By the provisions of Act No. 37 of 1916, various amendments have been made in the import duties specified in the South African Customs Tariff Act of 1914. These amendments consist partly of the increased duties imposed last year, which lapsed on March 31st, 1916, and which are now re-imposed till June 30th, 1917, unless otherwise enacted by the Union Parliament; and partly of new duties which have no date assigned for their termination.

Among the duties re-imposed as mentioned above is the general *ad valorem* rate of 20 per cent. on "all goods, wares, and merchandise not elsewhere charged with duty and not in the Free List and not prohibited to be imported," with a rebate of 3 per cent. *ad valorem* on goods produced in the United Kingdom or reciprocating British Possessions. This item includes such electrical goods as electric torches and refiles therefore, spare printed records for electric meters, electric motor hair brushes, electroliers, and electric fuses for blasting purposes.

BRITISH INDIA.—New regulations dated July 22nd last prohibit the importation, otherwise than by parcel post, of all goods from the United Kingdom which had previously been imported into that country from Norway, Sweden, Denmark, Belgium, Holland, and Switzerland, unless copies of the "Specification for Foreign and Colonial Merchandise" (Form 30) or the "Shipping Bill" (Form 64), as the case may be, duly certified by the Customs authorities in the United Kingdom, are presented to the Customs collector at the port of import in respect of such goods.

It is provided, however, that this shall not apply to goods which, on import direct from the foreign countries specified above, are not required to be covered by certificates of origin. It is provided also that the Customs collector may, in his discretion, allow delivery of any goods exported from the United Kingdom which have been imported into that country from the other European countries aforesaid, even if unaccompanied by certified copies of the documents above prescribed, on condition that the importer executes a bond to the amount of three times the value of the goods for the due production of the prescribed documents within a period to be specified in the bond, or furnishes a deposit to the like amount which shall be liable to forfeiture if the said documents are not produced within such period as the Customs collector may direct.

PORTUGAL.—As a consequence of the passing of the Anglo-Portuguese Commercial Treaty Act, 1916, which received the Royal Assent on August 23rd, the Treaty of Commerce and Navigation between Great Britain and Portugal which was signed at Lisbon on August 12th, 1914, and ratified on May 20th, 1916, will come into full force and effect as from September 23rd.

Under Article 5 of the Treaty the trade of the United Kingdom will benefit by the application, to certain classes of articles produced or manufactured in this country, of the special rates of duty which have been conceded by Portugal in respect of such articles under her commercial arrangements with Russia, the Netherlands, and France.

Article 8 exempts merchandise produced in one country and passing in transit through the other from all transit duties, &c.

Article 10 contains the following provisions in regard to commercial travellers and their samples:—

"The stipulations of the present Treaty with regard to the mutual accord of the treatment of the most favoured nation apply unconditionally to the treatment of commercial travellers and their samples. The Chambers of Commerce, as well as other trade associations and other recognised commercial associations in the contracting States as may be authorised in this behalf shall be mutually accepted as competent authorities for issuing any certificates that may be required for commercial travellers.

"Articles imported by commercial travellers as samples shall, in each country, be temporarily admitted free of duty on compliance with the Customs regulations and formalities established to assure their re-exportation or the payment of the prescribed Customs duties if not re-exported within the period allowed by law. But the foregoing privilege shall not extend to articles which, owing to their quantity or value, cannot be considered as samples, or which, owing to their nature, could not be identified upon re-exportation.

"In order to facilitate the clearance of samples of goods brought by commercial travellers of one of the two States into the territories of the other to be used as samples or patterns for the purpose of obtaining orders and not for sale, the marks, stamps, or seals affixed by the Customs authorities of one country to commercial samples at the time of exportation, and the list of such samples drawn up in proper form and certified by the competent authority, such list containing an exact description of the samples, shall form sufficient evidence, so far as the respective Customs authorities are concerned, of their nature, and shall entitle them to exemption from all Customs examination except in so far as may be necessary to establish that the samples produced are identical with those enumerated in the list. The Customs authorities of either country are, however, at liberty to affix a supple-

arbitrary mark for such samples, should this precaution in particular cases be considered necessary.

NEW TARIFF.—The following Customs decisions have been recently issued and are of interest:

Electric cables, in sets, with terminals attached, specially suited for use in connection with electric ignition of motor vehicle engines, are dutiable under No. 169A of the Tariff at the rate of 10 per cent. *ad valorem* on goods manufactured in any part of the British Empire, and 20 per cent. on foreign goods.

Wooden poles for carrying electric wires, shaped by hewing only, when imported without metal attachments are free of duty; when imported with metal attachments permanently fixed, they are dutiable under No. 176 of the Tariff at the rate of 20 per cent. *ad valorem* on British goods and 30 per cent. *ad valorem* on foreign goods.

NOTE.—A preliminary duty of 1 per cent. *ad valorem* is levied on the above goods in accordance with the Finance Act, 1915. This duty is payable on importation, and is levied irrespective of whether the goods are otherwise liable to duty or not.]

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Patents applied for by: **THE PATENT OFFICE, 25, Abchurch Lane, London, E.C. 4, and at Liverpool and Belfast.**

- 12,125. "Apparatus for heating electrically." **D. M. BROOKS,** August 28th.
- 12,126. "Internal-combustion engines." **W. H. LAY,** August 28th.
- 12,127. "Device for heating water electrically." **D. M. BROOKS,** August 28th.
- 12,128. "Vaporisers for heavy liquid fuels for internal-combustion engines." **F. W. BAKER,** August 28th.
- 12,129. "Electric furnaces." **BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.),** August 28th.
- 12,130. "Electrical switches." **M. BROOKS, J. E. FRANKS, A. E. READ and WALSHAM HARDWARE MANUFACTURING CO.,** August 28th.
- 12,131. "Variable capacity for liquid-vacuum transmission systems." **G. CONSTANTINCO,** August 28th.
- 12,132. "Railway signalling apparatus." **C. CHEVALIER,** August 28th.
- 12,133. "Vapour electric converters." **BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO.,** August 28th. (U.S.A., August 28th, 1915.)
- 12,134. "Automatic and semi-automatic telephone systems." **O. GRAHN and RELAY AUTOMATIC TELEPHONE CO.,** August 28th.
- 12,135. "Insulation of electric cables." **H. THIEGEN,** August 28th.
- 12,136. "Electric lamps." **H. J. T. COOK,** August 28th.
- 12,137. "Rheostats for starting electric motors." **C. KOSNICK,** August 28th.
- 12,138. "Electric furnaces." **BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.),** August 29th.
- 12,139. "Induction electric motors." **G. PESTARINI,** August 29th.
- 12,140. "Apparatus for controlling electric circuit of flash signs, &c." **A. MEIER & C. ROSSIGNOL,** August 29th.
- 12,141. "Aeroplanes, airships, &c." **W. E. COCKS,** August 29th.
- 12,142. "Carburetors for internal-combustion engines." **G. E. BRADSHAW,** August 30th.
- 12,143. "Combined starting device and auxiliary air valve for internal-combustion engines." **E. RUSSELL,** August 30th.
- 12,144. "Electric furnaces." **BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.),** August 30th.
- 12,145. "Field service exchange." **R. RANDALL,** August 30th.
- 12,146. "Spark plugs for internal-combustion engines." **R. G. BOOTH,** August 30th.
- 12,147. "Ignition terminals for aeroplane engines, &c." **R. G. BOOTH,** August 30th.
- 12,148. "Apparatus for converting or transforming electric currents." **K. T. WANG,** August 30th.
- 12,149. "Carburettor and feeding apparatus for internal-combustion engines." **W. P. KELLY & D. C. SLATTERY,** August 31st.
- 12,150. "Trolley poles for electric trolleys, &c." **T. WARSON,** August 31st.
- 12,151. "Carburetors." **W. H. SMITH,** August 31st.
- 12,152. "Systems of electric motor control." **BRITISH THOMSON-HOUSTON CO. and H. F. FARMER & H. C. HASTINGS,** August 31st.
- 12,153. "Regenerative braking systems." **T. H. THOMAS & W. V. TURNER,** August 31st. (U.S.A., February 5th.)
- 12,154. "Automatic train-control systems." **W. V. TURNER,** August 31st U.S.A., April 1st.
- 12,155. "Internal-combustion engines." **I. V. RAMSDEN,** August 31st.
- 12,156. "Electrical warming apparatus." **J. BEIN,** September 1st.
- 12,157. "Magnetic chucks." **H. HUMPHREYS,** September 1st.
- 12,158. "Valve-operating mechanism for internal-combustion engines." **L. CANTALEN and SUNBEAM MOTOR CAR CO.,** September 1st.
- 12,159. "Internal-combustion engines for aircraft, &c." **W. H. PEIRCE,** September 1st.
- 12,160. "Means for operating apparatus at receiving station from sending station by electric pulsations." **A. J. SARNMARK,** September 1st. (Sweden, September 7th, 1915.)
- 12,161. "Electric furnace." **I. RENNEDER,** September 1st. (Sweden, September 8th, 1915.)
- 12,162. "Telephone systems." **AUTOMATIC TELEPHONE MANUFACTURING CO. and A. J. RAY,** September 1st.
- 12,163. "Signalling apparatus for mines, &c." **L. J. D. HOLMES, H. S. HOLMES & W. HOLMES,** September 1st.
- 12,164. "Safety controlling gear for electrically-propelled vehicles." **F. GARRETT & H. K. PRATT,** September 1st.
- 12,165. "Means for control electrically of signal indicators of mine hauling systems, winding engines, &c." **I. P. FEINBERG,** September 1st.
- 12,166. "Arrangement of regulator and circuit interrupter fixed upon electric generators having a variable speed." **Soc. ANON. pour l'Équipement Électrique des Véhicules Sup. Les L. (France),** No. 29, 1915.
- 12,167. "Internal combustion engines." **F. SMAL,** September 2nd.
- 12,168. "Measuring instruments." **BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.),** September 2nd.
- 12,169. "Method of cranking engines." **J. G. P. THOMAS & THOMAS TRANSMISSION, LTD.,** September 2nd.

- 12,170. "Resonance apparatus for alternating-current distribution systems." **I. RENNEDER,** September 2nd.
- 12,171. "Electric signalling systems." **F. G. BELL, W. C. DAVIES and STERLING TELEPHONE & ELECTRIC CO.,** September 2nd.
- 12,172. "Conduits." **A. E. BODRIAN & DAVIER CO.,** September 2nd.
- 12,173. "Detection of electrical apparatus." **W. HAYDOCK,** September 2nd.

PUBLISHED SPECIFICATIONS.

1914.

- 7,436. "ELECTROMAGNETIC MEANS FOR VIBRATING PIANO STRINGS AND THE LIKE." **A. H. MOTT & A. H. G. MARTIN,** March 23rd.

1915.

- 11,600. "TELEPHONE SYSTEMS. Relay Automatic Telephone Co., F. M. Ward, G. H. Bryant & T. M. Inman. August 11th. (Cognate application, 1,869/16.)
- 11,655. "TELEPHONE SYSTEMS. Automatic Telephone Co. & W. Aitken. August 12th.
- 11,678. "INTERNAL-COMBUSTION ENGINES. A. R. Brougham. August 12th.
- 11,690. "ELECTRIC REGULATOR OR GOVERNOR. B. O. Holm Hansen. August 12th.
- 11,945. "DYNAMO-ELECTRIC MACHINES. A. H. Neuland. August 18th.
- 11,974. "DRIVING AND CONTROLLING DYNAMO-ELECTRIC GENERATORS. W. E. W. Rhodes & J. Firth. August 19th. (Cognate application, 13,469/15.)
- 11,981. "ELECTRICAL FLASHER. W. Reed-Lethbridge. August 19th.
- 12,314. "ELECTRICAL INSTRUMENTS OF THE MOVING COIL TYPE. S. F. Palmer. I. Deham & Percival, Ltd. August 26th.
- 12,361. "SYSTEMS OF ELECTRIC SHIP PROPULSION. British Thomson-Houston Co. (General Electric Co., U.S.A.). August 27th.
- 12,868. "ELECTRIC MOTOR CONTROL SYSTEMS. British Thomson-Houston Co. (General Electric Co., U.S.A.). September 8th.
- 13,556. "STARTING GEAR FOR INTERNAL-COMBUSTION ENGINES. H. J. Craymer and H. P. Simpson. September 23rd. (Cognate applications, 16,169/16 and 338/16.)
- 13,717. "INTERNAL-COMBUSTION ENGINES. F. W. Golby. September 27th. (Franklin R. Wright, U.S.A.)
- 13,768. "LUBRICATORS FOR INTERNAL-COMBUSTION ENGINES. D. McGregor. September 28th.
- 13,815. "IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. H. R. Van Deventer. September 28th. (October 1st, 1914.)
- 14,311. "SYSTEM FOR THE GENERATION OF ELECTRIC CURRENTS. C. F. Benitez. October 9th. (Addition to 17,811/14.)
- 14,436. "COUPLING FOR MECHANICALLY AND ELECTRICALLY CONNECTING WIRES, METAL CORDS, AND THE LIKE. O. Bejma-Riva. October 12th.
- 15,107. "STARTING APPARATUS FOR INTERNAL-COMBUSTION ENGINES. Sir K. I. Crossley, W. M. Huskinson & L. F. Barley. October 26th.
- 15,695. "METHODS OF MAKING VITREOUS BODIES. British Thomson-Houston Co. (General Electric Co., U.S.A.). November 6th.
- 16,695. "ELECTRIC ARC LAMPS. A. H. Railing & A. E. Angold. November 26th.
- 17,901. "EARTH CURRENT DETECTORS AND CUT-OUTS FOR ELECTRICAL CIRCUITS." **J. John & W. J. John,** December 22nd.

1916.

- 826. "PROTECTING APPARATUS FOR VEHICLES." **Electric Light Co.** March 30th, 1916. (100,221.)
- 1,374. "MEANS FOR CONTROLLING AND REGULATING ELECTRIC MOTORS. Igran Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.). (101,103.)
- 1,483. "ELECTRO-MAGNETIC RELEASE OR CUT-OUT. A. Pantini. January 31st, 1916. (101,104.)
- 2,234. "COMBINED VAPORISING AND INDUCTION PIPE FOR USING MIXED OR HEAVY FUELS IN CONNECTION WITH INTERNAL-COMBUSTION ENGINES. A. Gray, J. Gaskill & W. T. Wilkes. (Cognate application, 5,392/16.) (101,111.)
- 3,808. "INTERNAL-COMBUSTION ENGINES. E. T. W. Addyman. March 14th, 1916. (101,115.)
- 6,541. "ELECTRO-MAGNETIC RELAYS. Siemens & Halske Akt. Ges. June 22nd, 1915. (100,732.)
- 6,648. "MEANS FOR SUPPLYING COMBUSTIBLE CHARGES TO INTERNAL-COMBUSTION ENGINES. G. C. Henderson. May 9th, 1916. (Addition to 5,620/14.) (101,132.)
- 6,696. "MEANS FOR DIMINISHING STATIC ELECTRICITY FROM A MOVING PICTURE FILM OF THE LIKE." **C. Van Deventer.** May 17th, 1915. (100,487.)

Cuba.—The U.S. Consul, writing on the trade future in Cienfuegos, concludes thus:—"One result is certain in connection with the extension and maintenance of trade now secured—success to any marked degree will never be attained through correspondence solely, excepting in the mail-order business in the relatively smaller articles. In the extension of trade the direct contact of representatives and prospective purchasers will accomplish greater and more satisfactory results than by long-distance negotiations and catalogues. And by representatives is meant men who not only know the business they represent, but the language of the country as well. . . . Looking still farther ahead, Cuba need be but a stopping-off place, but one point of an extended route covering Central and South America. To hold trade once secured the eradication of one evil at least is absolutely necessary, that of substitution. In Europe, should a house not have the exact article desired, it is secured from other sources and, if need be, regardless of cost, in order that the customer may be accommodated and his trade retained. Extension and retention of trade will be governed entirely by merit and business accommodation. Merit will not terminate in the article itself, but includes as well the way in which it is presented for sale and packed for shipment, details in which European countries excel."

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LABOUR AND DEMOBILISATION.

IN our recent series of articles on "Labour and Industry" we reviewed the demands of the various groups which were being formed by Labour. As we stated at the time, there were matters included in some of these programmes which had been the dreams of Socialists for many a long day, but which it would be quite unprofitable to discuss while the guns were still at work. The new atmosphere after the war will probably lead the nation on to new ideas regarding some things that we were hardly willing to regard as matters for serious argument in the former days of Peace, and it will be for the good of all if, for the moment, we leave these aside and consider the basal matters which will inevitably cry aloud for all the serious thought that we can devote to them, because upon these the new state of things will rest. Whatever the future may bring in regard to the relations of Capital and Labour, and the attitude of the different classes in society towards each other, the subject of demobilisation will be one of the greatest questions that we have ever had to settle. It may be said that upon the manner in which we deal with that problem will most largely depend the atmosphere, peaceful or turbulent, of the nation after the war. Nobody knows either when the war will end or approximately how many men will return to the ranks of industry. But, whenever the time, and whatever the number, the setting up of the machinery for dealing effectively with the vast work and questions attending demobilisation must not be delayed. It is therefore satisfactory to know that Mr. Asquith, in his reply to the Triple Labour Alliance, has stated that demobilisation shall be gradual, and that in a very short space of time the Demobilisation Committee will be able to formulate conclusions to enable the Government to set up in advance machinery which can be brought into active co-operation the moment hostilities definitely cease. With most of us it has been a foregone conclusion that demobilisation would be gradual, and it has been stated in Parliament again and again; indeed, already, slowly and in a small way, the work of demobilisation has begun by the return of disabled and other discharged soldiers to civil life. It may be that many more now at home will have to be combed out of factory and other occupations to take the places of these in the fighting forces. Yet the demobilisation machinery for releasing millions must be in preparation even while more men are being mobilised, or we shall not have plans suited to the circumstances of the case prepared in time. The Government has appointed a new Committee representative of

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4, Ludgate Hill, London, E.C.

Labour interests to enter with it, and probably the Committee will formulate the conclusions of the Demobilisation Committee. Of course, the Government will understand that it can reckon upon the whole-hearted support of our manufacturing and industrial concerns in whatever efforts may be made to facilitate the return of men to civil occupations. It is hardly likely after all that our industrial leaders have done to provide the wherewithal for war that the value of their experience and counsel will be overlooked when the question of providing employment for returned soldiers presses. As Prof. Flinders Petrie very wisely pointed out in the *Times* on Tuesday last, in a timely letter on "Recuperation," what is so important is that in dealing with this matter we begin at the right end. He shows how essential it is to produce food, and goods for export, in order to restore our proper prices of goods and labour, and that until we do so we cannot undertake works that do not give immediate returns. "When we read of railways, tunnels, harbours, or municipal glorifications, is it supposed that the sky rains wages for such work? Will not every pound raised for this be a direct hindrance to more needful business?" He goes on to say that until we shall have crowded in every man that can be used on the business of food and exports, no men or money should be taken off for anything else, and that "every pound raised in rates or taxes 'to provide work' is a direct blow to the recovery of the nation." "If rates and taxes can be raised, better let Government lend the money to promoting farming and trade rather than spend it on withdrawing labour on works which can be postponed without any damage." It is obvious that the industrial activities of the nation are a matter of the first concern in connection with the question of demobilisation, and after the recent discussions at the Trade Union Congress we may be sure that this aspect of the problem will be before the minds of the newly-appointed Labour Committee, of the Demobilisation Committee, and of the Reconstruction Committee of the Cabinet. We hope, with the Prime Minister, that it will indeed be only "a very short time" before the Demobilisation Committee is able to begin, in its commandeered abode, its immense and momentous activities. The eyes of the returning soldiers and of the nation as a whole will be turned in that direction, and if it proceeds with its great task with suitable thoroughness and expedition, it may rest assured that it will have the good wishes of all, and particularly of those who are concerned with the great engineering industries of the Empire, and are anxious to contribute their full share toward securing industrial harmony upon a sure and lasting foundation—prosperous industry assuring a fair recompense alike for Capital and Labour.

We have no desire to exaggerate "Out, Damned Spot!" the importance of the Asseling Army Clothing scandal, but we may at least be permitted to relieve our feelings by saying that it is damnable that when we are fighting a corrupt foe, with motives which have raised British prestige higher than ever in the eyes of the whole civilised world, there should be corruption in our own midst. If the Asseling case were an isolated occurrence there would be little need to unduly concern ourselves, for in every community there are to be found some traitors to the public interest, some who are willing to betray their trust and sell a birthright of honour for a mess of pottage. These things have occurred on both sides—the Allies and the Enemies have all, according to briefly reported occurrences, had their experiences of them, while across the ocean westwards there is

such a term as "graft." In normal times we have had our Prevention of Corruption Acts to deal with bribes sought and paid in connection with business contracts, but the law is in an anomalous condition, and is, we fear, too seldom put into force.

In this case the Courts have dealt with a strong hand with the principal offender, but we join in the judge's regret that others who were knowingly parties to these grave irregularities could not be made to suffer in a way other than by damage to their business reputation. What is, perhaps, as lamentable as anything in connection with the whole affair is that such irregularities should be possible, the opportunity having been afforded by inefficiency in the control of a Government department which must have been responsible for the spending of many millions of pounds during the last two years. A pretty commentary this upon the business methods of a public department! We hear much about waste in public affairs, listen to many speeches on the need for economy all round, watch the recommendations of a Retrenchment Committee and its strange dealings with the necessary Consular activities, and all the while we are so entangled in our confusing maze of red tape that it is possible for the business system (save the mark!) in public departments to pass with five-and-twenty approving ticks a document which ultimately proves to be false. We have seen something of this elaborate passing of documents from one department to another, and know something of the waste of time and labour, and, therefore, of public money, that is involved, unless it lead to efficiency and the proper safeguarding of public interests. How often have grants for small necessities been quibbled at and delayed, whilst big amounts have been approved with the smallest amount of supervision! Really, when we talk of the need for better business organisation in connection with industry we must not shut our eyes to the crying need for it in higher places. We have not an ounce of sympathy with either party to the clothing fraud. They have been found out, and because of that must drink the cup of consequences to the last dregs. But what of the department which could, and should, have prevented it? We admit that the work falling on Government departments is far in excess of what it was ever dreamt it would be, and our war purchases probably run into millions a day, but it should not be beyond the ability of experienced men of business, of whom thousands are giving their services ungrudgingly to the State in these days, to devise means for preventing leakages of this kind and removing easy opportunities of gain from the path of unscrupulous servants and contractors. These and some other things make one wonder what would have been the cost of the war if we had been able to conduct it as one great business undertaking, efficiently and economically from start to finish.

ALTHOUGH the talk of a recrudescence of scarcity in copper may seem to be somewhat exaggerated,

Copper. the position has admittedly gathered considerable strength in the last few weeks, as testified by the renewed marking up of prices, and the tendency is seemingly still upward, so far as can be gauged from the insatiable demand going on, chiefly for munition purposes, and from the more sparing offers coming on the market from all quarters. The price of standard copper, which not long ago had fallen back to about £107, has again advanced to the extent of some £10 a ton, although the price is now inclined to fluctuate pending further developments in the general demand. The market has naturally been quickly affected by the fact that very few war-rants are coming on offer, or are at all available, while sellers are entirely influenced by the strong

character of the American advices received for weeks past.

Speculative offers are now, of course, out of the question, since dealings outside legitimate business are entirely prohibited under the regulations of the Defence of the Realm Act. There is another restraining feature to be mentioned which has doubtless had some bearing on the state of the market, and that is that certain home producers, who until recently sold part of their output of rough bar copper in the shape of warrants on the official market, are now only selling to consumers direct, and thus avoiding dealers. Trading in fine copper to meet requirements for munitions has been on a considerable scale, the orders placed for Russia through the medium of the British authorities having assumed quite heavy dimensions for shipment in the course of the remaining months of this year. Both Japanese and Australian producers have had an excellent opportunity to sell all they had at their disposal for shipment in the next few months. In order to complete these orders, a substantial tonnage has had to be obtained from American sources. The sales made in America for domestic consumption in the second half of August, and in the early part of this month, were also abnormally heavy, and this largely explains the decidedly more independent attitude of the copper magnates whose prospective output, it is suggested, has been already pretty well placed for three months or so ahead. Spot metal has become rather scarce in America, and those consumers who have neglected to cover their needs are now entirely in the hands of sellers. Prices there have risen to fully 28½ cents per lb., and on this side there is very little electrolytic obtainable for near delivery at a good premium, the value of near shipments standing at about £134 c.i.f. European ports.

As indications point to an extension of the war well into next year, it is probable that a steady demand has yet to be reckoned with for many months to come, and it is obvious, therefore, that American producers are more optimistic than ever as to the future of the metal. America is at present probably consuming at the rate of well over 50,000 tons a month, so that with a total refinery output of about 85,000 tons the balance is none too much to provide for regular large shipments to this side. The quantities accounted for within the last three months amount to roughly 107,000 tons, which should certainly be quite sufficient to keep pace with the enormous output of munitions by the Allies, though the fact is significant that additional orders had recently to be placed with the American munition factories for big quantities of material. Munition works in this country are doubtless getting a full supply of metal released to them by the authorities, but there is now a good deal of talk having regard to the further large prospective orders to be placed in America by Allied Governments to provide for needs over the first half of next year. The stability of the market over the end of this year, at any rate, seems pretty well assured.

Electricity Supply and Government Control.

ELSEWHERE in this issue a correspondent draws attention to the question of "Government control of electricity supply undertakings," and endeavours to clarify the situation by stating what he believes to be the actual facts of the case. Whether he has succeeded in the attempt is somewhat questionable; at any rate, we think his sketch of the history of the subject is open to correction. The proposal that some kind of Government control should be exercised over the public supply of electricity is no new idea; it was brought into prominence by Mr. R. A. Chattock in an article published in the ELECTRICAL REVIEW on December 19th, 1913, and was further elaborated by him in his presidential address to the

I.M.E.A., abstracted in our issue of June 19th, 1914. While Mr. Chattock—though a municipal engineer—boldly advocated the nationalisation of the electricity supply industry, a proposal which did not gain much support, his object was the same as that of the present movement—the centralisation of generating plant under the most efficient conditions, and the unification of systems of distribution and supply. The immediate origin of the recent discussions, however, was the paper submitted to the Institution of Electrical Engineers by Mr. E. T. Williams, in January last, which, in an abbreviated form, was used by the Council of the Institution to inaugurate a general discussion of the question on April 13th, and it is quite wide of the mark to give "the first place" to the committee appointed by the Board of Trade at the end of April to report upon the position of the electrical trades after the war, with special reference to international competition.

As our correspondent points out, the recommendation of the Council of the Institution with regard to State control—which arose directly out of the discussions above referred to, and the general consensus of opinion amongst electrical engineers in favour of the introduction of some such system of control—appears to be outside the reference of the Committee; in reality, however, it is not. By securing more economical conditions of generation and distribution, thus cheapening the supply of electricity for all purposes, including motive power, the productive capacity of electrical (and other) factories would be increased, the internal demand for electrical apparatus would be stimulated, and the scale of operations would be magnified—all valuable aids towards developing the export of electrical goods and apparatus from this country, as well as internal trade. At the same time, the consumption of coal and stores would be decreased, and other advantages would be gained, which have already been set forth in our columns. It is clear, therefore, that the recommendation was in order as having a direct bearing upon the welfare of the electrical trades.

That the shareholder should protest is customary and inevitable; we cast no stone at him on that account. If he does not look after his own interests, who will do it for him? But that his protests are based upon misapprehension, and pardonable ignorance of the truth, is clear. The shareholder, as a rule, is not a technical man, and cannot be expected to appreciate the position without assistance. We believe that Government control, in the form and to the extent that are proposed, would make for his advantage, and in support of this contention we may cite as a witness Mr. C. H. Merz, whose views were briefly published in our last issue. As the chief electrical adviser to the largest and most influential body of electricity supply shareholders in this country, Mr. Merz cannot be suspected of hostile intentions towards the interests of shareholders when he advocates the policy in question. We may also point out that the recommendation was submitted to the Committee, on behalf of the Council of the I.E.E., by the President, Mr. C. P. Sparks, consulting engineer to a great company, and though we cannot certify that he personally endorses it, we have no reason to suppose the contrary.

But another consideration which, to our mind, should over-ride all others without exception, is that it is believed by the leaders of the electrical industry that Government control of the supply industry would conduce to the national welfare. Before this argument all other interests must give place.

The proposal to substitute "arbitration" for "control" does not appeal to us; we have seen what delays, expense, and sometimes futility result from arbitration. Under present conditions a firm hand is necessary, and while we are definitely opposed to any attempt at the nationalisation of industry, we should welcome the enlightened but resolute control of an appropriate tribunal.

MERCURY-ARC RECTIFIER FOR CHARGING SMALL BATTERIES.

In a recent article in the *General Electric Review*, C. N. Green described the small portable mercury-arc rectifier known as Form K, which is being built in increasing quantities (by the General Electric Co., U.S.A.), and of which over a 1,000 outfits have been shipped to various parts of the United States, Manila, Australia, Cula and South America.

The device is filling the demand created by the extensive use of small batteries on automobiles, launches, &c.; even when a car is fitted with a generator it may be necessary to

and the rectifier when making connections for charging. This reversed connection resulted in the battery discharging through the rectifier, thereby materially increasing the current, which was usually followed by the loss of the tube. To overcome this difficulty, the Form K2 rectifier has been equipped with a fuse in one side of the supply line. When this fuse blows, the battery cannot further discharge, and the loss of the rectifier tube by over-heating is prevented. The change in connections from 3-cell to 6-cell load was made in the Form K rectifier by transferring the lead from one binding-post connector on the series reactance coil to another, which required the use of a screwdriver. In the Form K2 rectifier this is accomplished by simply transferring the fuse from one side to the other of the double-pole fuse block (see fig. 3).

The method of holding the cover to the base has also

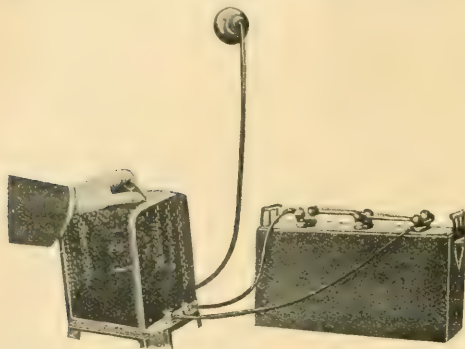


FIG. 1. RECTIFIER CONNECTED TO BATTERY.

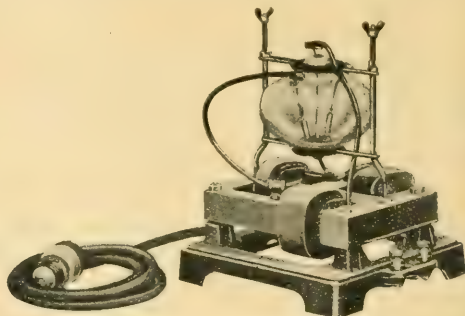


FIG. 2. -RECTIFIER WITH COVER REMOVED.

charge the battery independently during periods of idleness of the car.

The type of rectifier known as Type MS, Form K, will deliver 5 amperes at 7.5 or 15 volts, depending upon the connection, and may be connected to an ordinary lamp socket. It is designed to charge one 3-cell, one 6-cell, or two 3-cell batteries, and can be furnished for operation on 25, 30, 40, 50, 60, 125 or 133-cycle, 110-volt circuits.

A later modification of the Form K rectifier is that styled the Form K2, which has been improved with a view to making it more or less foolproof.

The rectifier consists of a metal case, on which are mounted the necessary reactive coils, the rectifier tube, and a suitable holder, all of which are protected by a sheet-metal cover.

been changed; four small machine screws, which were very liable to get lost, have been replaced by two wing nuts, one on each side of the handle. Spring connectors have been substituted for screw connectors on the leads to the rectifier tube. The Form K2 rectifier is compact; its outside dimensions being, roughly, 8 in. wide, 9 $\frac{1}{8}$ in. long, and 19 $\frac{5}{8}$ in. high for 60 cycles and above, and 11 $\frac{1}{2}$ in. high for 25 to 50 cycles. The net weight of the 60-cycle outfit is

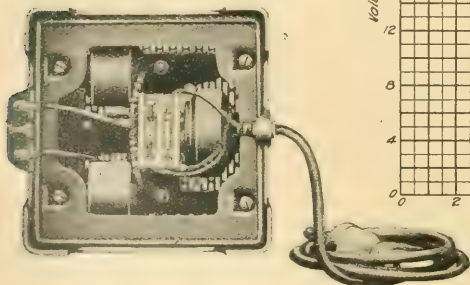


FIG. 3. BASE OF RECTIFIER, SHOWING FUSE.

The device is supplied with an attachment plug that may be inserted in a lamp socket and two binding posts, marked + and -, from which wires are run to the battery to be charged. This arrangement makes it unnecessary to remove the battery from the car. In other words, the charging apparatus is ordinarily much lighter and more convenient to move than the battery.

There have been cases where difficulty has been experienced by the reversal of the connecting leads between the battery

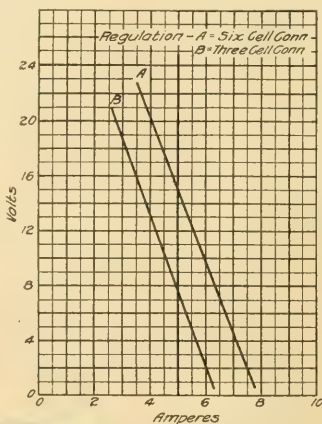


FIG. 4.—CURVES SHOWING REGULATION.

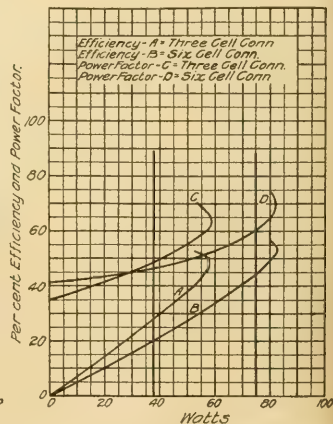


FIG. 5.—CURVES OF EFFICIENCY AND POWER FACTOR.

approximately 18 lb., which enables it to be readily carried from place to place.

The rectifier tube is spherical, and has no pockets in which mercury can be trapped, with the possible result of the tube being broken in shipment. The two anodes and cathode are sealed into the upper part of the condensing chamber, and extend downward into the tube. The tube is 4 $\frac{1}{2}$ in. in diameter by about 4 in. high, and has bosses top and bottom to prevent it from turning in the holder. Its weight is approximately 8 oz. The rectifier is shipped with the rectifier tube assembled, so that it is ready for connecting to a battery after being unpacked.

Rectifier tubes, when shipped separately, are packed in excelsior in paper cartons 8 in. by 8 in. by 9 in.; the Parcel Post Service may be employed. The gross weight is less

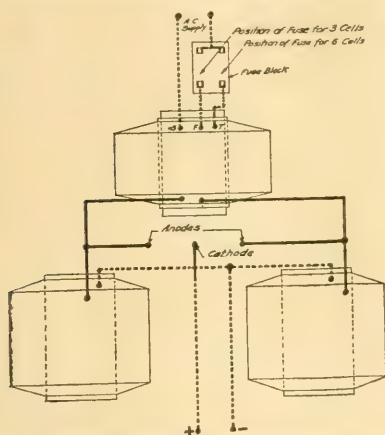


FIG. 6.—DIAGRAM OF CONNECTIONS.

than 2 lb. This method of packing, together with the rugged construction of the tube, has resulted in very few losses in transportation.

THE INSTITUTION WIRING RULES.

By DONALD SMEATON MUNRO.

THE Wiring Rules of the Institution of Electrical Engineers were this year presented, altered and revised for the seventh time. A Standing Committee of 20 has sat 24 times since 1911 and considered upwards of 500 amendments. The use of the revised rules is recommended by the Incorporated Association of Electric Power Companies, the Incorporated Municipal Electrical Association, the electricity supply companies of London, and the principal supply companies of the provinces. All the insurance companies were asked individually whether they would adopt the rules, and all—even at last the "Phoenix"—have said "yes." So we should expect, and actually do find, that the new rules are in many ways superior to their predecessors. Yet there remain a few things which are not quite clear.

No information is available as to what is the interpretation which each or all of the insurance companies would give to the word "adopt." The point is important. Have all buildings at present insured to be re-wired in accordance with the revised regulations? If so, what days or years of grace are granted? Must all buildings, now being fitted, conform in detail with the revised rules? The first paragraph states that the rules are not intended to take the place of a detailed specification. Now whether the specification be prepared by a good consulting engineer, a rascally contractor, or even an "expert" in the pay of an insurance company, there are almost sure to be points of divergence from the text; will the insurance companies "adopt" these divergencies too, because they are part of a detailed specification?

In actual practice we have found for the most part that, owing to competition, indifference, or ignorance, insurance companies do not make definite inquiry or investigation into details of wiring—even when claims arise. And the Wiring Rules, so far as these are concerned, are neglected as well as adopted.

If our industry were orderly, the insurance companies might have in each district a group of inspectors trained in electrical risks, and paid such salaries as to be above suspicion of favouritism, and free from the need of competition with regular consultants; or, alternatively, the companies might employ consultants. Only with some such arrangement could the insurance people undertake the responsibilities of the adoption of any set of wiring rules.

In the May report of the Council of the Institution, it is stated that the new wiring rules have been accepted as standard practice by the representative associations of the municipal and private supply companies. This also is not very clear. Do these powerful people now mean to conform to rules with regard to their station and service details and their free-wiring schemes, or do they simply mean to enforce rules on others, as has been their pleasing habit?

The phrasing of the rules has altered between editions, and, for the most part, the alterations are improvements. The fact that the rules overlap and have to be considered in relation to the Board of Trade, the Home Office Regulations, &c., &c., gives a certain impression of raggedness to the whole collection.

Nineteen definitions are given, and these range from elemental things like "bare" and "dielectric" to a "pipe-ventilated machine." When the latter class of apparatus is reached, one wonders why the definitions stop short and do not wander on to "oil-cooled transformers," and the like, for the kind of person who wants a pipe-ventilated machine defined would, I feel sure, also like to hear about an oil-cooled transformer. As in the former issue, the definitions are numbered consecutively with the rules; this hampers freedom in extending definitions as they are required, and means that one cannot refer to definite paragraphs in the various editions under the same numeral.

Several of the definitions are as stated in the Home Office Rules. Some of the others are neither crisp nor clear. "Switchboard," for instance, is defined as "An assemblage of switches, fuses, conductors, measuring instruments, and other apparatus for the control of electrical machinery and circuits." This description might equally well define a contractor's store-room or a full packing case after an electrical exhibition.

Then the two most important new definitions—Nos. 16 and 17—are given in a manner reminiscent of the clock which indicates 5-35, strikes 9, and means ten-to-three. These refer to grades of insulation of cables, and the first one reads: "Vulcanised rubber cable is said to be I.E.E. 250-volt cable when the minimum radial thickness of its dielectric is that shown in Col. 9 of the Table, and when its minimum insulation resistance is that shown in Col. 5 after application of a pressure test of 1,000 volts for half an hour." Is it not possible, with a very perishable rubber mixture, for a cable, when new, to pass these stated tests? As time is a stated element in the pressure test, should there not be definite guidance in respect of some indication during and after test as to the effect of the half-hour's pressure other than complete breakdown within that period?

The next similar definition refers to I.E.E. 650-volt cable, which has to undergo a test of 2,500 volts.

These two descriptions of cable (the I.E.E. 250-volt and the I.E.E. 650-volt) are evidently to displace the 600-megohm and the 2,500-megohm classification of the Cable Makers' Association. But it would appear that while the C.M.A. 600- and 2,500-megohm cables conform to the new standard for pressures up to 250 volts, a special new class of cable, with thicker dielectric, is required for medium pressures.

The good rule No. 24, which re-appears at the

beginning of the General Arrangement Section, stating that where energy is used for purposes additional to illumination, the lighting must have independent main fuses, is now deliberately broken as a matter of trading expediency by many important supply corporations who induce consumers to fit heaters, &c., to their existing lighting circuits. Another rule, No. 28, in this section states that with a permanently earthed neutral or negative, no fuse may be placed in any conductor, whether on a main, or on any branch circuit which derives its polarity from the earthed conductor of the supply. That, apparently, is an error, and should be rectified.

One notes that references are made in many of the preliminary paragraphs to rules of a later number, and some of the later rules bristle with back references. An extension of the definitions would help to obviate this defect.

Rule No. 32 states that in the final power sub-circuits for heaters, the maximum must not exceed 600 watts. Yet the supply companies of London and the provinces have approved!

The clause No. 34, referring to earth wires, states that they should be "permanently earthed." Now, unless these wires have a link or other means of occasional disconnection, it is impossible to test an installation to see if it is free from supplementary accidental metallic contacts, such as gas-pipe earths.

It is demanded that earth wires be suitably protected from mechanical injury, yet there is a good deal to be said for those authorities who insist on earth conductors being bare cables visible throughout their length.

No. 37.—A switch, socket, &c., mounted on any surface liable to become damp must, in addition to its own mount, be fixed upon a base block impervious to moisture. It is unlikely that slate or china is meant to be employed here, and it seems to be suggested that the ordinary oiled teak block as used on cheaper work is preferred to a cast metal switch box.

No. 38.—"In bathrooms and damp places special precautions must be taken to prevent the possibility of personal contact with any part of the system." This would seem to imply that wholly insulated switches are preferred to those in metal boxes with earthed handles, and one cannot easily obtain watertight china switches.

No. 40.—The size of lighting wires is regulated by "the permissible drop in volts, which under ordinary conditions must not exceed 2 per cent. plus a constant allowance of 1 volt." This 1-volt drop, of course, is most serious on the very low voltage installations now common.

In the 1911 edition, "taped only" cables were permitted in certain circumstances. Now it appears (No. 50) that these taped wires are wholly debarred, but "braided only" cables are substituted. This latter class of protection is very uncommon. It has been used perhaps chiefly by that very smart type of contractor who got cheaply a cable which looked all right—till the oily matter in the braiding had worked havoc with the unprotected rubber.

A good and interesting new rule (No. 51) refers to distinguishing colours of cable coverings. One wonders why, however, the neutral should be yellow or white in the case of continuous current and green with three-phase alternating current. Why not make them neutral colour in both cases, and save the wireman's memory and eyesight too?

At present it is the practice to run red wires for switches and black to lamps, irrespective of whether the supply is positive and neutral or negative and neutral. It will be necessary now to learn, before one wires a building, whether the corporation intends to supply from the + or - side, and if suppliers will really respect the rules they will be hampered somewhat when they re-adjust the balance on feeders.

Rule No. 52.—Concentric systems were permitted

under Institution Rules for the first time in 1911, although they have been in use since 1883. One could understand why the live inner should be specially well insulated, as it is deprived of the two thicknesses of insulation which prevail on normal two-wire installations. But why is it compulsory under this Rule No. 52 that the external neutral should have the same quality of insulation, especially when the alternative as shown in Rule No. 76 is no insulation whatever? It seems to the present writer that a comparatively light insulation on the neutral external conductor is the commonsense method of getting rid of the electrolytic possibilities of a bare outside conductor.

Rule No. 53.—With regard to flexible conductors, one notes that they are now to be less flexible, for No. 36 S.W.G. is the smallest wire to be used (formerly this was the largest size permitted). Rule No. 56 does not demand tinning of flexible conductors where there is a pure rubber separation—as there always nominally is. Hard wires where there is much less risk of sulphur attacking the copper are, however, to be tinned, or otherwise efficiently protected against this danger.

The whole subject of metal conduits, iron, steel, brass, and copper, screwed, clamped, and soldered, is dealt with under one rule, No. 63, which has, however, seven sub-divisions.

Plain slip couplings are utterly forbidden, and quite properly—they have had a long innings in some districts. Grip joint couplings are evidently to be used for low-pressure work only, although, of course, resistance at joints is more serious there than with the higher pressures, and electrolytic corrosion is as much to be anticipated.

The rule applies to all conduits, including brass and copper, and it states that for medium pressures heavy gauge screwed conduits must be used. So it seems that the British Standard Specification for steel conduits is now to apply to brass and copper conduits used for medium pressures. On the whole, however, the rule with its sub-divisions is unembarrassing, and leaves to erectors freedom to use the hundred-and-one methods and types of conduit and accessory systems now in the market.

(To be continued.)

SCIENTIFIC AND INDUSTRIAL RESEARCH.

(Concluded from page 291.)

If a healthy condition of inquiry is to be fostered in the scientific industries, the Council must for some time to come expend a good deal of attention and money upon convincing the manufacturing world in general that scientific research is a paying proposition. The shortest means to this end is an attack upon the pressing problems of manufacture which arise in the course of the ordinary routine.

Unless the generality of British firms can be induced to alter their present attitude the Council will have failed profoundly in one of its appointed tasks. In the United States of America there has in certain industries been an earlier realisation than in this country of the large part which the systematic application of science has played in the rapid progress of German trade. Large American undertakings during the last 20 years have set up research laboratories in increasing numbers. Pamphlets are in preparation which will show something of the progress that America has made, and give some indication of the competition that awaits us in the future. Three grades of laboratory are needed by every manufacturer who wishes to get the best results from the application of science to his business—the ordinary routine or "works" laboratory for controlling the quality of raw materials, finished products and processes; an "industrial" or "efficiency" laboratory where improvements in products and in processes tending to lessen cost of production and to introduce new products on the market are worked out; and the true research laboratory.

If a manufacturer has the necessary capital and has once realised the value of research, he needs no encouragement to continue. In other cases the best procedure will be to demonstrate the value of research to industry by carefully selected object lessons, and by the periodical issue of the pamphlets which will contain accounts of what has actually been accomplished and what needs doing in this field.

Research undertaken exclusively for the benefit of one among a number of competing firms either by a public institution or at the cost of the State is always likely to give rise to difficulties. There is only one authenticated instance of a grant from public funds in Germany to an individual manufacturer for research or any allied purpose. The German Governments no doubt frequently assist a whole industry by suitable tariffs, preferential railway and canal rates and harbour dues; and, most important of all, the German States spend lavishly upon education. They have not, however, save in the single case referred to, used the taxes, either local or Imperial, to pay for research in the interest of a single firm; nor have their universities and technical high schools ever given exclusive privileges to an individual manufacturer.

The question of the part which universities can and should take in the application of science to industry is extremely important, but also extremely difficult. Such an experienced observer as Dr. Mees is strongly of opinion that the fundamental theory of a subject upon which the development and maintenance of industry chiefly depend "cannot possibly be carried on to any large extent in collaboration with a university." Although the German universities and technical high schools have been able in the past to do much for the industries because their professors have had little routine work to do in comparison with British standards, the increasing complexity and length of the research necessary for modern scientific manufacture is making it increasingly difficult for the professor or the university laboratory to take a dominating share in the advance. In the past no doubt the freedom of the university professor to work for a manufacturer was of great importance in building up the industries, but in present-day circumstances he is not usually more than a consultant to the firms who are interested in his science. One important function which he has exercised throughout he is never likely to lose so long as he keeps in touch with the needs of the manufacturer, namely, that of training a sufficient number of young men for the service of the industrial laboratories.

The universities can and must be the main sources of research in pure science, the discoveries in which lie at the root of all practical and technical applications. Yet they will not be able to do their fair share of this vital service unless they can attract more students and larger funds. Though progress has been made in the foundation of universities and the number of professors has largely increased, the endowment of professorships, the one safe means in Huxley's view of endowing research, has not kept pace with the number of foundations. Until our universities are in the position to offer appointments which carry with them real freedom from financial anxiety, it is certain that their teachers will not, because they cannot, take the leading part which they should in the national contributions to knowledge. If the universities can do their full share of the new work in pure science they will do much, but they can do more. They can also with their existing organisation assist smaller firms and less important industries to solve the problems immediately in front of them, and they can, no doubt, attack those fundamental problems of research in applied science which are not too complex or too extended in their nature.

When the scientific bases of a whole trade are in question some other machinery must be devised; at this point the university ceases to be a suitable agent. Yet a place may be found for the universities in some at least of these more comprehensive and complicated researches. They have done much already by means of separate technological departments closely related to the industries. The present organisation of such departments will need modification and development if they are successfully to carry the burden that will be put on them. It is important to keep the finance of research institutes distinct from the general university finance, for many reasons. It seems no less important to give the industry concerned a responsible share in the policy of the institute as much in the interests of the industry as of the research. Yet if the institute is to be connected with a university or other educational institution, the suzerain power must have an effective means of criticising the work in its broad and general outlines and must have control of at least the principal appointments. Otherwise the university or college connection will be meaningless. These are the difficulties of any such connection, but the advantages are obvious, especially at the present stage of our scientific development.

Scarcely less important than the encouragement of research in our educational institutions and our factories is a due correlation of the research activities of the Governments of the Empire. This can best be achieved by the free exchange of information given in a spirit of hearty co-operation. Accordingly, arrangements have been made by which the Council can keep in close touch with all Government Departments concerned with or interested in scientific research. Without their help, it would have been impossible for it to do its work effectively. The further it proceeds the clearer becomes the intimate interdependence of education and research on the one hand and industry and research on the other.

The needs which led the Mother Country to formulate a scheme for the organisation and development of scientific and industrial research had been realised with equal conviction in other parts of the Empire. A strong committee, appointed by the Commonwealth Government, reported in favour of the establishment of a national research institute

under the charge of three directors with an advisory council, and the Government accepted the proposal in its main outlines. Meantime the Committee of the Council had submitted a memorandum to the Colonial Office for communication to the Dominions, containing suggestions as to the various ways in which the home organisation might co-operate with similar organisations in other parts of the Empire.

In Canada a similar movement has begun, and an Order in Council was issued on June 6th establishing machinery similar to that in this country for the encouragement of scientific and industrial research. The proposals of the Government are based on their conviction that each part of the Empire should organise its present machinery for research before attempting collaboration with the Mother Country. The Canadian Pacific Railway has recently set up a department for the scientific investigation of the mineral wealth and the hydro-electric and chemical resources of the Dominion especially in those districts served by the railway. The New Zealand Government also has the matter under consideration. The existence of such organisations throughout the Empire will immensely facilitate the Council's task by enabling it to enlist the best brains for the attack on problems of Imperial significance irrespective of the researcher's domicile.

It seems probable that one of the first and most necessary preliminaries to joint research in the stricter sense will be found to be the making of a systematic survey of the mineral and other resources of the Empire. The whole question will doubtless be considered by the Committee appointed by the Prime Minister to consider the commercial and industrial policy to be adopted after the war.

The experience already gained enables the Advisory Council to foresee some of the more important conditions which will need to be secured if the object for which the Committee of the Council was established is to be attained.

These conditions stated in the shortest possible terms are: First, a largely increased supply of competent researchers; secondly, a hearty spirit of co-operation among all concerned, men of science, men of business, working men, professional and scientific societies, universities and technical colleges, local authorities and Government departments. And neither condition will be effective without the other.

The first condition of success cannot be secured rapidly at any time, and for the moment is out of the question. It is certain that the number of trained research workers who will be available at the end of the war will not suffice for the demand that will then exist. Without the scientific rank and file it will be as impossible to staff the industrial research laboratories which are coming as to fight a European war with seven divisions. There is as much place and need for plodding labour in scientific research as in other kinds of work.

The responsibility for dealing with the situation rests with the education departments of the United Kingdom. It is useless to offer scholarships if competent candidates are not forthcoming, and they cannot be forthcoming in sufficient numbers until a larger number of well-educated students enter the universities. That is the problem which the education departments have to solve, and on the solution of which the success of the present movement in the Council's opinion largely depends.

As regards the second condition of success, progress in co-operative effort is undoubtedly being made in many directions. There are specially strong reasons for more co-operation between the various British firms in each industry and between the industries and the State in the furtherance of research. Fundamental research requires a very large expenditure on brains and equipment. It also requires continuous effort. The firm that starts out upon this quest must either be very powerful, or it must find the necessary strength in association with others. If the general level of manufacture can be rapidly raised by co-operative effort in the exchange of information between firms, and in the support of national trade institutes for research, as well as in the improvement of the conditions and efficiency of labour, this country will have gone far towards establishing its industrial prosperity on a firm basis.

There is already a certain number of large firms in this country who, realising the unity of interest between employers and employed, have systematically striven to raise the standard of living among their workers and to give them a direct interest in the firm's success. But the small firm finds it as difficult to provide pensions or clubs as to pay for research laboratories or original workers. Some form of combination for both purposes may be found to be essential if the smaller undertakings of this country are to compete effectively with the great trusts and combines of Germany and America.

The economic problem, says the Council, lies outside its province, but it is an important aspect of the great issue with which it is concerned, and that issue cannot be met effectively unless a co-ordinated advance is made simultaneously on the whole front. The voluntary efforts of manufacturers in friendly union which enabled the problem of munitions to be rapidly solved may lead to a new kind of reciprocity between firms which will avoid the evils both of monopoly and of individualism. As people have learnt to combine against the risks of fire or shipwreck without losing either initiative or freedom, so firms may come to look upon expenditure for research as a necessary kind of insurance.

It is certain that the results will, on any adequate estimate, be in the order of many tens of thousands per cent. in favour of the latter.

The great industries which have an output worth many millions sterling a year and employ labour in proportionate amount need research on a scale which calls for the financial and intellectual assistance of all parties concerned. When co-operation has done all that is possible in the common interest, there will still remain a mass of research work to be done by individual firms in their own interests, which will amply repay the cost and effort.

If it is supposed that modern industry can be developed or even maintained by a process of detailed investigations, a series of particular inquiries, however careful, the time, trouble, and expense involved will be largely wasted. Such a supposition is based on fallacious conceptions of the manner in which scientific research proceeds, and of the way in which the great scientific industries have been built up. Research of this order does not cease when a problem has been solved. It must be continuous in its operation, and its ramifications will spread as knowledge grows.

TRADE STATISTICS OF AUSTRALIA.

The following figures, showing the imports of electrical and allied goods into Australia during the twelve months ending June 30th, 1915, are taken from the recently-issued official trade statistics, which now cover the twelve-monthly period ending June 30th, instead of the calendar year. The figures for 1913 have therefore been given for purposes of comparison and notes of increases or decreases have been added. The increasing share of the United States is noteworthy.

	Year ending 1913. June, 1915.			Inc. or dec.
	£	£	£	
<i>Gas and oil engines.—</i>				
From United Kingdom ...	148,000	127,000	—	21,000
" United States ...	38,000	48,000	+	10,000
" Germany ...	2,000	1,000	—	1,000
" Other countries ...	4,000	8,000*	+	4,000
Total ...	192,000	184,000		8,000

* Sweden £14,000.

<i>Portable and traction engines.—</i>				
From United Kingdom ...	87,000	41,000	—	46,000
" United States ...	56,000	25,000	—	31,000
" Other countries ...	2,000	4,000*	+	2,000
Total ...	145,000	60,000		85,000

* From Germany.

<i>Dynamo electric machines up to 200 h.p., static transformers, coils, &c.—</i>				
From United Kingdom ...	168,000	135,000	—	33,000
" Germany ...	48,000	16,000	—	32,000
" Italy ...	5,000	3,000	—	2,000
" Sweden ...	9,000	6,000	—	3,000
" United States ...	154,000	175,000	+	21,000
" Other countries ...	9,000	8,000	—	1,000
Total ...	393,000	343,000	—	50,000

<i>Dynamo electric machines over 200 h.p. and parts.—</i>				
From United Kingdom ...	56,000	42,000	—	14,000
" Germany ...	3,000	—	—	3,000
" United States ...	10,000	5,000	—	5,000
Total ...	69,000	47,000	—	22,000

<i>Earth and rock cutting, excavating, &c., machines.—</i>				
From United Kingdom ...	31,000	27,000	—	4,000
" Germany ...	7,000	—	—	7,000
" United States ...	18,000	12,000	—	6,000
" Other countries ...	2,000	2,000	—	—
Total ...	58,000	41,000	—	17,000

<i>Coal-cutting machines.—</i>				
From United Kingdom ...	1,000	1,000	—	—
" United States ...	12,000	14,000	—	2,000
" Other countries ...	1,000*	—	—	1,000
Total ...	21,000	15,000	—	6,000

* From Germany.

<i>Regulating, starting, and controlling apparatus.—</i>				
From United Kingdom ...	26,000	32,000	+	6,000
" Germany ...	7,000	3,000	—	4,000
" United States ...	39,000	50,000	+	11,000
" Other countries ...	1,000	3,000	+	2,000
Total ...	73,000	88,000	+	15,000

	Year ending 1913. June, 1915.			Inc. or dec.
	£	£	£	
<i>Machinery.—</i>				
From United Kingdom ...	78,000	48,000	—	30,000
" Germany ...	11,000	3,000	—	8,000
" United States ...	55,000	52,000	—	3,000
" Other countries ...	4,000	3,000	—	1,000
Total ...	148,000	106,000	—	42,000

<i>Hand and portable rock drills.—</i>				
From United Kingdom ...	3,000	2,000	—	1,000
" United States ...	28,000	23,000	—	5,000
" Other countries ...	1,000	—	—	1,000
Total ...	32,000	25,000	—	7,000

<i>Steam factories, economisers, superheaters, &c.—</i>				
From United Kingdom ...	92,000	115,000	+	23,000
" Germany ...	11,000	5,000	—	6,000
" United States ...	5,000	2,000	—	3,000
Total ...	108,000	122,000	+	14,000

<i>Electroliers, gasoliers, &c.—</i>				
From United Kingdom ...	36,000	30,000	—	6,000
" Germany ...	3,000	1,000	—	2,000
" United States ...	2,000	5,000	+	3,000
" Other countries ...	1,000	—	—	1,000
Total ...	42,000	36,000	—	6,000

<i>Motive power machinery not elsewhere included.—</i>				
From United Kingdom ...	263,000	241,000	—	19,000
" France ...	5,000	3,000	—	2,000
" Germany ...	20,000	9,000	—	11,000
" Sweden ...	—	3,000	+	3,000
" Switzerland ...	5,000	3,000	—	2,000
" United States ...	80,000	70,000	—	10,000
" Other countries ...	4,000	3,000	—	1,000
Total ...	377,000	335,000	—	42,000

<i>High-speed reciprocating steam engines for coupling or coupled to electric generators or pumps.—</i>				
From United Kingdom ...	26,000	27,000	+	1,000

<i>Electric fittings, switches, fuses and lightning arresters.—</i>				
From United Kingdom ...	51,000	33,000	—	18,000
" Germany ...	11,000	2,000	—	9,000
" United States ...	16,000	31,000	—	15,000
" Other countries ...	3,000	3,000	—	—
Total ...	81,000	69,000	—	12,000

<i>Electrical appliances not included elsewhere.—</i>				
From United Kingdom ...	90,000	85,000	—	5,000
" Denmark ...	10,000	8,000	—	2,000
" Germany ...	55,000	14,000	—	41,000
" Holland ...	10,000	21,000	+	11,000
" United States ...	36,000	15,000	—	21,000
" Other countries ...	10,000	5,000	—	5,000
Total ...	211,000	158,000	—	53,000

<i>Lamps and lampgear.—</i>				
From United Kingdom ...	57,000	49,000	—	8,000
" Germany ...	41,000	13,000	—	28,000
" United States ...	47,000	48,000	—	1,000
" Other countries ...	9,000	12,000	+	3,000
Total ...	154,000*	122,000	—	32,000

* Included incandescent mantles in 1913.

<i>Telephone switchboards and appliances.—</i>				
From United Kingdom ...	47,000	58,000	+	11,000
" Belgium ...	25,000	2,000	—	23,000
" Germany ...	7,000	1,000	—	6,000
" Sweden ...	16,000	22,000	—	6,000
" United States ...	47,000	60,000	+	13,000
" Other countries ...	2,000	—	—	2,000
Total ...	174,000	143,000	—	31,000

<i>Bins, iron, and steel.—</i>				
From United Kingdom ...	80,000	52,000	—	28,000
" Germany ...	327,000	98,000	—	229,000
" United States ...	219,000	229,000	—	10,000
" Other countries ...	5,000	37,000*	+	32,000
Total ...	641,000	416,000	—	225,000

* Canada £31,000.

<i>Electric heating and cooking appliances.—</i>				
From United Kingdom ...	6,000	3,000	—	3,000
" United States ...	3,000	3,000	—	—
" Other countries ...	1,000	—	—	1,000
Total ...	10,000	6,000	—	4,000

	Year ending		Inc. or dec.
	1913.	June, 1915.	
	£	£	£
Rails, fishplates, &c.—			
From United Kingdom ...	1,045,000	636,000	— 409,000
" Belgium ...	12,000	6,000	— 6,000
" Germany ...	57,000	34,000	— 23,000
" United States ...	168,000	177,000	+ 9,000
" Other countries ...	—	233,000*	+ 233,000
Total ...	1,282,000	1,086,000	— 196,000
* Canada £231,000.			
Accumulators, carbons, measuring and recording instruments, arc lamps, &c.—			
From United Kingdom ...	109,000	69,000	— 40,000
" Germany ...	43,000	1,000	— 42,000
" United States ...	11,000	15,000	+ 4,000
" Other countries ...	4,000	1,000	— 3,000
Total ...	167,000	86,000	— 81,000
Wire (copper).—			
From United Kingdom ...	175,000	99,000	— 76,000
" Belgium ...	7,000	—	— 7,000
" Germany ...	19,000	7,000	— 12,000
" United States ...	11,000	14,000	+ 3,000
" Other countries ...	1,000	—	— 1,000
Total ...	213,000	120,000	— 93,000
Cable and wire (covered).—			
From United Kingdom ...	554,000	307,000	— 247,000
" Germany ...	56,000	10,000	— 46,000
" Italy ...	2,000	1,000	— 1,000
" United States ...	20,000	8,000	— 12,000
" Other countries ...	5,000	2,000	— 3,000
Total ...	637,000	328,000	— 309,000
Arc lamp carbons.—			
From United Kingdom ...	—	1,000	+ 1,000
" Germany ...	17,000	2,000	— 15,000
" Other countries ...	1,000	4,000*	+ 3,000
Total ...	18,000	7,000	— 11,000
* Spain £2,000.			

Electrical Trades Committee is to devise a measure to protect the electrical trade after the war, and especially to safeguard it against foreign competition. The evidence required, therefore, is only as to what will protect the industry and obtain advantages for the same. It is a little difficult to see how placing a Government tribunal to control the electricity supply branch of the industry will give that branch any advantages. It may conceivably give the public, the consumer, or anyone else, an advantage, but the purpose of the Electrical Trades Committee is wholly confined to devising benefits inside the industry. The only conceivable suggestion is that some undertakings will benefit at the expense of the others.

However, to return to the main point on which the recommendation has been attacked, viz., Government control, this has been done from the company-shareholder's point of view. The shareholder has an eye for only one thing—dividends. He assumes, therefore, that Government control is not being recommended with the sole view of increasing the dividend from his investment in the particular company in which he is interested. He knows that the control would have aims other than those expressible in dividends, and consequently assumes that the dividends will suffer—hence his protest.

The argument in defence is that the Government Tribunal would only deal with the technical side of the problem and not touch the financial. Whether such a thing is possible, whether a Tribunal can, in fact, lay down a course for an industry to follow and yet not interfere with its profits, is the main ground of contention.

Perhaps, however, one solution would be to eliminate the debatable word "control," and substitute "arbitrate." This would be better in keeping with the idea of a Tribunal, as not being endowed with power of initiative. The recommendation would then read "that a Government Tribunal be appointed to arbitrate on questions affecting the electrical supply industry of the country, with a view to preventing indiscriminate additions to undesirable systems," and so forth. This would obviate the possibility of any "control" in the ordinary sense of the term, and at the same time, provide a way of dealing with the "dog-in-the-manger" policy affected by so many undertakings when any question of centralisation comes along.

Anyhow, this is merely a suggestion, the main point of the present article being to present a statement of fact and of the grounds of disagreement as a preliminary towards a better agreement.

Arbiter.

September 16th 1916.
We refer to this matter in our leading columns to-day.
EDS. ELECT. REV.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electricity Supply Undertakings and Government Control.

During the last week or so a considerable amount of discussion has taken place in the technical and financial Press over the question of Government control of electricity undertakings. The references in the Press have given evidence of heated partisanship in the matter; so much so, indeed, that it might be worth while to pause, and, if possible, get at the actual facts of the case. These facts have certainly been obscured somewhat in the discussion, so readers may, perhaps, welcome a plain statement clear of party comment.

The facts are briefly as follows:—

In the first place, the President of the Board of Trade appointed various Committees to consider the position of certain British industries after the war, especially in relation to international competition, and to report what measures, if any, are necessary or desirable in order to safeguard that position. Among these Government Committees one was appointed for the electrical trades. This Committee was composed of the following members:—

The Hon. Sir Charles A. Parsons Mr. J. Devonshire.
 (chairman). Mr. B. M. Drake.
Mr. J. Annan Bryce, M.P. Sir John Snell.
Mr. T. O. Callender.

The Committee, in the course of their work, invited the Institution of Electrical Engineers, through the President, to give evidence before them. A special *ad hoc* Committee of the whole Council considered the matter, and on their deliberations the Council prepared certain recommendations to be submitted. The recommendations covered various points, from such things as securing an all-British home market to improving the status "of electrical engineers"—10 clauses in all. Nine of the clauses have apparently raised no discussion. One clause, however (No. 2), has raised—if not a whirlwind—at least a breeze. The recommendation runs as follows:—

"A Government Tribunal of the most independent character that can be devised to be appointed to control the electricity supply industry of the country, and also to prevent indiscriminate addition or extension of power stations or systems undesirable from the point of view of size, locality, or system."

This recommendation has been strongly attacked, though, curiously, its most vulnerable point seems to have escaped notice—that is, whether it falls within the scope of the evidence required. The purpose of this particular Board of Trade Committee—the

The Anglo-Boche.

I have not seen the ELECTRICAL REVIEW for nearly two years, but I anticipate that its leanings will not be towards what the *Daily Mail* picturesquely describes as the "Unseen Hand," so that a Boche-like development in electrical circles may interest you.

Some time ago, a London electric supply company (determined that, whoever suffered from the effects of the war, their shareholders should not) raised their price for current all round; possibly other companies did the same. If this merely offset additional cost, and did not produce additional profit, it was, of course, quite legitimate. However, a further increase became necessary—or desirable.

One may suppose that important customers may have protested at the former advance, so the directors decided to squeeze a class who would be powerless to resent their action—the similarity to Boche methods is too obvious to need underlining. They proceeded to enforce the legal minimum charge per quarter, knowing, of course, that this would affect, not their large customers, but the occupants of small houses and flats, the great majority of whom are serving their country on somewhat inadequate pay.

In a typical case, the bill for current has been more than doubled to a family of three, one of whom is in the Grand Fleet, one in the R.N.V.R. afloat, and the third working 11 hours a day at (unpaid) war work.

Although the company had been informed that their customer was away on service, they sent in their usual notices, which accumulated in his absence, and finally cut off the current, all in the approved style of profound peace.

The comic relief is added by the fact that, like the blundering fools who are their patterns, they could not even perform this graceful act efficiently, but, to the astonishment of the occupant of the flat below, cut off his current instead.

Now I should like to make it clear that I do not know that the directors of the company in question are of German origin, but I suggest that their methods are so characteristic, that the international authorities might be moved to investigate. In any case, I and others will not forget, after the war, that among our foes were those of our own (electrical) household, and that they seized their opportunity to stab us in the back while we were assisting to protect them when they were too busy—or, shall we say—prudent, to protect themselves. The name of the company is at your disposal if you wish it.

Engineer-Lieutenant.

To Go or Not to Go?

"Balanced Up"—I nearly put Fed-Up—is one of those young men, who, like the poor, are always with us. He is probably one of those men perpetually permeated with the spirit of discontent. He is likewise probably of the type of young man recently described by a manager in a munitions Tribunal case as "one of

those who come to pick up all the information they can in order to better their positions as electrical engineers."

But cheer up, "B.U.," the turn of Fortune's wheel may in the course of two or three years see you blossom forth as a full-blown electrical engineer.

Has "B.U." read certain of the speeches given before the British Association at Newcastle? Let him do so. Let him read Mr. Stoney's paper with particular reference to that part dealing with the dead as against the live languages. Let him substitute one or two other words in place of those used by Mr. Stoney (ELEC. REV., page 306, line 43), and the passage can be made to read thus: "The operation of power stations and systems as they are usually operated has been standardised to the last degree, and as a result they can be operated by the semi-skilled man, and the skilled man is not necessary. In fact, the operation of power stations and systems is a pure 'repetition job.' At the same time no operator's training is complete unless mechanical is combined with electrical, and also with operating, experience and here lies one great danger of the modern operating engineer feeling himself entitled to less worse pay."

Let him proceed to read Merz on Electrical Power Distribution, and take the following extract: "... that interconnected electrical power distribution are essential if ... labour costs ... are to be kept to a minimum." (ELECTRICAL REVIEW, page 307, line 53.)

From "B.U.'s" statement that he is connected with 20,000 volts, one may infer that he is employed within, say, 500 miles of Newcastle-upon-Tyne, and he may, therefore, bear in mind that he is on a concern "standardised to the last degree," and where "labour costs are to be kept to a minimum."

Remember Alfred Lester, in the "Arcadians," with his "Gay life and a short one;" also the story of Robert the Bruce and the Spider, then, "Balanced Up," if you can't manage it on the 1-volt bus-bars, keep on trying the various voltages to be met with, and if you last till then, I feel sure the 20,000-volt busses will find you a very certain means of solving the question "To Go—or Not to Go?" At the same time, "B.U.," take care while trying to form a low-resistance path between red and blue phases on the 20,000-volt bars, that you do not cause a general shut-down on the

North-East Coast.

High-speed Squirrel-cage Winding.

In further reference to your notice on page 263, of September 8th issue, I have to say that in connection with the experimental work in the development of the "Paragon" electrical power system, this type of winding has been successfully used on my motor omnibus induction motor rotors, and has also been proposed and tendered for in connection with my "Paragon" variable-frequency, variable-speed induction motor system for ships' auxiliary machine driving; the said patent cannot, therefore, be valid, although the design is sound and good.

William P. Durnall.

London, N., September 18th, 1916.

The Metric System.

In view of your efforts to modernise the present effete system of weights and measures in this country, I forward you a cutting from the *Western Mail* of to-day's date, which only reiterates what has already been stated so often in your columns. Unfortunately, although recognised by all leading business men—and others—to be a reform urgently necessary, the Government do not move in the matter, and unless they act quickly, we shall find Peace with us once again, and the opportunity, so favourable at the present moment, will have been lost.

We have had the Liquor Control Bill, the Summer Time Bill (Daylight Saving), Compulsory Service, and many other drastic measures imposed upon us during the past few months, all of which in pre-war days would have been considered semi-revolutionary. The public have accepted them almost without murmur, and have become quite accustomed to these startling changes in our daily life.

Now, therefore, would appear to be the moment for the universal adoption of the metric and decimal system of weights and measures, unless we have definitely resigned ourselves to the old-fashioned systems, which we had to labour under for all too long.

The trouble and inconvenience which would be inseparable from such a reform would be very quickly counterbalanced by the greater convenience and simplicity attaching to the Continental system—advantages which would be quickly realised by the masses in general.

What is wanted, however, is a leader; and the question is—Where is he?

One Interested.

Héroult Furnaces in the U.S.A. In the past six months the United States Steel Corporation has granted licences for a total of 28 Héroult electric furnaces for steel-making in the United States and Canada, which exceeds by four the number licensed during the full year of 1915. At present a total of 72 Héroult units are either in operation, in course of building, or have been authorised in the United States and Canada. Arrangements for a large number of additional furnaces have been made by various companies through licences from the Steel Corporation during recent weeks.

ITALIAN ELECTRICAL INDUSTRY.

THE economical uprising of Italy, which goes back 25 to 30 years, has been accompanied by an extremely rapid growth of its electrical industry. From 1880 to 1914 more than 1,000,000 horse have been harnessed, as may be seen from the following tabulation extracted from statistics published by the Italian Ministry of Finances.

Years	H.P.	Years	H.P.
1880	135,000	1906	549,280
1884	160,000	1907	612,035
1899	180,000	1908	729,029
1900	250,889	1909	820,368
1901	289,756	1910	897,461
1902	311,014	1911	956,150
1903	379,568	1912	963,294
1904	526,706	1913	976,268
1905	485,579	1914	1,022,960

This growth in electrical installations was concurrent with a reduction in net cost and sale price. While prices of necessities of life rose on an average 50 per cent. during the last 15 years, the price of electricity underwent a decline. In 1894 the kW-hour for light cost at Milan 140 francs; to-day it is sold at 40, 30, and 20 centimes. The kW-hour for motive power which sold at 25 centimes in 1894 comes out to-day for large industrial users at from 6 to 5 centimes; for industries which do not need an uninterrupted flow of energy, it is even possible to have the kW-hour at 1 centime and below. Notwithstanding these relatively low prices, the electrical undertakings have succeeded in realising some fine profits, and the capitals invested in electric undertakings have yielded sure dividends of a high average. According to a publication of the *Credito Italiano*, the average of dividends of 151 share companies, embracing the whole production of electricity, with a capital of 453,400,000 fr., and reserves of 32,400,000 fr., were:—6.74 per cent. in 1909, 6.83 in 1910, 6.31 in 1911, 7.16 in 1912, 5.64 in 1913. For a year of crisis like that of 1913, the dividend of 5.64 per cent. shows a pretty respectable revenue. These data become still more impressive if, instead of an average dividend, we consider the individual growth of a great company from the point of view of capital, dividend, current produced, &c. Below are the figures relating to one of these companies: the Società Ligure Toscana di Eletticità:—

	Capital, fr.	Dividend, per cent.	k.w. hours produced.	Lamps installed, No.	Motors installed, H.P.
1905...	1,000,000				
1906...	2,000,000				
1907...	2,000,000	4	2,000,000		
1908...	2,000,000	5	4,000,000	21,000	3,500
1909...	2,000,000	5.5	5,000,000		
1910...	4,300,000	5.5	7,000,000		
1911...	7,000,000	6	9,500,000		
1912...	10,000,000	6.5	15,000,000		
1913...	10,900,000	7	20,500,000		
1914...	19,000,000	7	31,500,000		
1915...	22,000,000	7	48,000,000	270,000	26,000

This company, founded to supply 3,000 H.P. to the city of Leghorn, now furnishes electric current to the provinces of Livorno, Leghorn, and in part, Pisa, Florence, Massa, and Grosseto. In the space of 10 years the company in question has undergone a remarkable expansion. Its original capital of 1,000,000 lire has swollen to 22,000,000, and it has absorbed other smaller economic entities, such as the Società Toscana di Pisa, the Società Livornese di Eletticità, the Società Forze Motrici di Lucca, the Società Eletticità di Pescia, et Montecatini, &c. If we examine the economic aspect of other electric companies, we find everywhere the same characteristics. From the technical standpoint, grandiose installations, with a very centralised production of motive power and an extremely ramified distribution network; from the financial standpoint, a very strong concentration of capital. This great amalgamation of installations has a foundation essentially technical. It has been rendered possible, and even needful, by scientific discoveries which allow of the transmission of current over vast areas. The work of a stream of water gathered up in a mountain valley may be sent by means of a copper wire, those silent bearers of electric current, to great industrial centres at remote distances. The high cost of works where water-power is utilised, renders absolutely unremunerative installations on a small scale. A single and large station, which can serve a province, and sometimes even an entire region, is the one and only reasonable mode of utilising water-generated electric motive power. It is this principle of economy of force which, in an irresistible manner, has stimulated the creation of enormous hydroelectric stations and huge companies for the distribution of electric current. Statistics of the calls for concessions clearly prove this. While in 1885-6 the average power asked for concessions reached 36 H.P., it was 130 in 1889 and 1892, 230 between 1897 and 1898, and rose to 2,160 in the period from July 6th to December 9th, 1899; and during all the later years it was possible to register calls for concessions of 100,000 H.P.

LEGAL.

WORKMEN'S COMPENSATION.

At Bolton County Court on September 13th, James Herbert Howarth, of Handel Street, sued the Bolton Corporation for compensation and a declaration of liability in respect of an accident on June 29th, 1909.

Mr. GREENHALGH (solicitor) said plaintiff was employed by the Corporation on the date mentioned and was assisting in the repair of overhead electric wires when he fell from the wagon. One of his thighs was broken, and his thumb was injured and had to be amputated. In April, 1915, he was admitted to the Army as a water-on in the dining room and cookshop at Bury Barracks, but was discharged in May, 1916, as physically unfit. The Corporation had paid fees for his tuition in motor driving, but his first job as a driver was too heavy for him. Plaintiff now said he was earning 8d. per hour and for an 84-hour week earned over £2.

For the defence, Mr. J. HALL (deputy Town Clerk) contended that the man had been able to do light work since 1910, but the Corporation had paid full compensation down to 1915. His discharge from the Army was for muscular rheumatism, not on account of the effects of his injuries. His earning capacity now, it was argued, was better than ever before, for by his training as a motor-driver and repairer, he was a skilled man, whereas he was formerly unskilled.

The Corporation asked that the compensation award should be terminated altogether.

In the end the Judge made an award of 4s. 4d. per week from May 1st, 1915, to August 8th, 1916, and gave a declaration of liability with costs on B scale.

WAR ITEMS.

A Labour Committee.—It is announced that Mr. Arthur Henderson, in his capacity as Labour Adviser, has invited 15 trade union leaders to form a consultative committee, with a view to "establishing a regular and definite means of co-operation and communication between organised labour and the Government."

Workers of Military Age.—Edwin Milne, manager of Messrs. T. C. Smith & Co., motor-car and electrical engineers, Aberdeen, was charged with having failed to make and keep constantly posted up in the premises a list of the male persons between the ages of 18 and 41 in the employment of the firm, contrary to the Defence of the Realm Regulations. He pleaded guilty. The Sheriff imposed a fine of 20s.

Belgian Light Railways.—For years past Belgium has enjoyed an admirable system of light railways. Reuter, quoting the *Telegraaf*, says that the report of the Germans having seized a large quantity of rolling stock belonging to the Belgian light railways is confirmed. Several lines of the important steam tramway system, the centre of which is at Aerschot, have been closed. Locomotives and rails have been sent to Germany in spite of the protests of the management of the tramways.

Our Trade with New Zealand.—Mr. R. W. Dalton, N.M. Trade Commissioner in New Zealand, has been deprecating the tendency that he has observed for British manufacturers to delay their measures for appointing agents in New Zealand until after the war. Mr. Dalton quotes New Zealand opinion as being in favour of immediate action, at any rate in regard to preliminary negotiations. As may be imagined, there are others besides British houses who know the value of good agents, and if we allow "after the war" to look after itself, as a certain politician would advise, we may not be able to find such agents free to represent us when that greatly desired day shall dawn.

Germany After the War.—An Exchange telegram states that the *Vossische Zeitung* suggests the possibility of a closer union between the Hamburg-America and Norddeutscher Lloyd Lines after the war on a basis that cannot be revealed at present. "Both companies are reorganising their boards of directors and electing the financial leaders of Germany with the object of obtaining large credits which they will need at the close of hostilities. Among the new members of the boards are also delegates of big coal and electric concerns in Germany, where large orders are to be placed for new shipping machinery. It is anticipated that the two concerns backed by Germany's greatest financiers will easily cope with the after-war situation."—*Times*.

"Tubs for Tommies."—We have heard a good deal this week about those wonderful "Tanks" which have sent our men into battle laughing, and have struck terror into, and kindled the wrath of, the enemy, but there are "Tubs" as well at the Front; their usefulness cannot be questioned, and they provoke no wrath—only smiles, for "Tommies" satisfaction with them is complete. In some parts instead of waiting 28 days for a bath, our fighting men have been able to have one every eight days, and the Emergency Voluntary Aid Committee of the Empire Club (35, Dover Street, London, W.) has made this possible by providing tubs and heating appa-

ratus. We learn from Mr. C. Williamson-Milne, the chairman, that the military authorities are willing at once to distribute at the Front, wherever the need exists, a further 1,000 baths and 200 heaters, and for this purpose the Fund needs £1,500. A sum of £10 will provide a unit of five baths, with stove, boiler, towels, soap, scrubbers, &c., with which 100 men per day can have a warm bath. The desire of our men for a wash and a shave is almost proverbial, and their "fitness" is maintained because of such healthy habits. The nation provides the "Tanks" from the national exchequer, but it has been ordained that private donations shall provide the "Tubs," and any of our readers who can do so should send remittances to Mr. J. W. Howe, the honorary secretary, at the above address.

Exports to Liberia.—The "London Gazette" for September 19th contains a further list of those to whom exports to Liberia may be consigned.

Prize for the Best Mechanical Hand.—According to the *Times*, a donor, who wishes to remain anonymous, has offered to the Société Nationale de Chirurgie, 12 Rue de Seine, Paris, a prize of 50,000f. (£2,000) to be handed over to the maker of the mechanical apparatus which best supplies the place of a hand. All competitors must belong to Allied or neutral nations. They are to present to the society mutilated men who have been using their apparatus for at least six months. The Société de Chirurgie will test each apparatus with mutilated men for the length of time it thinks fit. The apparatus which wins the prize is to remain the property of its inventor. The competition will be closed two years after the end of the war.

Exemption Applications.—Mr. A. R. Barry (24), electrician, Upminster, has appealed on business and domestic grounds. He stated that after rejection he got married, thinking that he would not have to serve. Exemption refused.

The Ullocoats Mining Co. appealed to the Whitehaven Rural Tribunal, on September 12th, for their electrical engineer (25) at Egremont, who had taken charge of new plant being erected, and who was formerly with the Westinghouse Co., and was there badged. It was stated that he came to the Ullocoats company on the understanding that he would be exempt there also. Conditional exemption was conceded.

At Whitehaven, appeals were made by the Corporation for exemption for the acting borough electrical engineer (Mr. Gillitt), the only mechanical fitter left, an outside foreman and joiner, a stoker, two shift engineers, and the electrical and works superintendent. Mr. Gillitt was conditionally exempted; six months each were allowed to the fitter and foreman; and three months each to the others.

Four engine fitters were appealed for at Aldershot by the Traction Co. Mr. E. G. Hawkins, for the company, said that the chairman of the Reserved Occupation Committee had informed him that men employed in the maintenance of "buses and machinery came under the heading of a reserved occupation. The Chairman observed that the Appeal Court, which was senior to them, said the men did not belong to a reserved occupation. He asked if there were not women fitters, and Mr. Hawkins replied that he had never heard of them. Two of the men were allowed three months, and the others two months.

Mr. H. C. Francis (27), electrician, Redhill, has been allowed exemption from combatant service on condition that he undertakes farm work.

Pittington Co-operative Society have made an unsuccessful application for the retention of their electrician, who has a crippled arm.

At Faversham, on September 14th, conditional exemption by agreement was allowed to five employees at the Corporation electricity works, on the application of the electrical engineer, Mr. Sommerville.

A car driver, aged 21, was claimed at Dartford by the Light Railway Co. as being in a certified occupation and indispensable. It was stated that owing to the absence of housing accommodation older married drivers could not be imported; three from the Isle of Thanet taken a year ago had not yet obtained houses. Badges had been applied for for drivers, but the Ministry of Munitions would not grant them. Two months, with no further appeal without consent, were allowed.

High Wycombe Tribunal has granted three months' exemption to Wilfrid Parmenter (28), electrical operator at a local picture theatre. Appellant is very deaf, and the Tribunal considered he was not fit for any form of military service, although passed by the Medical Board.

Mr. E. H. Milner (38), electrical engineer, High Wycombe, who had recently been starred, appealed at High Wycombe for exemption. Questioned, he said that his business was beyond the power of women to do. Ever since their formation he had belonged to the Volunteers. Six months were granted.

Exemption has been refused, at Torquay, to Chas. Webber, employed in tipping coal into the Corporation generating station.

An appeal by the Military against exemption allowed to A. E. D. Chaundy (32), electric wireman with Messrs. Hill, Upton & Co., electrical engineers, Oxford, has been withdrawn, the man being totally rejected for any form of service.

The Military appealed at Oxford against exemption granted on February 24th to R. J. J. Child (23), electrician with Mr. John Goundrey, passed for foreign garrison duty. Child only

plaintiff that he had not had a proper medical examination, but the court was not prepared to grant an order.

At Oxford, Messrs. C. H. & Sons, electrical engineers, appealed for Mr. H. H. Watson (31), electrical engineer and fitter, the only electrician left on the staff. As Dixon was passed for general service, Mr. H. H. Watson said that if two months were allowed he would be able to get a medical certificate. A certificate was granted, therefore, for two months.

The Grantham Tribunal has conceded conditional exemption to John R. King (40), with the Urban Electric Supply Co., Ltd.

Gloucester Corporation having been granted exemption for two tramway inspectors on the ground that they were indispensable, the Military appealed, it being contended that it was not in the national interest that they should be retained on the staff. One is the chief inspector (aged 39), in charge of the whole of the traffic, and the other is the traffic inspector (aged 59). The Military contended that the latter should serve. Mr. F. H. Corson (general manager) stated that both men were indispensable, and if he was given three months he did not think that he could obtain and train a man to take the place of the traffic inspector. He pointed out that, with one exception, the whole of the employees attested before compulsion was brought in, and 71 had joined the Forces. The Court allowed conditional exemption to the chief inspector, and allowed three months to the traffic inspector, with leave to appeal again if a suitable substitute could not be found.

The Merthyr Tydfil Tribunal has conditionally exempted one of the two last stokers left with the Merthyr Electric Traction Co., Ltd.

Appealing for extended exemption, Mr. Gilbert Clark (34), electrician, of Bath, has been granted a final month.

At Denton, Mr. J. Brown appealed last week for William Hope, of Hyde, electric plant attendant, and conditional exemption was granted. The same Tribunal granted conditional exemption to three electric car drivers, a car-shed foreman, and a horseman on the emergency repair wagon, who were appealed for by the Oldham & Ashton Tramway Co., Ltd. An appeal by H. D. Smith, chief storekeeper for the company, was dismissed.

The Elland Tribunal decided that Ernest Turner, electrical engineer, was in a certified occupation, and he was exempted to the extent provided by such reservation.

At Durham Appeal Tribunal, an electrical engineer appealed in respect of an employee aged 23, unmarried. The firm were engaged in making rope to expedite the work of the Navy. If appellant had been married he would have been exempt. All they wanted was three months' extension to enable them to finish the work. Appeal dismissed.

A Brighton electrician, passed for labour duty abroad, who was recently put back until called up, having received his papers, has now been given three months' exemption.

St. Albans City Tribunal has refused exemption to Thomas G. Brookwell (20), junior charge engineer with the North Metropolitan Electric Power Distribution Co., Ltd., claimed as being indispensable in the interest of the lighting service.

Messrs. Barlow & Alden, Ltd., Oxford, appealed for Albert Greenaway (33), electrical fitter, engaged on installations at farmhouses and farms. He was conditionally exempted whilst remaining in his present occupation.

Three months' exemption has been allowed to Mr. F. P. Beale (33), Watford, for 16 years electrician to Mr. Grimes, at Bushey Hall.

The Military appealed at Oxford against a certificate of exemption granted on January 11th to A. C. Tombs (22), junior assistant electrical engineer with the Oxford Electric Co., Ltd. The chief engineer, Mr. Francis, said that it was difficult to get a man of sufficient experience and acquainted with local conditions for the particular work done by Tombs. The certificate was withdrawn.

On domestic grounds, conditional exemption has been granted to Mr. E. Green (34), electrician, of Oxford.

At Oldham, Messrs. Caton & Sons, electrical engineers, appealed for the manager—a practical engineer on motor and dynamo work, aged 38, and married—who was indispensable; and also for three electrical fitters, all married. Temporary exemption until January 1st was allowed to the manager and two of the fitters, and the remaining man, who is 32 years of age, was ordered to serve, but is not to be called before October 14th.

Three youths employed at an electricity station were appealed for at Stretford, and it was stated that their ages were 18 years. The appeals were disallowed, but the three are not to be called up before the end of October.

At Blackpool, on September 7th, conditional exemption was allowed to the foreman of a local firm of electrical engineers, who claimed that he was in a reserved occupation.

At Ramsbottom (Lancs.), an appeal was made for a tramway depot foreman, aged 23 and single, and it was stated that an effort had been made to get an older man, but without success. If he were taken away the car service would probably be stopped until another man could be found. Exemption until January 1st was allowed. Conditional exemption was granted to a tramcar driver, aged 31 years and single.

The Bury Tribunal has granted conditional exemption to a Corporation tramway employee, married and 30 years of age, who was employed in the Corporation tramway department.

until October 31st to the chief clerk in the Corporation electricity department, aged 29; and a similar period to a student of wireless telegraphy, aged 19, who is to sit for an examination shortly.

At Rochdale, Messrs. A. Diggle & Co. appealed for Percy Dawson (19), armature winder, who was described as indispensable. The Tribunal decided that the man should report for service in three weeks, and a representative of the firm said he would appeal against the decision. Temporary exemption till December 31st was allowed to W. Jenkins (41), assistant to engineer-in-charge of electric pumps, &c., appealed for by Mr. S. S. Platt.

Oldham Tribunal has given two months' exemption to Mr. W. S. Long, electrician, of Whissenthorpe.

At Hastings, on September 13th, exemption was claimed for Charles Winter (40 years and 8 months), electrician at the "Albany" Hotel, employed by Sir H. Lunn. He was given three months on joining the Volunteers.

The Peterborough Electric Traction Co., on September 13th, appealed for a chief traffic inspector, a mechanic and driver, a fitter and mechanic, an electrician and mechanic, a foreman, and the chief clerk, cashier, and storekeeper. Each was given four months' exemption.

BUSINESS NOTES.

A Birmingham House of Commerce.—The Birmingham Chamber of Commerce, which increased its membership from 1,637 in 1913 to 1,908 in 1914, and 2,208 in 1915, the increase showing an accelerated pace in the early months of this year, is proceeding with a scheme for establishing a Permanent House of Commerce in New Street, at a cost of £50,000. Donations are being invited from those interested in the commerce of the city and district, and we understand that, as a result of private efforts, £22,000 has been raised. It is desired to erect a building which shall be worthy of the commerce of the city and district. We would urge those who are interested either in the scheme itself or in the progress of the Birmingham Chamber of Commerce, to communicate with the president, Mr. H. W. Sandilake, at the registered offices, Winchester House, Victoria Square, Birmingham.

Book Notices.—*Directory and Chronicle for China, Japan, Siam, Szechwan, Indo-China, Philippines*, No. 1916. London: Hong-Kong Daily Press, Ltd. 30s. net.—This Directory has now reached its fifty-fourth year of publication, and that fact alone, before one proceeds to examine its contents, gives it a considerable measure of authority. It opens with a calendar of the year, a list of the Chinese festivals and observances, and particulars of weights, measures and money; very full information concerning treaties—commercial and otherwise—and a host of other subjects of real value follows, leading on to the Directory sections in which the different places in the countries mentioned in the title are dealt with in detail, names and addresses of public departments and officials, traders and commercial houses and their personnel being given. Excellent maps are attached to most of the sections, and at the end there is an alphabetical list of Foreign Residents in the whole of the places included. Those having trading relations with these parts, or anxious to promote such, should find the volume of inestimable value.

The Slide Rule, By C. N. Pickworth. Manchester: Emmott and Co., Ltd. Price 2s. net.—The fourteenth edition of this well-known work has been revised, and a section has been added dealing with the solution of algebraic equations of the second and third degrees by the slide rule. It is often less troublesome to arrive at an approximate solution by trial and error than by the orthodox methods, and, as usual, the slide rule comes in handily.

"Dynamo and Motor Attendants and their Machines." By F. Broadbent. London: S. Rentell & Co., Ltd. Price 2s. 6d. net.

"Mechanical Drawing." By C. B. Howe. London: Chapman and Hall. Price 7s. 6d. net.

"Proceedings of the Incorporated Municipal Electrical Association." 1916. London: Wyman & Sons. Price 5s.

American Export Trade Investigations.—We read in the U.S. Commerce Reports that an expert (Mr. Frank Rhea) from the Division of Valuations of the Interstate Commerce Commission will represent the Bureau of Foreign and Domestic Commerce in an investigation of the field for American railway equipment and supplies in the Far East, Australia, and South Africa. He is already engaged in making arrangements for conferences with manufacturers, contractors, and selling agents, which will be held during a preliminary trip to the principal manufacturing centres in the States in September. He will then go abroad to enter upon a careful study of the conditions as they affect railway construction, equipment, traffic, the probable extension or reconstruction of railways, tramways, &c. While all specific opportunities for securing orders will be promptly reported, the real purpose of the investigation is to gather fundamental facts for the American manufacturer.

Patents and Alien Enemies.—Application has been made to the Board of Trade to avoid or suspend Patent No. 3,117/11, granted to Van Devoorde, for the removal of boiler incrustation, by Messrs. J. C. McQuinn, Ltd., and Patent No. 3,555/11, granted to Piernay, for refuse destructors, by Mr. S. N. Wellington. A licence has been granted to Messrs. Russell & Co. Ltd. in respect of Patent No. 3,251/12 granted to Lawcock.

Catalogues and Lists. MESSRS. FRASER & CHALMERS, LTD., Erith, Kent.—Illustrated catalogue of 40 pages (Series A, Section 15), containing full descriptive particulars of their steam turbines. The half-tone illustrations show a number of plants that have been installed by the company, including a high-pressure turbine of 6,300 kW., 3,000 R.P.M., driving a turbo-alternator, recently supplied to the South Metropolitan Electric Light and Power Co., Ltd., and giving very satisfactory results.

MESSRS. SANDYCROFT, LTD., Chester.—Illustrated list of between 10 and 50 pages (art paper), describing, and excellently showing, their patent enclosed liquid starting switches; standard water-cooled liquid controllers for winder and haulage motor control; and automatic liquid controllers for A.C. and D.C. motors driving air compressors. Copies will be forwarded on application.

EDISON SWAN ELECTRIC CO., LTD., Ponder's End, Middlesex.—Leaflet No. B.3.146, containing descriptive particulars concerning Edison H.O. 641.

MESSRS. OZONAIR, LTD., 96, Victoria Street, London, S.W.—Supplement to their pamphlet relating to ozone apparatus for laboratory and research work. It describes a new laboratory ozone generator for which an efficiency hitherto unattained is claimed. The impetus which the war has given to research in the chemical and metallurgical industries is expected to cause a considerable demand for such apparatus.

MESSRS. BERRY, SKINNER & CO., 56, Newmarket Street, Oxford Street, London, W.—Folder giving latest prices of Osram drawn wire lamps for automobile lighting.

MR. HARRY MOSS, 116, Horton Grange Road, Bradford.—Illustrated price list of the "Whisperphone."

American Investigation of Electrical Export Possibilities. *The Electrical Review and Western Electrician* publishes the following interesting piece of information:—"The Bureau of Foreign and Domestic Commerce, United States Department of Commerce, has selected R. A. Lundquist, consulting engineer, of Minneapolis, Minn., to study the markets for electrical goods in China, India, Australia, South Africa, and a number of other countries in the Far East. Some years ago American electrical goods met with considerable competition in the Far East, but the war has greatly handicapped the principal European competitors, and American manufacturers are making a serious effort to take advantage of the situation and get permanent possession of the markets. A great deal of preliminary study is still needed, and Special Agent Lundquist's part in the campaign will be to ascertain the types, qualities, and costs of electrical apparatus with which American goods come into competition, as well as to look into the general opportunities for the sale of such goods. Before leaving on the trip, the special agent will spend some weeks in the principal business and manufacturing centres conferring with manufacturers, exporters, and business houses on the scope of the investigation."

Liquidations. DERBY ELECTRICAL CO., LTD.—This company is winding up voluntarily with Mr. J. Perry Jones, Woods Lane, Derby, as liquidator. A meeting of creditors is called for September 22nd.

BAKELITE CO., LTD.—Creditors should send particulars of their claims, &c., to the Controller, Sir W. B. Peat, 11, Ironmonger Lane, E.C., by October 12th.

DEV TIME REGISTERS, LTD.—A meeting is called for October 23rd, at 57, City Road, London, E.C., to hear an account of the winding-up from the liquidator, Mr. W. R. Howard.

C. A. MULLER, electrical accessories merchant, Bradford.—Creditors must send particulars of their claims to the controller, Mr. W. Durrance, 12, Duke Street, Bradford, by October 20th.

BOHLER BROS. & CO., steel manufacturers, Sheffield.—Creditors should send particulars of their claims, &c., to the controller, Mr. G. C. Webster, Styrian Steel Works, Renton Street, Sheffield, by October 20th.

Bankruptcy Proceedings.—THOMAS BROOKES, electrician at munition works, late picture house proprietor, Halesowen.—Receiving order made September 8th, at Stourbridge, on debtor's own petition.

JAMES BROCKIE, mechanical engineer, 41, London Road, Forest Hill, Kent.—October 5th is the last day for the receipt of proofs for dividend by the trustee, the Hon. W. J. H. Boyle, 132, York Road, Westminster Bridge Road, S.E.

For Sale.—MESSRS. WHEATLEY KIRK, PRICE & CO., the agents for the Controller appointed by the B. of T., invite tenders, by October 4th, for the stock of cable and electrical accessories, office furniture, &c., of Turner & Burger. Particulars appear in our advertisement pages to-day.

Trade Announcements.—MESSRS. DICK, KERR & CO., LTD., inform us that in future the sale of the Britannia lamp in the United Kingdom will be entirely in the hands of a subsidiary company known as the Britannia Lamp and Accessories Co., Ltd., which will incorporate the existing business of Watlington & Co., Ltd., who have hitherto acted as distributors for the Britannia Lamp in London and the South of England. The lamp will continue to be made by Messrs. Dick, Kerr & Co., Ltd., at Preston, and they will remain responsible for its quality and performance. All communications in respect to lamps for use in the United Kingdom should in future be addressed to the Britannia Lamp and Accessories Co., Ltd., Britannia House, 48, Milton Street, London, E.C.

MR. H. FOWLER, electrical engineer, of William Street, Windsor, who is serving with the Forces, announces that his business is being carried on as usual, under the supervision of Mrs. Fowler.

Aluminium.—The statement attributed to U.S. Consul Willich, on page 275 of our issue of September 8th, to the effect that the "only other aluminium works in the British Empire" is that of the British Aluminium Co., Ltd., is, of course, incorrect. The Aluminium Corporation, Ltd., which, as our readers know, has its works in North Wales, is also a British manufacturer of aluminium, and is under Government control.

LIGHTING AND POWER NOTES.

Argentina.—An electric power house is shortly to be established at Puerto Deseado (Territory of Santa Cruz): the plant has been supplied from America.

Ayr.—ANNUAL REPORT.—The electric light undertaking continues to show progress, the total units sold being only 68,000 less than in the previous year, notwithstanding the reduction of 122,000 units for public lighting. The power units sold show an increase of 58,000. The account shows a credit on the year's working of £72. The reserve fund has been increased to £5,614. Last year the price of current was increased by 15 per cent., and this year a further increase of 10 per cent. has been found necessary. The whole of the new generating plant has not yet been delivered. The new plant when installed will effect a big saving, and go far to counterbalance the great increase which has taken place in the price of coal and other materials.

The Electric Lighting Committee recommended that the charges for electricity for heating, power, and lighting be increased by the addition of 25 per cent. to pre-war rates; for tramways, 30 per cent. to be added to pre-war rates; and for public lighting, 60 per cent. to be added to the pre-war rate of 24d. per unit. The increase in the charge for public lighting will commence as from May 16th last, and the increases to the other consumers will be effective from the commencement of the current quarter.

Balbriggan (Co. Dublin).—PUBLIC LIGHTING.—An improvement scheme, at present being considered, includes the introduction of public electric lighting.

Ballybay (Co. Monaghan).—E.L. SCHEME.—The electric lighting installation is now being proceeded with; poles have been erected, and a lease to build a power house on the Fair Green is being obtained.

Bedford.—YEAR'S WORKING.—The accounts for the year ended March 31st last show a total revenue of £27,413, and total expenses (including £438 war payments) of £18,608. The gross profit, £8,805, was insufficient to meet interest and sinking fund charges by £1,016, which sum was charged to the general district fund. The total output sold was 3,357,392 units, and the maximum load 1,750 kW. We note that the output included 2,383,756 units for power, exclusive of 233,041 units used in sewage pumping.

Bexhill.—In view of the special labour and clerical work thrown upon the staff, the E.L. Committee has decided that a charge of 6d. should be made for each special meter reading taken at the request of consumers in connection with the letting of furnished houses, the charge to be added to each account as rendered, and to operate as from January 1st next.

Bingley.—LIGHTING CHARGES.—The electrical engineer has been instructed to inquire into, and report upon, the question of charging consumers in accordance with their maximum demands.

Brighton.—GAS FIRING.—The T.C. was to consider yesterday a proposal from the British Coalite Co. that the Corporation should lease to it a site at Southwick, near the power station, for the construction of plant for carbonising coal, and should take the surplus gas for boiler firing, the price offered being 15d. per 1,000 cu. ft. for an estimated quantity of 4,800,000 cu. ft. of gas per day. Mr. Christie, the borough electrical engineer, recommends the proposal, and foresees from it substantial reductions in the cost of production of electrical energy. The company would require the Corporation to supply electricity for the plant used in the production of the fuel. The Electricity Committee states that the Corporation will have to expend £750 in addition to the cost of the pipes, &c., to adapt a section of the boilers for burning the gas, but considers the cost of fuel would be reduced by about one half.

Canada.—The Electrical World states that the Ontario Hydro-Electric Commission has decided to spend \$1,300,000 in extensions. A block of 25,000 H.P. has been diverted from export to the States for supplying Ontario consumers. It has been decided to double the Commission's Toronto and Dundas plants, and to duplicate the Dundas-Toronto transmission. The Niagara Falls station is being extended to handle an additional 50,000 H.P. from the Canadian Niagara Power Co. The maximum load of the Ontario system is 115,000—120,000 H.P., and it is expected that the Niagara system will use between 140,000 and 150,000 H.P. before January next. The Commission has also decided to link-up the power plants at Eugenia Falls, Big Chute, Wasdells and Swift Current, Ontario; some 41 miles of transmission line will be required, and will enable the surplus power of some of the plants to be used in other areas; moreover, the line will be only six miles from the Niagara transmission at Mount Forest, Ontario, and will, it is expected, be connected to it later.

Chile.—The *Compañía de L. P. de Valparaíso* states that a contract for the lighting company and the *Intendencia* of Valparaíso, by the latter at a cost of 25,000 pesos, the company decided to cut off the electric light in the office of the *Intendencia* and in the house of the *Intendente*. That official prevented this being done by calling in the services of the police. The same company notified the municipality that it would cut off the public lighting on September 1st if the municipal debt owing to it of about 1½ million pesos was not paid by that date.

San Antonio de Arica.—In contact with the local lighting company. It had been agreed that the municipality's back debt for lighting should be paid in two years—half each year, but notwithstanding, one year has passed without this obligation being met. It is necessary that the municipality should satisfy this compromise in order to avoid the inhabitants being left in darkness again, as happened some months ago.

Christchurch.—Having received an account showing an increase of 10 per cent. from the Bournemouth and Poole Electricity Supply Co., with whom it has a contract, the B. of G. has referred the matter to a Committee for a report.

Continental, Norway.—An unusually prosperous year's working has been achieved by the municipal electric light and power installation at Trondhjem. A surplus of 184,661 kroner was shown over and above the budget estimate of 380,000 kroner, enabling a sum of 223,000 kroner to be transferred to the credit of the city's general funds. The working of the electric tramways yielded a surplus of 135,783 over the budget estimate of 66,750 kroner, of which a sum of 50,000 kroner was diverted to the city's general funds. The electricity works and the tramways now represent an asset of 3,094,000 kroner.

The Norwegian *Storting* announced, on September 1st, its approval of the scheme of the communal authorities of Gjerstad to raise a loan of 30,000 kroner for the purchase of a waterfall as a beginning of the work of construction of the projected communal electric power station and electric light and power installation.

The communal administrations of Jevnaker, Lunner, Gran and Grandbu have decided to raise a loan of 500,000 kroner, under the common guarantee of the several communes, in order to enlarge the Hadelund electric station. The *Stadsraad* has sanctioned the scheme.

Denny.—PRICE INCREASE.—The T.C. has decided to increase the price of energy for power and lighting as from the beginning of the quarter by 4d. per unit.

Dover.—KENT COAL.—The local Snowdown Colliery is to supply 1,500 tons of an improved washed nut coal to the electricity department.

Elland.—PRICE INCREASE.—Owing to the increased cost of production, the U.D.C. has increased the price of electricity for lighting purposes to 5d. per unit, and for power purposes by a further 7½ per cent., making a total advance of 20 per cent.

Hove.—INCREASED PRICES.—The T.C. has decided, as from September 30th, to increase the price of electricity for lighting by 4d. per unit on the flat rate and by 10 per cent. on the indicator rates of 7d. and 4d.

India.—The question of introducing some form of electrically-propelled vehicle for use in Simla is once more engaging the attention of the municipality, and the electrical engineer has been instructed to submit specifications for an electrical jitrickshaw, based on suggestions made in a note by Captain Batty in the report of the Simla Improvement Committee.

A hydro-electric scheme to supply Coimbatore with electric power and good drinking water is being investigated. It is understood that the railway workshops at Podanur will be developed considerably. Coimbatore will be one of the most important towns in Southern India. A small separate scheme for lighting Ootacamund from the Sandinullah river is also being investigated and prepared by Mr. Gibbs, of the Tata hydro-electric scheme.—*Indian Electricity*.

Kilkeel (Co. Down).—E.L. SCHEME.—The Irish Towns Electric Light and Power Co., Ltd., has intimated to the District Council that it must delay the installation of electric lighting in the town owing to the difficulty of getting materials.

Kilmarnock.—The Corporation electricity department has had another very successful year. The units sold amounted to 5,026,800, and the revenue to £23,285. The output in units almost doubled, and the revenue increased by £9,429. The Corporation has been asked to take on a number of large consumers.

Kirkcaldy.—PROPOSED PLANT EXTENSIONS.—The T.C. has decided to ask Sir John Snell to report on the whole question of electric supply in the burgh, the engineer, Mr. Francis, having reported that a 2,500-kw. set could be erected on the present site for £21,500, and that a new power station on the sea front containing two 3,500-kw. generating sets would cost £113,950; two local firms have intimated that they will require a largely increased supply of electricity for power, for which the present plant is inadequate.

London.—ST. PANCRAS.—LINKING-UP REPORT.—The Electricity Committee has had under consideration the question of interconnection of electricity supply undertakings, and having considered the borough electrical engineer's report on the matter, has

decided that no advantages would be derived by the Council from linking-up with other undertakings commensurate with the cost to be incurred, and that no action be taken.

Mr. Baynes, in his report, says it is to be assumed that one of the Council's two generating stations has been disabled, and that it is essential to provide a temporary supply for the time being. The present combined maximum load on the two stations is 5,700 kw., and the loads on the respective stations are:—Regent's Park, 2,000 kw.; King's Road, 3,700 kw. He assumes that a linking main between two neighbouring power stations, capable of each carrying 1,500 kw., would suffice. Inquiries show that none of the adjoining installations generate power at the voltage or periodicity suited to the Council's needs; therefore, in every case transforming plant is essential to allow of an exchange of power between the neighbouring concerns. Mr. Baynes estimates the capital outlay on linking-up as follows:—Mains to Islington, or Hampstead, half cost, £4,535; transforming plant, £8,740. Linking to the Central Electric Co. (Grove Road) or St. Marylebone, half cost of mains, £3,135; transforming plant, £8,740. Total cost of linking-up, so as to draw or give energy to two neighbouring stations, based on the assumption that each power station pays half the capital cost of mains, £23,150. He points out that the cost of mains to link with the North Metropolitan Co. would be about £18,000, a prohibitive figure. Linking-up is an illusion, he continues, as its advocates well know, but it is a means to the end they have in perspective, viz., supply in bulk. In the 22 years of supply, except for the earlier years of experimental period, there is not an installation that can boast of a more reliable service than St. Pancras; with the modern plant, a higher standard of reliability is available than in the past, and a stand-by supply at this late period of the business by linking-up is now of less relative utility, and not worth the capital outlay. The Council must, therefore, regard such a scheme from a bulk supply standpoint: all the companies he has been in touch with are, naturally, not keen on a linking-up scheme, unless they are at the business end of the main. On the other hand, the borough authorities are more inclined (if a scheme of linking-up is commercially practicable), to regard the chargeable costs as purely reciprocal, the balance in the exchange of current in each year being returned to them, or paid for at an agreed nominal rate. The following figures are quoted for a supply in bulk measured at the switchboard at the Central Electric Co.'s power station, the Council bearing all transmission and transformation losses. (Note.—The company, should they need a reciprocal supply, are prepared to pay for any power from the Council at the same rates): For a maximum demand of 500 kw. during next winter, at £3 per kw., £1,500 per annum; current at 33d. per unit with coal at 20s., adjusted to 27s., at 20 per cent. load factor, £1,606 per annum. Allowing for transmission and transformation losses, this runs out at '926d. per unit. St. Marylebone figures for a supply in bulk, at 20 per cent. load factor, will be 1'19d. per unit. Mr. Baynes mentions the cost of production with the new plant:—Repayments on capital and interest on new L.C.C. terms, per unit, '0145d.; coal, '3730d.; water, oil, &c., '0139d.; repairs, maintenance, '0257d.; wages, '0349d.; extra rates, taxes, insurances, &c., '0142d.; total cost of production, '5462d. With reference to the B. of T. circular letter as to saving coal, bearing in mind the phenomenally low steam consumption obtainable with the new Ljungström turbine in operation, and having regard to the extra capital expenditure on linking up, it will be difficult, concludes Mr. Baynes, to show a commercial economy, including a saving in coal consumption, were the Council linked up to neighbouring power stations which do not possess machinery of so high a standard of efficiency.

YEAR'S WORKING.—The accounts of the electricity undertaking for the year ended March 31st last, show that after paying all working expenses, repayment of loans, interest, &c., and providing for accrued charges, a profit remains in the revenue account on the year's working of £10,896. Of this amount the Finance Committee proposes that a sum of £6,000 should be deducted from the lighting portion of the estimates for rates for the ensuing half-year, and that the remaining £4,896 be transferred from the revenue account to the reserve fund account.

FULHAM.—The Electricity Committee recommends an expenditure of £1,000 on repairing masonry and a fractured cast-iron circulating pipe, 20 ft. below ground, due to subsidence. A concrete culvert is to be constructed for the protection of the pipes, and a concrete wall round the pump.

Luton.—The Sanitary Committee is recommending that the House Sub-Committee be empowered to have electric light and radiators installed at Spittlesea Hospital, and that the borough engineer report upon the question of installing private telephones between the various blocks.

Newton Abbott.—PUBLIC LIGHTING.—At the meeting of the U.D.C., it was reported that the Electric Supply Co. was to make a further concession, which would result in an additional saving of £153, in regard to the termination of the contract for public lighting, which expires next June, in addition to the £215 a year already allowed.

New Zealand.—The report of the working of the Dunedin electricity undertaking for the year ended March 31st last shows that 12,079,925 units were sold, as against 10,999,608 units in the previous year; the total number of consumers connected amounted to 5,937, and the motors numbered 928, of 7,770 h.p. The connected load was 14,192 kw.—*Commonwealth Engineer*.

Nuneaton.—THREE-PHASE EXTENSIONS.—The T.C. has adopted a recommendation to utilise the three-phase system in meeting future requirements, amongst which may be Messrs. Courtald's new factory with 1,200 looms, and the extension of supply to the Stockingford district.

Portsmouth.—**YEAR'S WORKING.**—The accounts of the Corporation electricity undertaking for the year ended March 31st last show a total revenue of £50,695, or £1,000 less than in 1914-15; expenditure amounted to £35,820, a great increase on the previous year, and the gross surplus was reduced from £22,361 to £14,785, an amount which was insufficient to meet financial charges, and necessitated drawing on the reserve fund for £7,288—the deficit for the year.

This fund also contributed £4,331 towards new turbine plant, and still has a balance in hand of £19,787; the insurance fund account also amounts to £7,264. The energy sold amounted to 3,603,860 units, and the maximum load to 2,490 kW.

The T.C. has decided in order to meet some part of the loss in working, to increase the charges for electricity by 5 per cent. for lighting (making a 20 per cent. increase), and by 10 per cent. for power and lighting (making a 25 per cent. increase). The chairman said the trouble was due to increased coal cost; seaborne coal could not be obtained, and the fuel cost per unit had increased from .66d. in 1913-14 to 1'37d. in 1915-16.

Pwllheli.—The T.C. has decided to carry out a scheme for the provision of an electrical plant for the Corporation cinema at the Town Hall, at a cost of £220.

Shipston-on-Stour.—Owing to the failure of the electric supply from August 11th to 25th, and to the alleged prospective future breakdowns, the B. of G. has decided to obtain estimates for a plant of its own to be installed.

Silkstone.—The R.D.C. has given permission to the Yorkshire Electric Power Co. to erect a line at Silkstone Common and to lay mains at Silkstone.

Southend-on-Sea.—**STREET LIGHTING, &c.**—The Council has adopted the recommendation of the Economics Committee that the Highways Committee be asked to consider the question of substituting electricity for gas in those street lamps at present lighted by the latter illuminant, and for that purpose terminating the agreement with the Southend Gas Co. in March, 1917. The Committee has decided to await a report by the borough surveyor. The sale has been completed at the price of £1,155 of two 180-kw. dynamos, resulting in a profit of £200, which will be held against a probable increased cost of the machines when required by the electric lighting department after the war.

South Shields.—**YEAR'S WORKING.**—The annual report of Mr. H. S. Ellis, the borough electrical engineer, on the working of the electricity undertaking for the year ended March 31st last, shows the adverse effect of the war, the financial result being a deficit of £1,961, of which, however, £932 represents items not strictly chargeable to net revenue. The revenue for the year amounted to £30,738 (as against £34,183) and the gross profit was £13,515 (as against £16,949), working expenses showing a small reduction. After meeting interest and sinking fund charges, which were higher than in 1914-15, the result was as stated above, the amount required being transferred from reserve. In the previous year, £1,616 was contributed to the reserve and £1,600 to the rates. The reserve fund now stands at £14,815. Due to the severe lighting restrictions, and despite an increase in power units, the total output sold amounted to 4,423,154 units, as compared with 4,665,380 units in 1914-15. The total working expenses amounted to .91d., as against .85d. per unit in 1914-15, but coal cost fell from .35d. to .34d. per unit, and was less than in any previous year except 1912, this being due to the purchase of fuel having been left in the hands of the chairman and engineer to secure favourable lots as circumstances arose. During the year, 129,479 units were sold for heating, &c., and the revenue from this source is gradually expanding, according to Mr. Ellis, due to the efforts of the sales department, which has been in operation five months, at an out-of-pocket expense of £5. It is interesting to note that no increase has been made in the price of electricity. We note that the maximum load was 2,247 kW.; the connected load, 8,189 kW.; and the load factor, 27.5 per cent. From the summary of capital expenditure, 37.4 per cent. represents machinery and 38.7 per cent. mains; meters and instruments each account for 4.5 per cent., and together exceed cost of buildings, 8.6 per cent.

Swindon.—**PRICE INCREASE.**—The T.C. has decided to increase the charge for electricity for lighting from 4½d. to 5d. per unit; it is hoped to reduce an expected loss of £1,660 by about £1,000.

Waterford.—**NEW LOAN.**—The Irish L.G.B. has sanctioned the application of the Corporation for power to borrow £1,000 to defray the preliminary expenses in connection with the introduction of electric lighting.

NORWAY.—The electric tramway company at Bergen—a joint stock concern—has now shed all its German members, five residents of Bergen having been chosen in their steads at a meeting on August 24th. This may be regarded as one of the incidental effects of the war.

Edinburgh.—**TRAMWAY REPORT.**—The report of the experts on the future of the tramway system was submitted to the Tramways Committee last week. It was recently pointed out in an interim report that whatever system might be adopted by the Corporation, it was desirable that it should permit the freest communication without change of car between all parts, and that it was not advisable or necessary to retain the cable for any routes in the city. The latest report extends to 80 pages, and the Town Clerk will prepare a summary. Speaking on the matter at a meeting of the Labour Party, Councillor Graham stated that financial considerations alone might lead to the choice of the overhead trolley system for Edinburgh. They must decide without delay, for the future development of the city, especially towards the Rosyth area, was bound up with the immediate settlement of this problem.

Keighley.—The B. of T. has granted an extension of two years to the period for the construction of the tramways at Stockbridge, Aireworth Road, &c.

Leeds.—**ACCIDENT.**—Recently a car running from Pudsey to Stanningley got out of control on a steep gradient near the junction at the latter place, and, jumping the track, ran into a shop. Only one person was reported injured.

New Zealand.—The result of the year's working of the Dunedin Corporation tramway department to March 31st last, was a gross profit of £34,714 and a net profit of £4,840, being a reduction of £115 on the previous year. The passengers carried numbered 14,849,751, an increase of 150,740.

Portsmouth.—**YEAR'S WORKING.**—The report of the Corporation tramway department for the year 1915-16 shows that 29,338,918 passengers were carried as compared with 27,554,194 in 1914-15, although the car-mileage was only 2,170,778 as against 2,438,621.

The total revenue for the year was £127,546 (equalling 14d. per c.m.) as against £123,991; the working expenses, however, amounted to £62,078 as compared with £58,657 in 1914-15, and the gross surplus was £65,467, or about £130 better than in 1914-15. Allowing for interest credited and deducting interest and sinking fund repayment and income tax, a balance of £21,777 remained which was carried to the appropriation account, from which £13,000 was contributed to rate relief, and various contributions were made to renewals, reserve, and extensions. The renewals fund stands at £67,424, and the reserve and insurance fund at £24,235.

A total of 3,009,860 units were generated at the tramway power station, at a cost of .614d. per unit, and a total cost including distribution and capital charges of 1'385d. per unit. The station plant capacity was 2,075 kW, and the maximum load 1,100 kW.; the load factor was 19.5 per cent., and 3,29 lb. of coal were used per unit generated, the cost averaging .375d. per unit with coal at 21s. 2d. per ton.

Of the passengers carried over 90 per cent. were penny fares. We notice that the list of officers of the Corporation tramways comprises the town clerk, deputy town clerk, and borough treasurer, followed by the general manager, Mr. Spaven, and engineer, Mr. Lironi. We presume that the former gentlemen are essential to the operation of tramways, at any rate, in Portsmouth, but lest the ratemakers should think that the last two are superfluous, we would suggest that the order be inverted in future lists.

Rhyl.—The Council has sanctioned the taking of a strip of land at Foryd for the construction of a light railway between Kimmel and the town.

Southend-on-Sea.—The Light Railways Committee has adjourned for six months consideration of an offer of the Loughborough Car Co. to sell to the Corporation an Edison electric bus. The electrical engineer has reported upon the difficulties at present experienced in dealing with rail corrugation; it has been decided to purchase an oxy-acetylene cutting and welding plant for the repairing of rails, &c., at a cost of £48.

U.S.A.—The New York Chamber of Commerce has approved the proposed contract between the city and the New York Central Railroad for the West Side improvement, which contemplates the reconstruction and electrification of the company's freight lines on the west side of Manhattan. It is reported that a Haitian-American syndicate is to acquire the existing public utilities in Haiti, consisting of railroads, electric light plants, a tramway in Port-au-Prince and adjoining valleys, and an electric light plant in Cap Haitien.

TRAMWAY and RAILWAY NOTES.

Birmingham.—On Wednesday morning the tramway service was interrupted for 1½ hours, except as regards those portions supplied from the Aston generating station; the stoppage is reported to have been due to the difficulty of keeping up the steam supply at the Summer Lane generating station, where the poor quality of the coal now used has led to a similar state of affairs two or three times during the past year.

Continental.—**SPAIN.**—Good progress is being made with the electrification of the steam tramways of the Sociedad Valenciana de Tranvías, in the Valencia district. The first line to be completed is that between Valencia and Grao.

TELEGRAPH and TELEPHONE NOTES.

China.—The American Minister at Peking states that the annual report on the administration of the telegraph service of China for last year has been submitted by the Ministry of Communications. During the year, more than \$6,500,000 was received through the telegraph (wire and cable) \$750,000 through

The total amount received for the postal receipt of \$7,080,000. The total expenditure on the telephone service was \$4,110,000, leaving a profit of \$2,970,000 and more, making a profit of \$2,970,000 and more. The total profit was therefore \$2,970,000 and more, from this sum of \$4,110,000, the profit of the electric administration a net profit of \$2,970,000 and more, making a profit of \$2,970,000 and more.

France. The French Marine Commission has decided to appoint nine commissioners, who, with the delegates of the Navy, will control the installation of wireless telegraphy on the coast, and will also draw up the rules for the navigation of ships. *The Times.*

Russia. The Minister of the Interior has proposed to the Council of Ministers that the Chief Postal and Telegraph Department be empowered to negotiate with the Swedish-Danish-Baltic Telephone Co. for the purchase of the Moscow telephone system by the Treasury. The Minister urges that in view of the new law on the construction and maintenance of telephone communication, the Government is obliged, within the limits of its means, to undertake the purchase of the telephone systems, at least in the chief towns of the empire, and the first in order is the Moscow system, for the concession of the company named above was due on November 1st 1914. The cost of buying up the Moscow system will amount to 25,000,000 roubles, but this it is hoped, will be recouped by the profit on exploitation.

The telephone system in Petrograd, established originally on a concession basis, has passed entirely into the hands of the Town Council, the date of transfer being July 28th/August 10th. On that day the cessation of the agreement with the Post-Telegraphs Department for the exploitation of the telephone system became a fact.

CONTRACTS OPEN and CLOSED.

OPEN.

Argentina.—Tenders for the installation of electric power plant and material for the lighting of a hospital at Bell Ville, Province of Cordoba (about £10,000). Comisión Asesora de Asilos y Hospitales Regionales (Boletín 209, Buenos Aires). *Board of Trade Journal.*

Australia.—SYDNEY.—January 22nd, 1917. Electrical plant (converter, battery, booster, and switchboards) for the Castleburgh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.*

MELBOURNE, September 29th. City Council. Insulated and H.D. copper cables. See "Official Notices" September 8th.

October 17th. For the Deputy P.M.G. (1) Sleeves and tapes (Sched. No. 1,355), and (2) 3,100 stay-roads, with low tighteners (Sched. No. 1,359).*

October 18th. Victorian Government Railways. Electric time releasing mechanisms for automatic signalling (Cont. No. 30,343).*

November 1st. 50,000 yellow flame arc carbons.*

December 11th. City Council. Supply and erection of coal transporter plant. See "Official Notices" September 15th.

PERTH, November 8th. P.M.G. Accumulator parts (Schedule 527 W.A.).*

SOUTH AUSTRALIA.—November 15th. P.M.G.'s Department. Automatic switchboards and all associated apparatus, for telephone exchanges, Brighton and Glenelg.

Castlebar.—A difficulty having arisen in relation to the acceptance of the tender of Messrs. Burke for the electric lighting of the town, the Urban Council has decided to re-advertise.

Grenada.—October 31st. The Government of Grenada, British West Indies, is inviting proposals for supplying electricity for lighting and power in the town of St. Georges, Grenada, and residential suburbs within a radius of three miles. Plan and particulars, £2 2s. Tenders to Colonial Secretary, Grenada, British West Indies.

Halifax.—B. of C. Tenders for electrical fittings for the workhouse, the St. Luke's War Hospital and other institutions town & suburbs.

Manchester.—September 25th. Guardians. Six months' supply of electric lamps. Mr. J. Macdonald, Clerk, Union Offices, All Saints, Manchester.

September 28th. L. & Y. Railway. Twelve months' supply of steel sheets (Siemens and electrical), schedule 51. Mr. Waring, stores department, Osborne Street, Manchester.

New Zealand.—WELLINGTON.—October 11th. Public Service Stores Tender Board. 1,000 magneto extension bells, 1,000 olms.*

Spain.—Tenders have just been invited by the municipal authorities of Abant y Gernika (Province of Vizcaya) for the concession for the electric lighting of the town.

Tenders have just been invited by the municipal authorities of Albaida de Aljarañ (Province of Seville) for the concession for the electric lighting of the town during a period of 10 years.

October 3rd. Installation of a telephone system connecting the towns of Gandesa, Falset, and Reus (estimated cost £3,100). Tenders to Departament de Fomento de la Mancomunidad de Catalunya, Barcelona. *Board of Trade Journal.*

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Government Contracts.—List of new contracts during August, 1916:

WIRE CABLES.
Lamp cable and wire.—R. L. & Benda Cable Co. Ltd., General Electric Co. Ltd.; W. T. Hawks. Telephone Works Co. Ltd. Hooper's. Telephone & Telecommunications Works, Ltd. Johnson & Phillips, Ltd., Telephone & Telecommunications, Ltd., Siemens Bros. & Co. Ltd., Ward and Gossington.
Electric cable.—J. C. Fisher & Son, Ltd.; Siemens Bros. & Co. Ltd.
Transformer coils.—T. De la Rue & Co. Ltd.
Electric and magnetic.—Peters, Ltd.
Electric light fittings.—General Electric Co. Ltd.
Generating sets.—Aster Engineering Co. Ltd., Austin Motor Co. (1914), Ltd.; W. H. Dorman & Co., Ltd.; Fyfe, Wilson & Co.; Keighley Gas and Oil Engine Co., Ltd.; Peters, Ltd.
Telegraph-pole gins.—G. J. Young & Co.
Electric lamps.—Gossington, Ltd., General Electric Co., Ltd., Pope's Electric Lamp Co., Ltd.
Magnets.—C. A. Vandervell & Co., Ltd.
Motors and starting panels.—Electric Construction Co., Ltd.
Switchboard parts.—Automatic Telephone Mfg. Co., Ltd.
Works services.—Electric lighting at Sharncliffe, Leeds & Milne, Ltd.
Electrical plant at Farmouth, C.A. Parsons & Co. Ltd., Electrical supply at Woolwich; General Electric Co.

TELEGRAPH STATION EQUIPMENT.
Cable.—General Electric Co., Ltd.
Cells.—Siemens Bros. & Co., Ltd.
Receivers.—Creech, Bille & Co.
Wire.—General Electric Co., Ltd.; F. Smith & Co.

POST OFFICE.
Telegraph apparatus.—British L. M. Ericsson Mfg. Co., Ltd.
Telephone apparatus.—British L. M. Ericsson Mfg. Co., Ltd.
Battery boxes.—British L. M. Ericsson Mfg. Co., Ltd.
Telegraph cable.—Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Loading coils.—Siemens Bros. & Co., Ltd.
Repeating coils.—Western Electric Co., Ltd.
Telephone lamps.—General Electric Co., Ltd.
Insulator spindles.—F. W. Cotterill, Ltd.
Telephones.—Automatic Telephone Mfg. Co., Ltd.
Bronze wire.—B. L. & Helsby Cables, Ltd.
Galvanised-iron wire.—Rylands Bros., Ltd.

COMMISSIONERS OF PUBLIC WORKS, DUBLIN.
Electric lighting and bells.—V. G. Middleton.

Luton.—The Electricity and Tramways Committee has considered the electrical engineer's reports upon the details of three tenders he had obtained for ash-handling plant, and is recommending the Council to accept the tender of Messrs. Herbert Morris, Ltd., for an electric overhead trolley and runway and two tipping skips, for £1,888.

Salford.—The Electricity Committee has approved a report of negotiations with the B.W. Electric and Manufacturing Co., Ltd., resulting in a reduction of £50 in the contract price for a 1,000-kw. rotary converter, representing the amount of the reduction in the price of copper at the time of the acceptance of the tender. Tramways Committee: Hadfield's, Ltd., manganese-steel crossings, £220.

Sunderland.—Electricity and Lighting Committee: Babcock & Wilcox, 50 steel boiler tubes.

Walsall.—Electricity Committee: Messrs. J. C. Abbott and Co., Ltd., coal. Tramways Committee: Messrs. J. Parkinson and Son, 6½-in. centre lathe, £78.

FORTHCOMING EVENTS.

Iron and Steel Institute.—Friday, September 22nd. At 10.30 a.m. At the Institution of Civil Engineers, Great George Street, S.W. Annual meeting.

Municipal Tramways Association.—Friday, September 22nd. At 11 a.m. At the Surveyors' Institution, Great George Street, S.W. Annual general meeting.

Association of Supervising Electricians.—Tuesday, September 26th. At 7.15 p.m. At St. Bride's Institute, Bride Lane, E.C. Presidential address by Mr. A. P. Trotter.

NOTES.

Mica from German East Africa.—Writing to the *Times* recently, a correspondent stated that, in view of the recent capture of Mrogoro by our Rhodesian troops, it might interest readers to know that this district, prior to the war, was the sole German colonial source of mica, a mineral of supreme importance to the great electrical industry of that country. The output of these mica mines (which was shipped in German vessels, and exclusively to Hamburg), was increasing rapidly in importance, and was eagerly purchased by the German buyers, to the exclusion of the supplies they were otherwise obliged to obtain through the medium of English merchants.

Science and Industry in France.—Writing in *La Lumière Éclairée*, M. A. Blondel has put forward a scheme for the reform of the Académie des Sciences, with the object of bringing it more closely into connection with industry. It has been stated by M. Le Chatelier that in France, above all, there is a watertight compartment between scientists and men engaged in industrial occupations, and that the Académie should lead the way in removing this impediment to progress. M. Blondel points out that the founders of the Académie never had the intention of limiting its activities to pure science, but, on the contrary, admitted representatives of the applied sciences known in the eighteenth century, and he urges that representatives of the modern applied sciences should be added to its organisation. Various schemes were put forward by M. Blondel, and the Académie has appointed a Commission to inquire into the subject.

Electrical Equipment of the U.S.S. "Tennessee."—The contract for furnishing the necessary equipment for the electric propulsion of the U.S.S. *Tennessee*, a super-dreadnought of the largest class, now under construction, has been awarded to the Westinghouse Co., of East Pittsburgh, Pa. There are to be two steam turbines developing over 33,000 H.P. driving electric generators, which furnish current to four 6,700-H.P. motors, each motor driving a propeller. Electric driving for battleships has been adopted after a careful investigation by the Navy Department, to whom it presented numerous features of structural, operating and military advantage, among which are that the steam turbines developing the electrical energy may be located in any desired portion of the ship, that the propelling machinery may be better protected from injury, that full power may be available for reversing, and that greater rapidity in manoeuvring is made possible, compared with existing mechanical systems of control. In addition to the main generating equipment and propelling motors, the contract includes the auxiliaries for the main turbine generator sets and smaller auxiliary turbine generators supplying light and power throughout the ship. The *Tennessee* will also be used for cooking, ice-making, refrigeration, and numerous other purposes. In all, 37,500 H.P. will be needed. *Electrical Review and Western Electrician.*

Replacing Gas Lamps by Electric.—At Cincinnati, Ohio, the question of displacing the "gas arcs" extensively employed by commercial houses was considered by the Union Gas and Electric Co., which has now adopted the practice of giving a 300-watt electric lamp and fitting free in place of the gas arc, under certain conditions, which are that the electric lamp remains the property of the company for 12 months, then passes to the consumer, provided that he gives the company a gas arc for each electric lamp installed and uses the electric lamp during the 12 months it remains the property of the company. The latter maintains and renews lamps during the 12 months. On the basis of 300 watts burning four hours a day for 300 days per annum, the energy consumption would amount to \$18 a year, or \$60 a kw.-hours, which at 5 c. per unit would amount to \$18 a year, or \$60 a kw.-hours. The estimated cost of providing the lamp for the first 12 months includes: Lamp, \$5; selling expense, \$2; renewals and maintenance, \$3; a total of \$10, less the credit received for the gas arc, taken at \$1.5. The result of a two-months' campaign was the replacing of over 1,000 gas arcs and a number of gas burners, the proposition having been modified to the extent that one electric lamp is given in exchange for four gas burners, or a credit given of \$1.25 for each burner replaced. A feature of the campaign is that 120 stores which were using little or no electric service, have wired the principal part of their premises, and are now using little but electric illumination.

Large Electric Bake Oven.—A recent issue of the *Journal of Electricity, Power and Gas* contains a description of a large Hughes bakery oven used by the New Vienna Baking Co., of Salt Lake City, U.S.A. The body of the oven is 4 ft. high, 10 ft. wide, and 12 ft. deep, and is divided into four compartments, each with a 1½-in. tile floor, and the customary steam connection. Each half of the oven has three heating units, arranged at top, bottom, and intermediate floor, and each compartment has a thermometer and internal lights.

The heating units are made of resistance wire wound on insulated rods, which are mounted on an angle iron frame, which can be slid in and out for inspection or repair. Each unit is in three sections, and each section has three heats controlled by separate switches mounted in front of the oven. The oven doors are of the balanced type. The oven is operated on a 220-volt, two-phase service, and has a maximum demand of 75 kw., averaging 18 per cent. of its maximum demand on a 16-hour baking day, and 55 per cent. on an 8-hour baking day. It requires 45 minutes to load the oven, bake the bread, and take it out, using 1½ lb. loaves, and, on this schedule, 25,000 1½-lb. loaves could be baked in 24 hours' continuous baking. The product is admitted by all bakers to be superior to that produced by the old style of oven.

A uniform temperature can be maintained practically throughout the baking period, while in the brick oven the temperature gradually falls, and the baking time is extended, making it difficult to obtain a uniform product.

It is stated that the bare cost of electricity is rather higher than the cost of coal, but the counter advantages in the lesser space required, absence of dirt, smoke, &c., more than offset the increased fuel cost, it is also considered that the "bake-electrically" feature for advertising purposes will go far to offset the increased cost.

Engineering Labour Movement.—The Associated Iron and Steel Workers of Great Britain, having fully considered the scheme for the federation of the Unions in the iron and steel industry, have given approval to the scheme, and resolved to carry it into effect at the earliest opportunity.

The *Manchester Guardian* says that "a highly important scheme affecting about 400,000 skilled workers and the future Trade Union development of the engineering and shipbuilding trades is now being confirmed by a ballot of the members concerned. For some years it has been felt that there existed a lack of cohesion between the Trade Unions connected with the engineering and shipbuilding industry, and this led the Council of the Ironfounders' Society to associate with the Executive Council of the Amalgamated Society of Engineers in the promotion of a scheme having for its object closer unity and co-operation for offensive and defensive industrial objects. The Sub-Committee appointed included representatives of the Boiler-makers' and Pattern-makers' Societies, and a considerable number of engineering Trade Unions became identified with the movement. The new code of rules provides:—'This Federation shall consist of Trade Unions representing the workmen employed in the engineering and shipbuilding industry, and its objects shall be to maintain the right of the combination of labour to promote the principle of collective bargaining.'

By-Product Recovery in the U.S.A.—The iron industry of the U.S.A. is rapidly adopting the by-product coking process. There are practically no by-product coke plants in the United States which do not recover ammonia, tar and light oil (crude benzols). In the vast majority of the plants also surplus gas is recovered and utilised either at the plant itself, or by distribution to outside consumers. There is not over 5 per cent. of the by-product coke-oven capacity of the country that is not now equipped with benzol recovery plants, and the by-product coking plants now under construction have either contracted for benzol recovery equipment, or indicated a strong probability that such provision will be made.

Mr. J. E. Johnson states that, assuming that coking coal costs \$2.10 delivered at the works, if this were coked in old-fashioned ovens, the yield would be about 60 per cent., and the coking cost would be about 60 cents per ton of coke; coke, therefore, would cost \$1.10 per ton, and this cost would represent less than 60 per cent. of the heat value of the fuel. The same coke in modern by-product ovens would yield 70 per cent. of good screened coke, and the coking cost would be about 75 cents per ton of coke, so that coke would cost \$3.75 per ton. There are, however, some important deductions from this figure. The gas can be sold to the steel works for heating furnaces, the tar and ammonia are recovered (the latter in the form of ammonium sulphate) and sold; while under present, and, probably, future conditions, the benzol can be recovered at a handsome profit also.

The value of these by-products varies with the location, but is seldom or never less than \$1 per ton of coal. In a region of high-priced fuel such as has been assumed, \$1.50 per ton of coke would be a safe estimate. This would reduce the cost of coke to \$2.25 per ton; in other words, under such circumstances a ton of coke would cost little more than a ton of coal, in spite of the loss of weight and the cost of the operation. Cases exist in which the coke actually costs less per ton than the coal from which it is made, the value of the by-products making up all the losses and paying all the costs of the operation.

Admitting that there are considerable technical advantages in the use of gaseous fuel for power development, it is obvious that these may be commercially realised much more easily when the gasification is done in the blast furnace with a thermal efficiency of 90 per cent., and without labour and capital charges, than they can when the efficiency of gasification is 65 per cent., and the cost 50 cents per ton of fuel, as in the gas producer.—*Met. and Chem. Engineer.*

The Inquiries into Trade after the War.—A Press Association report states that the Committees appointed by the Prime Minister to collect information on the subject of our trade relations after the war are expected to have their reports drawn up by the end of the year. It is stated that in all probability the report of Lord Faringdon's Committee on Financial Facilities will be published some time this week.

We are pleased to note that Mr. Arthur Chamberlain, of Birmingham, who may be credited with knowing more about our national trade problems than Mr. Winston Churchill is likely to do if he lives to be a hundred, has been chastising the latter for his attempt at coin-phrasing when he said: "Look after the war and after the war will look after itself." If all business and industrial men were of military age and had to take up arms or be making munitions, there might be some reason for fear that in studying one problem we were neglecting the more immediate necessity. But perhaps Mr. Churchill already regrets his effort, for it has not been well received in any Press comment that we have seen. We have Mr. Lloyd George's word for it that Mr. Churchill encouraged the "tanks" idea; of course inventors and engineering and other experts had a little to do with the matter as well. To encourage the devisers of means for defeating the enemy in the field while he belittles the efforts of those who are trying to prepare suitable contrivances or devices for rendering us safe against enemy trade attacks after the war, is just a trifle inconsistent. But after 'all, who looks for consistency in a politician? Mr. Chamberlain declares that after the war will not look after itself, and every business man will agree with him. He holds that unless England looks after it now, and looks after it very seriously and very wisely, we shall enter on a period of depression and hardship equal to any in our history.

Fatalities.—At Brown Bayley's steel works, on Sunday, September 10th, while two new bars were being brought to rack by an electric crane, with an electromagnet attached, a man fell off the stack and lay on the bars till on top of him, causing internal hemorrhage and shock from which death ensued. The driver, according to a standard paper, said that when he was lowering the bars one of the electromagnets caught another causing a flash, and the carriage started running the opposite way. When it had travelled back two yards, the current went off. Mr. G. H. Golbehere, electrical engineer, said that one of the wires had come out of the collector and caught on the one below it, causing a short circuit and flash. Since the accident, precautions had been taken to prevent a recurrence. Verdict: Accidental death.

A young electrician named Walter Melrose, who was engaged at the auction mart of Messrs. John Robson, Ltd., Chichester Street, Belfast, in fitting up electric lights, has been killed by being crushed between a hoist and the shaft.

An inquiry was held on September 9th into the death of George Dickson, aged 21, of James Street, Hebburn. A witness named Robert Purcell stated that he, Patrick Nolan, and Dickson were walking along a footpath opposite the Cemetery, when Dickson touched an electric lamp standard with his left arm. Dickson was drawn towards the standard with his arms around it and his knees against it. They tried to release him, but a shock threw witness to the other side of the road. Witness came back and struck Dickson's feet from underneath him, and when the youth fell they pulled him away. He was dead. Alfred Dixon, assistant engineer with the Newcastle-on-Tyne Electric Supply Co., stated that the electrification of the standard had been caused by one of the cable wires getting into contact with the switch-chamber at the top of the standard. There could not have been a greater pressure than 240 volts, and he should not have thought that merely touching the standard would have been dangerous. A person who touched the standard was more likely to be thrown from it than drawn to it. The vibration caused by the road traffic might have caused the contact with the cable. The company had adopted a new method in regard to switch-chambers. In reply to Mr. T. Stuart, clerk to the Hebburn District Council, witness said that of the 540 standards in Hebburn, 130 had been changed. Mr. Stuart said a cable explosion occurred in March, 1913, and there was then a leakage from lamp standards. In the following September the company notified the Council that they were changing the system. In reply to other questions, witness said a leakage of 240 volts was too small to be recorded. He was not aware that in July a boy had been severely burned by contact with a standard. Dr. Norman said death was due to electric shock, but he thought Dickson had taken hold of the standard: merely touching it was scarcely sufficient to cause death. The jury returned a verdict of "Accidental death," and expressed the hope that the company would do all they could to prevent similar accidents. Mr. W. S. Burton, representing the Supply Co., said they regarded it as a very serious matter, and would take into consideration all that had been said that day.

At the Hebburn-on-Tyne District Council meeting, on Monday, the Clerk read a report from Prof. Thornton, who had been instructed by the Council to investigate the circumstances. The report stated that the leakage had been in existence for some days before the accident, and that the type of lamp-head and switch was acknowledged to be imperfect, and he advised that a complete change over of the lamp-heads should be made before the bad weather set in; he further recommended that an inspection once a quarter should be made.

The Chairman said it was lamentable that a great company should be so indifferent in regard to danger, not only on the high road, where there was heavy traffic, but over the whole district generally. It was also a matter for regret that the company had not shown sufficient sympathy with the deceased's family.

After discussion, it was decided to refer Prof. Thornton's report and all other details to the Board of Trade, and also to defray the expenses of the funeral of the victim.

At Mossley, on September 7th, an inquest was held on Harry Briggs, aged 12, of Denbigh Street, a half-time employed at Messrs. Radcliffe's mill. Sidney Etchells (10) said that on the previous Tuesday he was playing with deceased after school and they went to Radcliffe's mill, where he saw deceased touch an electric wire with both hands and fall into some water near the mill. They had often played there before, but had not touched the wire because they knew it to be dangerous. James Fawcett, carter, who sat deceased out of the water, said he received a shock when he touched the boy. The wire was in the boy's left hand under the surface of the dam, which was shallow. The boy was dead and his hand was burnt. Sergeant Hodgkinson said the wire came from a pole, went through a pipe underground to the dam, and the end should have been in the water, but had evidently been pulled out. Dr. Cameron said death was clearly due to electric shock, and the jury returned a verdict to that effect, adding that there had been no neglect on the part of the millowners, the wire having been insulated satisfactorily, and the boys having been trespassers.

Prof. Scott, of the electrical engineering department of Robert College, Constantinople, has been killed by contact with a wire carrying 10,000 volts.—*Science*.

Educational.—NORTHAMPTON POLYTECHNIC INSTITUTE.—We have received a copy of the "Announcements" for the Session 1916-17, giving particulars of the day and evening courses in civil, mechanical, and electrical engineering, technical optics, and horology; the engineering courses include sub-sections in automobile work, aeronautics, and radiotelegraphy, and there are evening courses in electrochemistry and metallurgy. The day classes begin on October 2nd, and the evening classes on September 25th. Special classes for Post Office employees and submarine cable

companies' employees are provided. Dr. R. Mullineux Walmsley, the Principal, is head of the electrical engineering and applied physics department, and with him is associated Mr. F. M. Denton.

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY. The City and Guilds (Engineering) College has instituted a diploma course of instruction in atomistics, extending over a period of three years; it includes teaching in electrical technology, wireless telegraphy, &c.

The Manchester Education Committee announces that the classes established last year—the "Handyman" classes for adults—giving short courses of instruction in the use of simple household tools and their application in dealing with the practical everyday problems of the home, are to be continued this winter, and that instruction will also be given as to what to do in various emergencies, such as the temporary failure of the electric light, the care of electric lamp bulbs, &c. Last year the classes were very successful, the fee being a nominal one.

Industrial "Peace" in Australia.—In the course of our series of articles on "Labour and Industry," we referred to a book on "Industrial Peace," written by Mr. Williams, the secretary of the Geelong and District Employers Association. An esteemed Australian correspondent in the course of a letter to us on this subject says:—"I can fully substantiate Mr. Williams's opinion of the absolute failure of the Federal Arbitration Court and Wage Board System to in any way deal with industrial troubles. This country is seething with unrest, and the Unions are taking advantage of the shortages due to recruiting, to make fat jobs for those remaining behind."

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place, S.W.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, September 25th. Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10. Signalling Class. Recruits' Drill, 6.25—8.25.

Tuesday, September 26th. Range Practice.

Wednesday, September 27th. Lecture, 6.15. Lecture, Mr. W. Eyles (late R.E.), "Demolitions." Platoon Drill, Platoon No. 2. Range Practice.

Thursday, September 28th. Instruction Class, 5.45. Platoon Drill, Platoon No. 6. Range Practice.

Friday, September 29th. Technical for Platoon No. 10; Regency Street. Squad and Platoon Drill No. 9. Signalling Class. Recruits' Drill, 6.25—8.25.

Saturday, September 30th. General Parade, 2.45. Uniform. General Meeting of Corps, 5.30. The Commandant hopes to see a large attendance.

Sunday, October 1st. Entrenching. Parade Victoria Station (S.E. & C. Railway). Booking-office, 8.45 a.m.

MACLEOD YEARSLEY, Adjutant.

3RD BATT. (OLD BOYS) COUNTY OF LONDON VOLUNTEER REGIMENT.—Battalion Orders by Major R. J. C. Eastwood (Commandant), Thursday, September 21st, 1916:—

Week-end Parade, Route March. On Saturday, 23rd inst., the Battalion will parade as strong as possible on the Practice Ground at Lord's Cricket Ground, at 2.45 p.m.

Entrenching Duties. Entrenching on Saturday, 23rd.

Sunday.—The Battalion will parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 9.30 a.m., for Entrenching duties.

Musketry.—Members who have sent in their names to shoot at Bisleigh on Sunday, 24th inst., will report in uniform to Sergt. J. W. S. Burmester, at 9.45 a.m., at No. 8 Platform, Waterloo Station.

G. H. F. DUNCAN, Acting Adjutant.

Copper Prices.—THE WEEK'S CHANGES.—Messrs. F. Smith & Co. report, Wednesday, September 20th:—Electrolytic bars rose from £132 to £137; ditto sheets, £150 to £155; ditto rods, from £140 to £145; ditto h.c. wire, from 1s. 8½d. to 1s. 8½d.

Messrs. James & Shakespeare report, Thursday, September 21st:—Copper bars, sheets, and rods (best selected) rose from £150 to £154.

Electrical Industry in the U.S.A.—The following statistics are given by the *Electrical World*:—

	Investment or capitalisation	Persons employed	Annual earnings or sales
Central electric stations	\$3,038,000,000	104,000	\$403,300,000
Isolated electric stations	1,519,300,000	52,000	201,600,000
Street and electric railways, power generation, distribution, and application	2,681,800,000	165,000	350,500,000
Street and electric railways, trolley operation	2,681,800,000	165,000	350,500,000
Electrified divisions of steam rail roads	204,700,000	15,000	30,300,000
Telephone	1,202,750,000	247,000	329,900,000
Telegraph (land and ocean)	231,600,000	44,000	75,300,000
Electric machinery, apparatus, and supplies (including electric products of other industries)	460,100,000	185,000	383,300,000
Electrical dealers and contractors	15,000,000	50,000	120,000,000
Electrical jobbers	25,000,000	6,000	80,000,000
	\$12,129,650,000	1,023,000	\$2,324,700,000

Italian Standard Rules for Italy.—It was announced, a few months ago, that the Associazione Elettrotecnica Italiana intended to prepare standard rules for the construction and acceptance of delivery of electrical machinery in substitution for those of the Verband Deutscher Elektrotechniker. The rules have now been published. It is considered certain that the rules will be adopted by all Italian electrical constructional and consulting engineers, and the Association is also confident that the Government will fall into line, and insist upon the observance of the rules in contracts with the State.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—In view of his impending departure from West Ham to take up the general management of the Belfast Corporation Tramways, consequent upon Mr. Andrew Nance retiring from the active management of that undertaking, the Metropolitan Association of Electric Tramways Managers entertained Mr. J. S. D. MOFFET to dinner at the Municipal and County Club, Whitehall Court, S.W., last Friday evening. In addition to the guest of the evening, there were also present Messrs. Ullmann (East Ham), Schofield (Leyton), chairman and vice-chairman respectively of the Association, Bruce (L.C.C.), Harvey (Ilford), Hammond (M.E.T.), Mackinnon (L.U.T.), Goodyer (Croydon), hon. secretary, Littler (ex-Chairman West Ham Corporation Tramways), Blain (L.G.O. Co.), Rooke, Scholey, Walton, Wyld, Myers, Beal, Compton, Robson (Southampton) and Chisholm. Letters expressing regret for inability to attend were received from Messrs. Fell and Slatery (L.C.C.), Williams (Erith), Murray (Walthamstow), and Mason (South Met.).

At Blackpool Corporation electricity works, on September 14th, Mr. Moss, an engineer driver who, after 16 years, is retiring for health reasons, was presented with a gold Albert with medal pendant. The presentation was made by Mr. Wm. Parkinson, works manager, in the absence of the borough electrical engineer.

On the recommendation of the Electricity Committee, the Newport (Mon.) Council has agreed to allow Mr. A. NICHOLS MOORE, the borough electrical engineer, to act in an advisory capacity to the board of management of a national shell factory, and also to be responsible for the supervision of the electrical equipment.

Mr. S. HANN, borough electrical engineer at Stoke Newington, formerly a petty officer of the Royal Naval Division, has been appointed to a second lieutenancy in the London Electrical Engineers.

Mr. T. H. WELCH, shift engineer at the Fulham B.C. electricity works, has been awarded the Honorary Vellum of the Royal Humane Society for life-saving under circumstances reported in our issue of June 9th.

Mr. SHOESMITH, works assistant at the Dover Corporation electricity works, and Mr. GASSON, mains assistant, have resigned. Mr. DALE has been appointed to fill the latter vacancy.

General.—The *Times* understands that Mr. THOMAS WORTHINGTON, the Director, from its inception, of the Commercial Intelligence Branch of the Board of Trade, will retire at the end of this month. "Mr. Worthington is an instance of a business man brought in to do special work for the Board. He first attracted attention as a Special Commissioner to South America to report on the prospects of British trade there. On the establishment of the Commercial Intelligence Branch it was at once recognised that he possessed the qualifications necessary for its director. The office was opened at 50, Parliament Street, in 1899, with three or four clerks, but was moved to 73, Basinghall Street in 1904. More than 150 clerks are employed. Since the outbreak of war the Branch has done useful work in following up the ramifications of enemy trade and helping merchants to find among British manufacturers alternative sources of supply of goods previously obtained from enemy firms."

Gazette Notice.—Territorial Force. Royal Engineers.—*London Electrical Engineers.* Sergeant H. F. Waterhouse to be Second Lieutenant (on probation). Second Corporal W. S. Brown to be Second Lieutenant (on probation). Q.M.S. K. W. Adcock, Singapore R.E. Volunteers, to be Second Lieutenant (on probation).

Mr. ARTHUR H. HALLORAN (vice-president and managing editor, *Journal of Electricity, Power, and Gas*) has been appointed Pacific Coast representative of the Society for Electrical Development.

Mr. E. W. ABBOTT has taken over the management of the Newcastle branch of Messrs. Crompton & Co., Ltd., at 21, Pearl Assurance Buildings, Northumberland Street, Newcastle-on-Tyne. For many years he has been in charge of the contract department at Chelmsford, and has carried out the electrical equipment of many important main winders, rolling mills, coaling cranes, large haulage gears, &c. Mr. Abbott was responsible for the design and equipment of many of the early central stations in this country.

Roll of Honour.—Sergeant H. BRAMAH, Signal Sergeant to the 1st Battalion Gordon Highlanders, who has been awarded the Military Medal for gallant work in the field in July last, was a clerk in the office of the resident engineer at the East Sussex County Asylum, Hellingly, S.O. Sussex. The battalion orders read: "He repeatedly went out along the wires down the dangerous road leading into — during the time of a heavy barrage fire by the Germans, and through his devotion to duty, and gallantry, the battalion was able to keep up communication with the brigade and batteries during

a very critical moment, and so practically saved the situation."

Private STEPHEN KIRK, Manchester Regiment, and Private R. E. DAVIES, Cheshire Regiment, two former employes of the British Westinghouse Co., Trafford Park, have been wounded. Corporal WALTER BAILEY, Manchester Regiment, another employe, was reported missing some time ago, and is now officially reported killed.

Private JOHN MCGREEVY, of the King's Own Royal Lancaster Regiment, killed in action at the age of 19 years, was an apprentice electrician at Fleetwood prior to his enlistment.

Rifleman G. H. BRADLEY, of the King's (Liverpool) Regiment, who has been wounded, was employed prior to his enlistment in the Wigan Corporation electricity department.

Private CLIFFORD MORRIS, Cameron Highlanders, aged 19, a former employe of Messrs. Whipp & Bourne, electrical engineers, Castleton, has been killed in action.

Driver JOSEPH WIGNALL, of the R.F.A., who has been wounded, and is in hospital at Rouen, was formerly employed by Messrs. Dick, Kerr & Co., Ltd., Preston. Another employe of the firm, Lance-Corporal C. F. ALDRIDGE, Loyal North Lancashire Regiment, is reported a prisoner of war. Gunner JOHN COULTHURST, R.F.A., aged 26, who was formerly on the clerical staff of the firm, has been killed in action.

Private WILLIAM PAUL, Machine Gun Company, Bedfordshire Regiment, who enlisted whilst with the North Metropolitan Electric Supply Co., at St. Albans, has been killed in action in France.

Private E. MILLER, North Staffordshire Regiment, reported killed in action in France after being posted as missing, was formerly with Messrs. Bullers, Ltd., electrical china manufacturers, Hanley.

Lance-Corporal HAROLD WILLIAMS, K.R.R., who has died of wounds, was on the staff of the Potteries Electric Traction Co., Hanley.

Private FRANK G. CHADWICK, Oxford and Bucks Light Infantry, who has fallen in action, was, on his enlistment, an engineer with the General Electric Co. Ltd., Birmingham.

Private W. ASKEW, 20th County of London Regiment, who enlisted whilst at Birmingham with the B.I. and Helsby Cables, Ltd., has been killed in France by the blowing up of a trench mine.

The Distinguished Conduct Medal has been awarded to Bombardier ARTHUR EDWARD ELLIS, R.F.A., who enlisted in October, 1914, whilst with the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, E. In September, at Vermelles, he repaired telephone wires in 17 different places under heavy shell fire, and enabled communication to be kept up.

Private GEORGE PERCIVAL, Cheshire Regiment, killed in action, aged 19, was, employed prior to enlistment at the Helsby Cable Works.

Gunner JOHN ASHWORTH, of the R.F.A., killed in action, served in the South African war, and prior to the present war was employed in the Liverpool tramways department at Smithdown Road depot.

Private FRANK HIGGINS, K.O.Y.L.I., is officially reported killed in action. He was on the staff of the Wakefield and District Light Railway Co.

Private DOUGLAS GIBSON, Royal Welsh Fusiliers, reported wounded in action, was formerly employed in the electricity department at Blackpool Tower.

Private WILLIAM TITTERTON, of the Manchester Regiment, a former employe of the British Westinghouse Co., Ltd., Trafford Park, has been killed in action.

Private WALTER WILKINS, 2nd Battalion Oxford and Bucks Light Infantry, who has fallen in action in France, enlisted whilst engaged in the illumination department of the British Thomson-Houston Co., Ltd., Rugby.

Sergeant ARTHUR MASON, Oxon and Bucks Light Infantry, who was before the war on the Rugby staff of the British Thomson-Houston Co., Ltd., has fallen in action in France. He was 32 years of age.

Gunner FRED GOODMAN, R.F.A., for some years engaged in the special engineering office of the British Thomson-Houston Co., Ltd., Rugby, has died of wounds received in action in France.

Major A. ROBERTSON, D.S.O., R.E., a son of ex-Bailie Robertson, Aberdeen, and a member of the firm of Messrs. A. B. Robertson & Son, electrical engineers, Aberdeen, received his decoration from the King at Windsor Castle recently. The gallant officer is an Associate Member of the Institution of Electrical Engineers. He has been a Territorial officer for 12 years, and has been at the Front for 18 months. He is at present in a hospital in London recovering from illness.

We regret to learn that Lieutenant HAROLD LOMAS was killed in France in the advance of July 1st. Lieutenant Lomas received his technical education and training at Owens College, Manchester, and at the works of Messrs. Laurence, Scott & Co., Ltd., Norwich. In 1897, in company with Mr. H. C. GUNTON (now power engineer to the G.P.O.), he visited the States, and together these gentlemen wrote a series of illustrated articles for the *ELECTRICAL REVIEW* describing various electrical undertakings and works. Lieutenant Lomas subsequently served on the staff of Messrs. R. W. Blackwell and Co., Ltd., and on the staff of the Crocker-Wheeler Co., of

Electric Supply Co. of Victoria, Ltd.	In their report for the year ended March 31st, 1916, the directors give the following comparative figures for the past three years.		
	1913-14.	1914-15.	1915-16.
Lamps connected	1,000,000	1,500,000	1,600,000
Traumway passengers carried	5,566,470	5,177,368	4,877,325
Revenue	£89,024	£86,800	£86,080
Expenditure	57,524	58,900	55,378
Gross profit	31,500	27,900	30,702

As in the preceding year, the progress of the company has been adversely affected by war conditions. The returns for the past year may be regarded as satisfactory. The balance to credit of profit and loss is £28,944, plus £2,000 brought forward. Debenture interest requires £7,742, there is transferred to debenture stock redemption account £6,547, there is to be paid on account of arrears of preference dividend £10,222, leaving £6,433 to be carried forward.

German Electric Companies. The *Internationale Stickstoff A.G.*, of Wiesbaden, whose works are leased to the Nitric Acid Co., of Cologne, records a slight loss in 1915, thus increasing the deficit to £16,000 on an ordinary share capital of £103,000.

The directors of the *Kabelwerk Rheylt* recommend the payment of a dividend of 30 per cent. for the year ended with June 30th, 1916. This rate compares with 18 per cent. in 1914-15 and 12 per cent. each in 1913-14 and 1912-13.

The trading of the *Elektrowerke A.G.*, of Berlin, for the first year, which ended on March 31st, 1916, is reported upon. The company, the majority of whose shares are held by the Berlin Electricity Works Co., took over the Golpa-Jessnitz lignite works for the erection of a huge station, and entered into contracts for the supply of 740,000,000 kw.-hours per annum to the Bavarian Nitrate Works and the Electro-Nitrate Works. The accounts show a slight balance, which has been carried forward; the expenditure on the power station is recorded at £984,000.

The *Wolfram Lampen A.G.*, of Augsburg, reports net profits of £14,200 for 1915-16, including the balance brought forward. It is proposed to pay 6 per cent. on the preference capital of £27,000 by way of arrears for 1913-14 and 1914-15, leaving 1915-16 in default. The payment of any dividend on the ordinary capital of £26,000 is again omitted. It is added that a decision of the Supreme Court has not yet been given in the matter of the patent dispute concerning the manufacture of a drawn-wolfram (tungsten) filament.

The report of *Brown, Boveri & Co.*, of Mannheim, states that the production and turnover, which experienced a decline in 1914, again increased substantially in 1915, but raw materials were dearer, and salaries and wages largely advanced. Nevertheless, the financial results were more satisfactory than in the preceding year. The gross profits rose from £185,000 in 1914 to £285,000 last year, and the net profits from £84,000 to £58,000 in the two years respectively. It has been decided to pay 10 per cent. on the share capital of £450,000, as against 5 per cent. in each of the two preceding years.

Swiss Companies. The report of the *Société Electromotale Unigine Paul Girod, et Associés*, whose principal installations and investments are in France, states that the French subsidiary company—the Forges et Acieries Electriques Paul Girod, of Ugine, Savoy—worked very successfully in 1915. As net profits, the accounts of the parent company indicate the sum of £59,000, and after several dividendless years a distribution at the rate of 8 per cent. has been declared on the ordinary share capital of £450,000.

The chairman, at the recent general meeting, referred to the acquisition of important water powers, which he characterised as one of the principal bases of the company, and he expressed the opinion that the non-conclusion of the agreement with the Creusot Works for the reconstruction of the Swiss undertaking, as was proposed prior to the war, had been a fortunate event for the Girod Co.

The report of *Brown, Boveri & Co. of Baden, Switzerland*, which deals with the financial year ended on March 31st, 1916, states that as a result of the great decrease or complete stagnation in the peace production of the nations at war, an extraordinary demand arose for the company's manufactures, and orders were available to any extent. The problem of bringing sale prices into harmony with the cost of production proved to be more difficult, as all kinds of raw materials rapidly rose, and in some cases reached a fantastic level, and it was scarcely possible to adjust sale prices to this increase. It was, however, still more difficult to procure supplies of materials, and the possibility of obtaining them also limited the possibility of production. This was particularly the case with copper, and the seizure of a large delivery in course of transport resulted in a loss in output amounting to several millions of francs. The output in 1915-16 was considerably less than in the last peace year of 1913-14, and the value of the turnover, despite the higher prices, was also greatly below that of 1913-14. The report further remarks that the company had adhered to its policy mentioned a year ago and had restricted its manufacturing operations exclusively to the normal production in years of peace. In the case of the foreign undertakings in which the company is interested, the conditions had again assumed a form which could be regarded as normal, having regard to existing circumstances. With one exception, these companies had carried on a success-

ful business last year, and equal results were expected for the present year. The electrical supply companies in which the company was also interested were partly working satisfactorily and were partly prejudiced through the war, owing to their local situation or two special circumstances. The gross profits of the Baden company, including the yield from securities and participations, amounted to £454,000, as compared with £388,000 in 1914-15. After devoting a larger sum to depreciation than in the preceding year the net profits are returned at £106,000, as against £94,000, and the dividend recommended is at the rate of 6 per cent. on the ordinary share capital of £1,280,000, this contrasting with 5 per cent. in each of the two preceding years and 8 per cent. in 1912-13.

Official Announcements re Companies.—The following companies are to be struck off the register unless cause to the contrary is shown within three months:—

Auto-Flash Sign Co.
C. J. M. G. S. R. P. S. S.
Llanidloes Electric Lighting Co.
Dunlop Pump Works Ltd.
Scientific Researches Co.
Turbo Engine & Pump Co.
Wireless Telephones.

County of Dorset Electric Supply Co., Ltd.—At the annual meeting, held at the end of July, Dr. J. A. Hosker, who presided, referred to the difficulties of war-time; fuel and other costs had been continually on the up-grade, and the lighting restrictions which had been strictly enforced in all their four towns had diminished the revenue by 25 per cent. Notwithstanding these facts, the gross revenue had shown an astonishing increase of 30 per cent., due chiefly to the increased private demand, and the demand of the War Office at the Dorchester Prisoners' War Camp. Since the date of the balance sheet a considerable increase in output had been recorded. The Blandford business was making excellent progress, Swanage output was steadily increasing, but at Lyme Regis there was a slight diminution in receipts.

Stratford-on-Avon Electricity Co., Ltd.—In their report for the year ended December, 1915, the directors express regret that in consequence of the large abnormal expenditure on repairs to mains, coupled with the increased cost of materials and standing charges, they are unable to recommend a payment of any dividend. Under the circumstances, the directors will not at present draw their usual fees. Mr. J. A. Priest has been elected to the board in place of Mr. J. Macgregor. The annual meeting was held on September 8th.

Clyde Valley Electrical Power Co.—For the half-year ended June 30th last, the profit amounts to £40,322, plus £12,613 brought forward. After transferring £17,500 to contingency fund for depreciation, &c., bringing this fund up to £167,500, the directors recommend transferring to special reserve fund £3,836, the payment of the preference dividend (£9,000), a dividend of 1½ per cent. on the ordinary shares (free of tax), requiring £7,500, and to carry forward £15,456.

British Aluminium Co., Ltd.—The directors have declared a dividend at the rate of 8 per cent. per annum (less income-tax) on the ordinary share capital for the six months to June 30th; also a dividend at the rate of 6 per cent. per annum (less income-tax) on the preference share capital for the six months to June 30th.

Direct Spanish Telegraph Co., Ltd.—In addition to the dividend at the rate of 10 per cent. per annum on the preference shares, the directors have decided to pay an interim dividend at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares—both for the half-year ended June last.

The Canadian Loan.—We read in the "Financial Times" that one of the first subscribers for the Canadian loan was received from the Commercial Cable Co., who applied for \$2,000,000, thus increasing its holding of pro-British loans to \$10,000,000.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended July 28th, 1916, amounted to 2,021,562, compared with 1,972,641 during the corresponding four weeks of 1915.

Stock Exchange Notice.—The committee has been asked to allow the following to be quoted in the Official List:—Consolidated Gas, Electric Light, and Power Co. of Baltimore.—\$619,000 additional common stock.

Folkestone Electricity Supply Co., Ltd.—Interim dividend at the rate of 6 per cent. per annum (3s. per share), less income-tax, for the past half-year, on the ordinary shares.

Eastern Extension Australasia & China Telegraph Co., Ltd.—Interim dividend for the quarter ended June 30th last of 3s. per share, free of tax.

Eastern Telegraph Co., Ltd.—Second quarterly interim dividend of 1½ per cent. on the ordinary stock, free of tax.

Dick, Kerr & Co., Ltd.—Dividend at the rate of 6 per cent. per annum on the preference shares.

Lancashire Dynamo & Motor Co., Ltd.—Interim dividend on the ordinary shares of 5 per cent., tax free, against 3 per cent. a year ago. — *Financial Times.*

British Insulated & Helsby Cables, Ltd.—Interim dividend of 5 per cent. for the half-year ended June 30th, less tax.

STOCKS AND SHARES.

FRIDAY EVENING.

The excellent character of the news from the various battle-fronts is a helpful factor in keeping prices strong. There is, moreover, a possibility of the Bank Rate being reduced, in view of the advent of a new loan towards the end of the year. Business on the whole is not bad. A disquieting influence is the weakness of Home Railway stocks, induced, of course, by the attitude of the men in regard to the 10s. per week increased pay for which they are asking, and by their refusal of the 3s. offered them. This acts as a severe damper to the market. [The additional war bonus has, since writing, been settled by agreement at 5s.—Eds.] On the other hand, New York is running a boom in American Rails, which is not without sympathetic effect upon Canadian utilities and Mexican issues. Amongst industrials, the feature continues to be the strength of the rubber market, which this week has been fortified by a rise in the price of the raw stuff.

Central London assented ordinary stock is steady at 73, but the non-assented continues very weak at 45½. The two classes of preferred stocks are called 62½ and 72, and, of the deferred stocks, 27½ and 71 for the non-assented and assented respectively. Metropolitan has given way to 24½, after being still easier, and districts went back to 18. East London ordinary changed hands the other day at 78/9.

All the Steam stocks, without exception, are weak and depressed. So dull is the market, in fact, that it would seem to be approaching the condition at which stocks would be cheap. There is, of course, little bare account in these days of Treasury restrictions; but, in spite of this, the amount of stock available is very small, and improvement in the labour situation would bring about a sharp upward reaction.

The position in Mexico does not appear to have altered much from what it was when last we wrote, but, as mentioned above, the New York boom in rails has shed a dim reflection upon Mexican stocks and shares. Mexican Light and Power bonds are 2 points up at 45, the preferred gained a point at 35, but Mexico Trams are steady and show no change. The feature in this section is once more a jump in British Columbia Electric Railway stocks, the preferred leading easily with a rise of 2½. The preference put on 2 points, and the deferred at 55 is ½ up. The debenture stock was quoted ex dividend last week.

The Anglo-Argentine Tramways group remains dull and heavy, for reasons that we have mentioned from time to time here recently. The first preference shares are 6s. 3d. down at 34; the seconds are £3, changing hands on this basis a few days ago; while the debenture stocks have recently been done at 74, 76, and 74½ for the 4 per cent., the 4½ per cent., and the 5 per cent. issues respectively. Most other things connected with the Argentine Republic have a weak tendency. The dividends on Anglo-Argentine Tramways preference are due in June and December.

The Telegraph market is a little easier. Eastern ordinary eased off to 145½, so that the stock, for once in a way, stands about a point lower, relatively, than Eastern Extension shares, the latter being 14½, and showing a small fall on the week. Anglo-American Telegraph deferred is a point down at 102. At par, the stock may be regarded as a reasonably-priced 6 per cent. investment. Westerns are ½ down at 143. There is not much doing in Marconis. The parent shares remain at 3 3/16; and while Americans are well maintained at 19s. 3d., the excitement recently noticeable in them has largely died down. Canadian Marconis have advanced to 11s. on a report which makes a reasonably good showing, and which suggests that it will not be so very long before the proprietors receive some return on their money.

Movements are unimportant in the home electricity section. Kensingtons are better at 5½, and London Electric preference hardened to 4½. Bromptons, on the other hand, are a trifle easier. Chelseas have regained the dividend of 1s. 6d. deducted last week. County ordinary and preference are both ex dividend; and, allowing for this, there is no particular change in the prices.

Metropolitan Electric ordinary keep firm, on the expectation that at the meeting next week the scheme proposed by the Shareholders' Committee, details of which were set forth in full in these columns last week, will be duly carried, and the company thereby enabled to start afresh upon a peaceable and prosperous career. South Metropolitan ordinary are a firm spot at 19s., though business in them has been very limited of late. South Londons have hardened to the near neighbourhood of 3.

The British Insulated & Helsby Cables Co. has announced the usual interim dividend of 5 per cent. on the ordinary shares, the price of which remains at 12½, holding the advance of 5s. established last week. A rise of 1s. 9d. took British Westinghouse preference to 9 1/16, the hope being revived that the company will be able to increase the dividend

from the 7½ per cent. recently paid. General Electric ordinary at 14½ are the fraction to the good, and other manufacturing shares are steady. There is a brisk demand for iron, coal, and steel issues of all kinds. The excellent dividend from the Armstrong Co. quickened a demand for armament shares. The rubber market keeps good, as already observed, and the recent earthquake in Java may be said to have exercised virtually no effect upon prices.

The Bombay Electric Supply & Tramways Co. is inviting the holders of its 1½ per cent. debenture stock to offer the same to the company, and some of the proprietors are a little perplexed as to what they should ask for their holdings. The last recorded bargain in the Stock Exchange Official List was at 83, on July 13th; but as the interest is payable on January 1st and July 1st, there is nearly three months' accumulated dividend in the price. Considering the excellent character of the security, it is probably worth something in the neighbourhood of 90, at which the return would work out to the full 5 per cent. on the money. Proprietors might ask this price, or a little higher.

The Electric Supply Co. of Victoria reports a net revenue of £90,700, or about £1,000 more than that for the preceding year. The directors are proposing to pay the preference dividend, carrying forward £6,400. This would still leave another 3 per cent. to be paid on the preference shares before they are clear of arrears. The 5 per cent. first mortgage debenture stock last changed hands at 86½. Victoria Falls preference are a good market at a sovereign, and the ordinary shares have risen to 10s. 3d., while the 5½ per cent. debentures are better at 10½. The improvements are due, as we were saying last week, to the expectations of a dividend on the ordinary shares within the course of the present year.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.					
	Dividend	Price			
	1914.	1915.	Sept. 19, 1916.	Rise or fall this week.	Yield p.c.
Brompton Ordinary ..	10	10	62	—	47 11 0
Charing Cross Ordinary ..	5	5	30	—	7 1 4
do. do. 4½ Pref. ..	4½	4½	30	—	6 6 4
Chelsea ..	6	4	45d	+1/6	6 18 4
City of London ..	9	8	12½	—	10 8 8
County of London ..	7	7	103½d	—	6 9 8
do. do. 6 per cent. Pref. ..	6	6	103½d	—	6 15 8
do. do. 6 per cent. Pref. ..	6	6	103½d	—	6 15 8
Kensington Ordinary ..	9	7	52	—	6 4 5
London Electric ..	4	8	62	—	10 5 8
do. do. 6 per cent. Pref. ..	6	6	44	+ ½	6 13 4
Metropolitan ..	3½	3	23	—	5 9 1
do. 4½ per cent. Pref. ..	4½	4½	34	—	7 4 0
St. James' and Pall Mall ..	10	8	62	—	6 5 6
South London ..	6	6	21½	—	6 18 1
South Metropolitan Pref. ..	7	7	12½	—	6 7 8
Westminster Ordinary ..	9	7	62	—	6 12 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref. ..	6	6	102	—1	5 17 6
do. Def. ..	80/	33/6	23½	—	7 8 9
Chile Telephone ..	8	8	7	—	5 14 6
Cuba Sub. Ord. ..	5	5	8½	—	6 8 6
Eastern Extension ..	7	8	1½	—	5 9 6
Eastern Tel. Ord. ..	7	8	145½	—1½	5 10 0
Globe Tel. and Tel. Ord. ..	6	7	12½	—	5 8 8
do. do. 6 per cent. Pref. ..	6	6	10½	—	6 10 4
Great Northern Tel. ..	22	22	42	—	6 4 9
Indo-European ..	13	13	49	—	6 12 8
Marconi ..	10	10	3½	—	3 9 9
New York Tel. 4½ ..	4½	4½	100	—	4 10 0
Oriental Telephone Ord. ..	10	10	22	—	4 8 11
United R. Plate Tel. ..	8	8	6½	—	5 16 6
West India and Pan. ..	1	1	1	—	—
Western Telegraph ..	7	8	78	—	5 8 0
HOME RAILS.					
Central London, Ord. Assented	4	4	14	—	5 9 7
Metropolitan ..	1½	1	24½	—	4 0 10
do. District ..	Nil	Nil	18	—	Nil
Underground Electric Ordinary	Nil	Nil	12	—	Nil
do. 5 Pref. ..	8	8	87	—	3d. Nil
do. do. Income ..	6	6	89½	+ ½	5 14 1
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref. ..	6	6	4½	—	6 1 6
Anglo-Arg. Trams, First Pref. ..	6½	6½	3½	—	7 17 2
do. 2nd Pref. ..	5½	5½	8	—	6 10 4
do. 6 Deb. ..	5	5	75	—	6 11 8
Brazil Tractions ..	4	4	60½	—	6 14 8
Bombay Electric Pref. ..	6	6	10	—	6 15 8
British Columbia Elec. Ry. Pref. ..	5	5	77	+2	Nil
do. do. Preferred ..	5	5	64	+2½	Nil
do. do. Deferred ..	Nil	Nil	60	+ ½	Nil
do. do. Deb. ..	4½	4½	65½	—	6 10 1
Mexico Trams 6 per cent. Bonds ..	Nil	Nil	44	+1	Nil
do. do. 6 per cent. Bonds ..	Nil	Nil	86	+1	Nil
Mexican Light Common ..	Nil	Nil	19	—	Nil
do. Pref. ..	Nil	Nil	85	+1	Nil
do. 1st Bonds ..	Nil	Nil	45	+2	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox ..	14	15	8½	—	4 18
British Aluminium Ord. ..	5	7	25½	—	5 6
British Insulated Ord. ..	15	17½	12½	—	7 0
British Westinghouse Pref. ..	7½	7½	2½	+1/9	5 17
Calenders ..	15	20	12½	+ 2	6 17
do. 5 Pref. ..	20	6	—	—	6 6
Cassner-Kellner ..	Nil	—	35	—	Nil
Edison & Swan, £3 paid ..	Nil	—	10½	—	Nil
do. do. fully paid ..	Nil	—	12	—	8 0
do. do. 5 per cent. Deb. ..	6	6	62	—	5 11
Electric Construction ..	6	7½	17½	—	6 0
Gen. Elec. Pref. ..	6	6	10	—	6 0
do. Ord. ..	10	10	14½	+ ½	6 18
Henley ..	20	25	12	—	7 9
do. 4½ Pref. ..	4½	4½	42	—	6 6
India Rubber ..	10	10	12	—	8 3
Telegraph Con. ..	20	90	89	—	6 4

* Dividends paid free of income-tax.

THE BRITISH ASSOCIATION.—III.

ONE of the most notable meetings that took place during the visit of the British Association to Newcastle-on-Tyne was that held jointly by the Engineering and Chemistry Sections, on September 8th, to consider the problem of fuel economy. Mr. GERALD STONEY, president of the former section, was in the chair.

The first report of the Committee appointed for the Investigation of Fuel Economy, the Utilisation of Coal, and Smoke Prevention, was submitted; an abstract of it is given below:—

THE chief material basis of the great industrial and commercial expansion of this country during the past century has been its abundant supplies of easily obtainable coal, which, until recent years, has given us a position of advantage over all other countries. We can no longer claim any advantage in this respect over our two closest competitors.

Up to the present we have been wasteful and improvident in regard to our methods of getting and utilising coal; not only are great economies in both these directions attainable, but also the question of the general adoption of more scientific methods in regard to these matters is one of vital importance, in view of the trying period of economic recuperation which will immediately succeed the war.

For some years before the war the average price of coal at the pithead had been decidedly on the up-grade, owing chiefly to deeper workings, higher wages, and greater precautions for ensuring the safety of the mines. The result of the great coal strike of 1912, and the legislation which it provoked, was to accentuate this tendency. And if, as seems probable, prices continue to rise for some time after the war at an accelerated rate, as compared with the pre-war period, the question of the best utilisation of fuels will be of increasing importance to the nation.

The fact that the available reserves of coal in Great Britain only amount to about one-fortieth, whilst those of the whole Empire do not amount to more than about one-fourth of the world's estimated total, is one which ought to be brought home to everyone responsible for the economic development of our national and imperial resources, especially in view of the fact that the United States, whose competition in the immediate future will probably be much more severely felt than ever before, possesses more than half the estimated world's coal, and that also in regard to the two prime considerations of quality and cost of production she probably compares favourably with Great Britain and the Empire.

In the United States both the Government and the University of Illinois have, for some years past, conducted numerous important chemical investigations and large-scale trials upon the character of the principal American coal seams and their adaptation for various economic ends, and in consequence American manufacturers have at their disposal much more complete and systematic information about their country's coal resources than is at present possessed by their British competitors. Nor has Canada lagged behind her neighbour, as is proved by the recent exhaustive "Investigation of the Coals of Canada with reference to their Economic Qualities," conducted at the McGill University, Montreal, under the authority of the Dominion Government. No such comprehensive investigations have ever been undertaken in this country, where they are much needed. The Committee is of opinion that the example of the United States and Canada might be followed with advantage to the industrial community by the Government of Great Britain, and that representations should be made with the object of inducing the Government to provide adequate funds in aid of further researches and investigations upon the chemical character of the principal British coal seams, the best means for their future development in the national interest, and upon problems of fuel economy, including the utilisation of all the by-products obtainable from coal.

During the ten years' period immediately preceding the outbreak of war the world's demands have continuously increased at a compound interest rate of nearly 5 per cent. per annum. These demands have been principally met by the United States, Great Britain, and Germany, which, between them, have hitherto annually raised 83 per cent. of the total anthracite and bituminous coals consumed in the world. Up to the outbreak of the war the coal output of the United States was increasing annually at a compound interest rate of about 6 per cent., that of Germany at about 4 per cent., whilst the British output was increasing at 2 per cent. only. During the period 1910-14 the United States produced nearly twice as much coal as Great Britain, and, assuming that these relative rates of increase are maintained after the war, it may be predicted that Germany's output of coal will overtake that of Great Britain about 20 years' hence, when each country will be producing some 420,000,000 tons per annum.

The public cannot be too often reminded that not only is coal of prime importance as a fuel, but also that, when suitably handled by the chemist, it yields very valuable by-products, which are the raw materials of important industries. There is no doubt that we in this country have not been sufficiently alive to the importance of recovering such by-

products from the raw coal raised in our mines, and that we have been very much behind Germany in this respect. Thus, for example, whilst in the coking industry modern by-product recovery plants had been universally installed years ago throughout Germany, we were, in 1913, still carbonising about six and a half million tons of coal annually for metallurgical coke in old-fashioned beehive ovens. Also, whereas our total production of ammonia sulphate from coal was in 1913 about 318,000 tons, Germany produced nearly half a million tons from a very much smaller output of coal.

Progress in fuel economy involves something more than increased thermal efficiency in respect of power production and of heating operations generally, important as these undoubtedly are. It also involves the whole question of the better utilisation of our coal, including the recovery of by-products and the consequent abolition of the smoke nuisance, which at present, directly and indirectly, costs the country many million of pounds per annum.

There are two outstanding features in the history of the British coal trade to which the Committee desires to draw attention. One is the remarkably steady increase in the total output of our mines, which, since 1870, has been maintained at an almost uniform compound interest rate of 2 per cent. per annum.

The second feature is the phenomenal growth of our export trade, which, during the past 60 years, has increased something like twenty-fold, both as regards the quantities and the values of coal exported. Moreover, its value relative to other values exported has, during the same period, increased fourfold, until at the outbreak of war it constituted about 10 per cent. of our total exported values.

The proportion of the coal raised annually in the United Kingdom which is exported has been doubled within the past 35 years, trebled within half a century, and is still increasing. Three factors have operated in producing this result. One is the proximity of the finest coalfields to our ports, another is the increased demands for coal from Europe and South America, while a third has been the phenomenal growth of our mercantile marine.

A vast amount of usable coal is left behind in the mine because, under present individualistic conditions, it does not pay to bring it to the surface. A larger profit on the capital of a colliery company can often be earned by working the better classes of coal and leaving the less valuable grades underground. According to figures issued in the Report of the 1905 Royal Commission on Coal Supplies, this wastage amounted to nearly 25 per cent. of the total raised in the larger coalfields. The question of checking this 'wastage' by finding out in what ways the less valuable grades can be turned to good account commercially is one of supreme national importance, and the Committee desires to draw special attention to it. Much of the coal now left behind in the mines ought to be converted into useful forms of energy and products for public purposes, and one of the most important aspects of the fuel-economy problem in Great Britain is the devising and organising of means for making it possible to raise this hitherto wasted coal at an economic advantage.

Coming now to the possible saving in the coal consumed annually in this country at the outbreak of the war (nearly 200,000,000 tons), the 1905 Royal Commission on Coal Supplies found that the possible saving in our then annual coal consumption (467,000,000 tons) amounted to between 40 and 60 million tons. Notwithstanding the improved apparatus which has been put into use in the best factories throughout the country during the last ten years, the average result obtained for the country as a whole still lags behind the best possible obtainable to-day in as great a proportion as it did in 1905. It will be the business of this Committee to estimate as nearly as may be the present possible margin of saving, and to point out the particular directions in which it can be attained from a national point of view.

ORGANISATION OF THE COMMITTEE'S WORK.

Having regard to the magnitude of its work, the original Committee of 13 members appointed by the Association in October, 1915, decided to exercise somewhat freely its powers of co-optation, so as to make a general committee sufficiently large and representative of all the important interests involved, which for the more detailed and special study of particular aspects of the fuel question resolved itself into five sub-committees.

The General Committee next appointed an Executive Committee, which could meet frequently in London for the discussion of matters relative to the organisation and co-ordination of the work of the Committee as a whole. In all, 30 meetings have been held during the year. At the first meeting of the General Committee it was decided to organise a series of conferences of manufacturers and others interested in the fuel question in a number of the larger industrial centres; six conferences have already been held, and were productive of valuable information.

During the first year of its existence the attention of the Committee has been fully occupied with questions of organisation and a preliminary survey of the ground which must be explored later on. Already several important lines of investigation needing the co-operation of manufacturers have been instituted and are well in hand, but the returns are in most cases not yet sufficiently complete to justify publication in the report.

The Committee recommends that it be re-appointed to continue its investigations.

THE WORK OF THE SUB-COMMITTEES

The Chemical and Statistical Sub-Committee (Dr. J. T. Dunn, Chairman) is preparing a memorandum and a bibliography on the question of the chemistry of coal, and is of the opinion that the time has now arrived for a re-investigation of the subject. Some of its members have undertaken experimental work, with the object of providing a basis for a more complete attack upon the subject in the near future. The Sub-Committee is of the opinion that the time is ripe for the organisation of a scheme of systematic co-operative research, aided by national funds.

The Sub-Committee is also compiling statistical information relative to the different purposes for which coal is used, and proposes to inquire into the amount of wastage due to coal which, for one reason or another, is at present left behind in the pits.

The Carbonisation Sub-Committee (Mr. T. Y. Greener, Chairman) states that the total amount of coal carbonised in this Kingdom for the manufacture of metallurgical coke or for towns' gas in the year 1913 was probably about 35 to 40 million tons, or approximately one-fifth of the total home consumption of coal for all purposes. The total coal carbonised in gasworks would be about 18,200,000 tons. The amount of ammonium sulphate produced by gasworks in that time in the United Kingdom was officially given as 182,180 tons, which would represent an average yield of about 22.4 lb. per ton of coal carbonised.

The amount of coal carbonised for the manufacture of metallurgical coke in 1913 probably did not fall much short of 20 million tons. The larger proportion was carbonised in by-product ovens, producing, besides coke, tar, benzol, &c., some 133,816 tons of ammonium sulphate.

With regard to the coking industry, the Sub-Committee has already undertaken steps to secure complete returns which will enable it to arrive at an approximate estimate of the margins of possible economies which can now be effected in the coking industry. A memorandum is also in course of preparation describing the more important developments of the by-product coking industry, from its inception until the present day.

With regard to gasworks practice, inquiries have been instituted regarding the present practice in connection with the manufacture of towns' gas; it is also intended later on to consider the question of low-temperature carbonisation from the point of view of its possible economic results.

The Metallurgical, Ceramic, and Refractory Materials Sub-Committee (Dr. J. E. Stead, Chairman) finds that the amount of coal consumed in metallurgical, ceramic, refractory materials, and cognate industries probably amounts to approximately 20 per cent. of the total home consumption. Of this, probably about three-fourths must be debited to the iron and steel industries.

The Sub-Committee has taken steps to obtain data from some of the larger manufacturers of pig iron, spiegeleisen, ferro-manganese, &c., throughout the Kingdom. A description will be given of the best methods now available for the utilisation of the surplus gases from a modern blast furnace.

In like manner a series of questions relative to fuel consumptions in steelworks has been prepared for circulation among the larger steel plants in the Kingdom. The Sub-Committee will endeavour to draw up a statement as to the best lay-out and arrangement of a combined by-product coking, iron-smelting, and steel-making plant from the point of view of utilising as completely as possible surplus gases and waste heat, and thus realising the maximum fuel economy in the heavy-steel industry.

Similar inquiries will be instituted in regard to present-day practice and results in relation to iron foundries, manufacture of wrought iron, specialised steel industries, and the ceramic industry. All information communicated to it by individual manufacturers will be regarded as confidential.

The Power and Steam Raising Sub-Committee (Mr. C. H. Merz, Chairman) has decided to deal with the subject under the following heads:—

1. To consider (a) the amount of fuel consumed, and (b) the corresponding power developed in the United Kingdom under the following heads: Factories, mines, railways, ships, and steam raising for other purposes than power.

2. To consider the present position of central electrical power plants and gas undertakings as regards power supply.

3. To discuss the relative merits of the present methods for producing power by steam, gas, oil, and petrol engines respectively.

4. To investigate the possible saving of fuel which might be effected (a) by improved plant, (b) by greater centralisation of power production, (c) by co-ordination with metallurgical and other manufacturing processes, (d) by some measure of public control, (e) by better supervision, and (f) by the use of inferior grades of fuel which are at present wasted.

While, on account of the magnitude of the subject and the amount of investigation involved, it is not possible at present to submit any report, it may be mentioned that information has been sought as to the amount of fuel consumed and the corresponding power developed, in official publications.

The average figure of 5 lb. of coal per H.P.-hour which was given in the Report of the Royal Commission on Coal Supplies in 1905 probably did not exaggerate the actual consumption at that time.

In view of the impossibility of obtaining accurate returns of fuel consumption per H.P.-hour from the whole of the

power users in this country, it has been decided to investigate the matter by asking for detailed returns from typical factories in various trades and in different districts throughout the country, selected by members of the Sub-Committee who have special knowledge of particular trades.

Special memoranda are in course of preparation on questions of organisation of power production for industrial and transport purposes, the use of large turbine and gas engines, and other important aspects of the power question.

The Domestic Fuel Sub-Committee (Mr. E. D. Simon, Chairman) states that the amount of coal actually consumed for domestic purposes in the United Kingdom probably does not fall far short of 36 million tons per annum—nearly one-fifth of the total consumption for all purposes in the United Kingdom. To this would have to be added the "coal equivalent" of the gas and electricity consumed for domestic purposes, if a correct estimate of the total domestic coal consumption was to be made. The Royal Commission of 1905 estimated that 50 per cent. of the coal consumed for domestic purposes might be saved by the installation of better appliances, so that there is clearly a vast field for economy.

The whole question of domestic uses of fuel bristles with difficulties and complications. It would appear that the kitchen is responsible for the greater part of our annual domestic fuel bill, and, therefore, the question of the relative efficiencies of kitchen ranges, gas and electric cookers, and hot-water supply apparatus assumes considerable importance.

The selection or recommendation of particular means or apparatus for domestic heating cannot always be based simply upon the question of thermal efficiency, because it also involves considerations of a physiological and even of a psychological character. Thus, for example, systems of central heating which have been recommended on grounds chiefly of thermal efficiency, and which are so universally used in America and on the Continent, are not usually acceptable to the average Englishman, who undoubtedly prefers to be warmed by the radiation from a bright fire.

This being so, the Sub-Committee feels that it will be wise to recognise at the outset that there is probably no single solution of the domestic heating problem which is likely to be universally adopted within any measurable period of time; and that, therefore, it should preferably concentrate its efforts upon questions of more immediate practical importance.

The Sub-Committee has arranged for experiments to be carried out with the object of determining how to produce in a given room suitably warm and healthy conditions at a minimum cost and with a minimum production of smoke, and how such conditions may be defined for any particular room. Also, experimental work is being carried out upon the relative efficiencies of coal fires, gas fires, electric heaters, and the like.

The Sub-Committee will also consider the important question of the prospects of substituting for raw coal some form of carbonised fuel (semi-coke or coke). There can be no doubt that if such a substitution could be effected, without either increasing the domestic coal bill or involving some other disadvantage, not only would there be a great addition to the amount of valuable by-products annually obtained from coal consumed in the Kingdom, but also the smoke nuisance in our large centres of population would be materially reduced.

Prof. BONE, in submitting the report, said the subject was such a wide one that it was obvious that the field had first to be carefully surveyed before any serviceable work in detail could be accomplished. Further, it was useless to arrive at anything like definite conclusions without doing a great deal of public educational work; consequently they had not reached a very advanced stage at present. He asked that the committee might be re-appointed. He did not think that those concerned in the question would ever relapse into that state of apathy that prevailed before. He mentioned that the committee had grown so large as to number 45 persons, and it had been decided to have a small executive committee which could meet regularly in order to deal with questions as they turned up, and between the rather long intervals at which the general committee could meet. The Executive was composed of gentlemen either living in London or regularly attending in London, and it was proposed that they should meet fortnightly.

Dr. J. T. DUNN, as chairman of the Chemistry and Statistical Sub-Committee, pointed out that the analyses of coal gave hardly any information of the chemical nature of coal, and that it was important that workers on that subject should collaborate.

Dr. J. E. STEAD, F.R.S., said that his Committee (the Metallurgical, Ceramic and Refractory Materials Sub-Committee) had set out a great many questions for manufacturers to answer, and it had been thought advisable that all answers should be regarded as absolutely private and confidential, and dealt with by Dr. Bone. It would be premature to say anything about results at present. It was hoped that in a year's time there would be something definite to report.

Sir HUGH BELL opened the general discussion. He said that the increases in the output of coal proved the late Lord Armstrong's prophecy to have been wrong in the first decade after it was made—53 years ago—and his own opinion in 1893 that the increase could not go on also was entirely wrong. Again, however, he thought it might be safely assumed that the very remarkable increment shown by the figures of 1911 and of 1913 could not be continued. Yet those who looked

back over any considerable number of years would agree that had they been told of the thinness of coal seams now worked successfully, they would have rubbed their eyes in amazement. Five or six years ago Sir William Ramsay made a suggestion that one could not set aside without examination. Accordingly, he placed himself in communication with Sir William, and told him that he would place at his disposal a seam of coal that would be eminently fitted to the experiment suggested. A considerable sum of money was spent in preparation, and in an installation for trying an experiment. Unfortunately, the illness and death of Sir William put an end to the experiment, but the apparatus was *in situ*, and if any person had imagination and daring, as had Sir William, he would be very happy to put it at his disposal. The consumption of coal at the pit was a very attractive problem, and the consumption of a seam of coal actually *in situ* more attractive still. But were it possible to consume the thinner seams of coal which at the present moment were inextricable, and which in all probability never could be extracted except in the form of the denser gases, it would add very greatly to the prospects of those who advocated the transmission of energy from the colliery itself.

Prof. LOUIS criticised the chemists for not having done more than they had in a matter of such importance. The chemists blamed the engineers for not saving the 2 per cent. of nitrogen, but did not reflect that they could have as much atmosphere with 80 per cent. nitrogen as they wanted for nothing. As to by-products, would it not be possible to utilise small coals and other waste coal products for the synthetic production of those compounds? At Barnsley only the "hards" were extracted, leaving at least one-third of the coal in the mine, while in Nottingham they screened the coal, leaving behind all that was smaller than 14 in. Nevertheless, a great deal of the waste was rather a problem for the chemist than the engineer, for the colliery manager was willing to turn his products into money if he were shown how to do it.

Sir CHARLES A. PARSONS said economy in the generation of electricity from coal lay chiefly in the size of the units. Now was the time to see how the efficiency of the country might be improved.

Dr. DUGALD CLERK stated that at the present rate of consumption the duration of an industrial civilisation based on coal and oil fuel could only be about 5,000 years. Before we could expand the duration of the industrial civilisation of Great Britain beyond 500 years, we must drastically enforce various economies. The consumption of coal for motive power could be reduced without any great difficulty, by sufficient capital expenditure, from 5 lb. per h.p. as at present at least to 14 lb. per h.p. In regard to heating, we should have to go in for more steam heating, the working of waste heat electric lighting stations, and an increased use of hydraulic power.

Prof. H. B. DIXON said the report of the Committee was a tentative one, and gave suggestions for future work. They would not at once persuade people to give up the open fire altogether, though they would endeavour to show that the open fire could be used with great economy if properly constructed and properly worked. They had also taken statistics in several large towns of the amount of soot poured into the atmosphere, and they must admit that the domestic fire was a great offender. More than one-fifth of the smoke came from house chimneys, and he thought it was a more difficult problem to stop the domestic supply of smoke than that from industrial sources. The vast problem of extracting the nitrogen, benzene, and toluol in coal must be attacked if we were to have a great chemical industry in this country; the engineers and chemists should work together for that great object.

Dr. DES VAUX, of the Smoke Abatement Society, detailed the steps taken in London, which he thought had made London fog a thing of the past. Smoke was a sign of inefficiency, and they were proving to the manufacturers that to prevent it meant money in their pockets.

Dr. E. F. ARMSTRONG gave some figures showing the saving of fuel by scientific management of the fuel departments of factories, and suggested that the Committee should urge on large consumers the advisability of engaging scientific men to control the coal departments. Large consumers would save the salary paid over and over again. The most stringent factor making for economy was the increased cost of coal.

Mr. STROMEYER attributed the improvement in London atmosphere to the efforts of the Smoke Abatement Society and electric lighting. The smoke that damaged window curtains and so on in London came not from outside, but from the fumes of the gas consumed within, and the present cleanliness was due largely to the electric light. The Manchester Steam Users' Association had carried out about 400 experiments on coke consumption, and had sent men through the county to show how stoking should be done. Overworking of the boiler was a fruitful cause of factory smoke.

Col. BLACKETT, speaking as a coal producer, said they had been asked to produce too much coal at too cheap a rate, and much had been wasted. He made an offer to the chemists that the producers would supply them with the small coal if the chemists themselves would produce the by-products; but ordinary collieries could not start chemical factories.

Prof. HENDERSON, speaking on the domestic aspect of the question, said that smokeless fuel was one of the certainties of the future. The Committee would no doubt consider carefully low temperature distillation with the object of produc-

ing smokeless fuel. It would solve very largely the question of smoke abatement.

Prof. BONE said the wastage occurring in the pits, according to the estimate of 1905, amounted to 25 per cent. of the total raised. The question of checking this wastage was of supreme national importance. The Committee would welcome an actual estimate of the margin of coal economy that could be effected by better management of existing plant, as mentioned by Dr. Armstrong. The Committee knew several instances in which competent men had been engaged at a good salary; money spent in that direction was saved ten times over, and he believed that in many cases it was the only way in which the fuel bill could be systematically kept down. Electrical methods were going to play a much more important part in the future than in the past, and the electrical power and distribution questions were of increasing importance.

The CHAIRMAN said that the greatest fuel economy would be effected if some other source of power than coal could be obtained. He did not feel at all sure but that in the near future coal might be superseded.

Mr. MERZ's paper on "Electric Power Distribution," of which we gave an abstract in our last issue, was then read.

Sir ARTHUR EVANS, President of the Association, said he had been very much impressed by the paper, and by the work that the Engineering Section, in conjunction with the Chemistry Section had been doing, because he felt that of all the good work done at the meeting of the Association, it was that, perhaps, which in some practical ways was the most important.

Mr. R. P. SLOAN read a paper on fuel economy, of which an abstract follows:—

Fuel Economy on the North-East Coast.

By R. P. SLOAN

ELECTRIC power supply, though of comparatively recent development, has already had a marked effect upon the industries of the North-East Coast. There is now, apart from the power companies, practically speaking no coal burned on the Tyne for power purposes, except by the railways and chemical factories and some collieries. Many collieries depend entirely upon electricity supplied from the Newcastle and Durham electric power companies' combined system for all their power requirements, and as a result of the adoption of electric traction, the suburban railway traffic facilities of Newcastle are more ample than those of any other town of similar size.

New industries have been established in the district purely because of the cheap power available, and extensive utilisation has been made of the waste heat and gases existing in the area, for the production of electrical energy. Several small, and therefore uneconomical, generating stations—municipal and company—have been shut down, and the electrical distribution systems which they supplied have been connected up to the power supply companies' system.

In coal, iron, and shipbuilding the North-East Coast figures represent respectively and approximately one-fifth, one-third, and one-half of the nation's output.

It was early realised that the more completely the electrical wants of the whole community could be met, the more cheaply could a supply of electricity be given and the more stable would the electric supply industry become.

The extent of the area served by the power companies (1,400 square miles) necessitated the generation of electricity at a pressure and in a form facilitating transmission over long distances, while the nature of the market to be catered for made it essential that the current should be produced as cheaply as possible. This, in turn, involved the use of extensive sites with ample coal and water facilities for the main coal-fired power stations, which were erected to deal with such portions of the load as could not be supplied with electrical energy generated by waste heat. The distance between the northern and southern extremities of the transmission system is 70 miles, and it is now possible to obtain electricity on the same system as regards frequency and voltage throughout practically the whole of the area. The main transmission and distribution system is 3-phase with a frequency of 40 cycles per second, and the working pressure is 20,000 volts.

The capacity of plant installed represents about one-ninth of the total plant installed in public supply stations in the United Kingdom, but as the North-East Coast power companies are working at a better load factor, the electricity actually generated is about one-fifth. The total power at present being supplied is 343,000 h.p.

Though the extension of the power supply system has been rapid, its development and the growth of its profit-earning capacity were considerably delayed by the work which had to be done from time to time, and the sacrifices that had to be made, to secure uniformity of system.

Throughout the area under consideration there are now only three public supply stations not conforming to the standard system and frequency, viz., those of the Sunderland, South Shields, and Darlington Corporations.

By taking full advantage of the best coal and water facilities available, by installing plant of a capacity much in excess of that which any individual manufacturer, however large, could adopt, and by catering for all classes of consumers, thereby securing a diversity of load with a resulting constancy of output and so utilising the plant installed to the

best possible advantage, with the aid of a highly skilled technical staff the power companies have secured an efficiency of production much greater than that practicable to any manufacturer producing power merely as an auxiliary to his main business.

By 1908 there was not a single firm of shipbuilders or engineers on the north bank of the Tyne which did not take 95 per cent. of its power from the company. To-day the proportion is probably higher still. Taking the whole area as regards the engineering trades as distinct from collieries and iron and steel works, from 75 to 80 per cent. of the power is supplied from the power companies' system.

Since the electrification of the Newcastle suburban railway system the train service has been more than doubled and the schedule speed improved by 20 per cent. More recently the North-Eastern Railway Co. have electrified some 50 miles of track on their Shildon-Newport route, which carries the heavy mineral traffic between the coalfields of South-West Durham and the blast furnaces and ironworks of the Middlesbrough district. No special generating station has been built, the whole of the current required being supplied by the power companies, whose existing mains are tapped at two points where they touch the railway.

The supply of electricity to coal mines has now reached a high stage of development. It is estimated that, apart from the smaller colliery supplies, pits having an output of over 20,000,000 tons of coal per annum now depend upon the power companies for their power supply. It is estimated, in the case of collieries, that at least 75 per cent. of the coal previously used for power purposes has been saved as a result of burning it at the economical generating stations of the power companies instead of each pit generating its own power; this is equivalent to a saving of at least 1,000,000 tons of coal per annum.

The counties of Northumberland and Durham and the North Riding of Yorkshire produce some 7,500,000 tons of coke per annum. The bulk of this used to be made in the old-fashioned beehive ovens, but during the last decade the retort type of oven has made rapid progress on account of its increased coke yield and the value of the by-products recoverable. The waste heat from these ovens and from the blast furnaces, and the exhaust steam from blowing engines, in the Cleveland district, form a considerable source of power. Local generating stations established where such surplus power is available feed into the main power companies' system in parallel with the five main generating stations of the power companies; they are run so that they each supply the maximum amount of energy possible, all regulating being done by the main power stations, which also act as stand-by against any breakdown. The power company, having a market for current many times greater than the output of any individual waste-heat station, is able to run such stations continuously at their maximum output capacity, so utilising completely all the current that can be produced therein.

There are now 11 waste-heat stations in operation in the North-East Coast area, and the waste heat available is sufficient for the generation of an amount of power very considerably in excess of that required by the colliery owners. During the year 1915, two stations alone turned out 40,000,000 units, of which only 10,000,000, or 25 per cent., were required for the working of the collieries, the remaining 30,000,000 units being delivered into the mains of the power supply company.

The total coal saving due to utilisation of waste heat on the North-East Coast now amounts to some 150,000 tons per annum.

There can be no doubt that a proper appreciation of the enormous economies which may be effected by the avoidance of inefficient and wasteful separate power installations, and by the pooling, not only of all power requirements of all kinds, but also of all power-producing plants, into one interconnected power supply system in each industrial district, will be one of the most important factors in that general development of the country's industries which we are all hoping to see.

Mr. W. B. WOODHOUSE (Dewsbury) said that the greatest stimulus that could be given to the economical use of coal was to increase its price, and that stimulus had not been wanting during the last 20 years, as, apart from periods of disturbance, the average price of coal at the pit mouth had steadily increased. Despite this, the progress made towards economy had not been rapid, very largely because of a lack of co-operation between the interests involved. To increase the rate of progress some further incentive to economy seemed necessary, and it was suggested that a tax should be imposed on all raw coal, that is, on all coal mined, and that the proceeds should be utilised for the development of fuel economy in its national aspect. There was an excellent precedent for such a tax in the application of the proceeds of the petrol tax for the purposes of the Road Board. As the essence of all economical fuel processes was carbonisation, and the extraction of residuals before combustion, it would seem reasonable to remit the tax on all coal so carbonised. Of an annual output of 270 million tons, some 30 million tons were carbonised, leaving some 240 million tons per annum on which the tax would be imposed. A tax of 1d. per ton would produce £1,000,000 per annum, and if this tax were steadily increased year by year up to, say, 1s. per ton, it would act as an increasing stimulus to economy, whilst giving time for developments to be made. The increasing

cost of coal and of its carriage had another aspect; the dearer coal became, the less profitable it was to carry inferior coals long distances. Carbonisation of coal and the use of low-grade fuels would for this reason be carried on most economically in the various coalfields. The development of carbonisation must therefore go hand in hand with that of power distribution by means of electricity, and, fortunately, there were organisations at work to this end in the shape of the power companies. What had been done on the North-East Coast under the guidance of Mr. Charles Merz could be, and was being, done in other industrial areas of the country. The rate of development could be enormously increased by a future co-operation between the coal owners, the steel makers, and the power companies. In the area of the Yorkshire Power Co., with which he was most familiar, there were some 400 collieries producing about 40,000,000 tons per year. The co-operation of these collieries would bring about three things: an increase of the amount of coal carbonised, the utilisation of low-grade fuels, and a reduction of the cost of power. If all the coal burnt at the various collieries for their own power were properly used, it would produce a surplus of electrical energy more than sufficient to drive all the textile mills in Yorkshire. A commencement with that co-operation had been made, and the Yorkshire Co., besides supplying a large number of collieries, were producing a portion of their power from coke-oven gas. By the end of this year it was anticipated that a further interesting development would be completed, namely, the co-operation of the company with works employing a low-temperature process of carbonisation, which would not only supply a large quantity of fuel gas, but also would produce a smokeless fuel for domestic purposes. That process was of special importance in view of the definite limit which must be set to the production of furnace coke, and to the large yield of certain distillates. Finally, on the point of the use of power for industrial purposes, taking the country as a whole, not more than one-tenth of the power used for industrial purposes was supplied by public electricity supply undertakings. He added that the use made of machinery in this country was capable of great development, and with it the productive output of each workman. In the United States the power use per workman in a large number of industries was three times as great as in this country. The field for development was therefore enormous. Power companies had been in operation for over ten years, and their progress had been retarded to a large extent by municipal indifference and opposition. For example, there were still in the Yorkshire area 12 municipalities with electricity supply systems. All of these were working independently of one another, and, with one exception, independently of the power company. There was a clear negation of a fundamental principle of power supply, and it could not be wondered at that the power user had been reluctant to accept a principle which had commended itself so little to the electrical industry itself. Fortunately there was a new spirit abroad, and the prospects of closer and more harmonious working seemed greater than they had ever been, for some 24 smaller undertakings were acting only as distributing agents, leaving the generation of power to the company.

Mr. McLAURIN (Glasgow) said that the chemists had already shown engineers a condition under which by-products could be obtained, and to his mind it was an engineering as well as a chemical problem, and one for co-operation. The 2 per cent. of nitrogen contained in the fuel was not a matter to be talked about lightly, because if they turned that into ammonia it might, roughly, be worth about 16s. They might never take the whole percentage of nitrogen out of coal, but they might take out about 90 to 100 lb. of ammonia, which at 1d. per lb. gave 8s. Then they could turn to the oil. Ordinary coal would contain from 15 to 25 gallons of oil that could be recovered, and cannel coal would contain 30 to 40 gallons of oil. These figures were realisable. He was asked by a colliery if he could handle cannel containing 30 or 40 per cent. of ash. The colliery was actually using 100 tons per week, but the boilers had not anything like a draught sufficient to burn coal with such a large percentage of ash, and the greater part of the oil went up the chimney. It was found, however, that by putting this through the producer they never used more than 80 tons of coal, and they got out of it about 40 gallons of oil and 40 lb. of ammonia. They found also that two boilers with gas would do the work of three with coal. Taking ordinary coal, he thought he was perfectly safe in saying that they returned to the boiler 66 to 75 per cent. of the energy in the fuel. They were taking away about 30 per cent., but they returned for that 20 to 40 gallons of oil, and also obtained 40 to 60 lb. of ammonia, and with proper means he believed it could have been brought up to 100 lb. If they took ammonia at 1d. per lb. and took 60 lb. they got 5s., and if they valued the oil at 3d. per gallon, and took 30 gallons, they got 5s.; there was 10s. returned for about 30 per cent. of their coal, so the problem was well worth tackling. At Glasgow they were distilling the coal not by external but by internal heat. The oil they obtained was different from anything he had had experience of. It was a crude oil they got from the oil retort, but it would dry on wood very rapidly, making a varnish or furniture polish. It also dried on glass like linseed oil. The oil could be separated into two distinct portions. One was suitable for lubricating oil, and he had been offered 8d. a gallon for it if he could raise the flash point. He concluded that there

was a big field for inquiry into these oils, for they were quite different from anything he knew.

Mr. CHAMEN said the point he wished to speak about arose out of Mr. Merz's paper, and concerned the question of co-operation or joint working between different companies and municipal suppliers. The Board of Trade some little time ago issued a circular that it was desirable to link up undertakings, and a joint committee was formed, with five members of each Association and two secretaries. They had had several meetings, and had advanced almost to a point where they hoped to take actual steps in the provinces. These two associations represented power companies on the one hand, and municipal undertakings on the other, and it was a point of some significance that they had been able to meet together and come to a practically unanimous conclusion. While they were quite unanimous that there must not be any interference between the areas held by municipalities and those held by companies, whether power or provisional order companies, yet the question of linking-up power stations in those areas could by common consent be quite well and most advantageously dealt with. They had formed a scheme whereby the country was divided into a certain number of areas, and they hoped to get those areas to form committees of the engineers interested in the generation of electricity to consider the whole question themselves. The object of the Committee had been, so to say, to get spontaneous action. They felt it a disgrace that electrical industries in this country should require anything in the nature of coercion by legislation. They thought that to a large extent powers for linking-up existing generating stations were available, and that it should not be necessary, unless in a special case, to go to Parliament at all. If they could bury the deadly hatchet—company against municipal enterprise—they hoped to succeed in getting some of the economies Mr. Merz had clearly shown to be possible by connecting up generating stations. It had been done already in some cases, and it had proved to be possible to make considerable savings in the fuel used, neither party having had to shut down his whole station; by agreement come to between them, one would work one week, including the week-end, and the other would take only the peaks, or such loads as the running station was not able to take for the time being. Then during the next week a change-over was made, and in that way it had been found possible to work linked up without any money passing at all. It was not likely that that result could always be obtained, but in that case it was obtained. His Committee desired him to speak at that meeting to let the public know that spontaneous effort was being made, and they hoped that a good deal more would be heard about it shortly. He would like to draw attention to one thing that required almost immediate attention in legislation, and that was that if they were to accomplish the linking-up of generating stations, and put in these big mains, they wanted something more in the way of statutory powers. At the present time all electricity undertakings had power to make agreements with land-owners and property owners for the construction of mains on their property, either overhead or underground, but no electricity undertaking had power to go on to land. The landlord had an absolute veto. Most landlords, he was thankful to say, had been, on the whole, reasonable, but occasionally the landlord had put his foot down and said, "No, I won't let you go," and they had no remedy. The Post Office had experienced the same difficulty, and had an Act passed putting their position right, and what it was possible for the Post Office to do was surely, in the interests of the nation as a whole, possible for the electrical power supply industries also.

Mr. CHATTOCK said it was apparent from what had been said that the greatest economy in the use of coal could be obtained by the gasification of coal and the recovery of its by-products, and it had been demonstrated that it was perfectly possible to run electricity generating stations by gas-fired boilers, in fact greater economy could be obtained by this means than by the burning of raw coal. From what had been done in this direction by members it was obvious that the amount of work in handling coal in that way was very much greater than at present in burning raw coal. Dealing with by-products would require a business in itself, and it was, he thought, hardly fair to ask the electrical industry to take on this duty in addition to that of supplying electricity; it seemed to him that the handling of coal in that way should be undertaken by some other body which should be primarily occupied with that alone, and that the generating of electrical energy should be distinct from the other. They would have to work in close touch with each other, but he saw no reason why both businesses should not be kept distinct, both from the financial and operating point of view. Possibly an association could be formed for handling coal for the production of by-products, an association, perhaps, of coalowners and users of by-products. They might all be represented and have statutory powers given them. Electrical energy was applicable to practically all purposes for which coal was used at present, so that there was no reason why energy should not be made available for the public in an electrical form, so long as it did not cost the public any more than at present.

Mr. HIGHFIELD said they were really considering two problems—the better use of coal and the obtaining of other materials from it. He thought that the discussion had shown that if they were to obtain those two results the coal must

be used on as large a scale as possible, and that involved the use of electricity to distribute it. The electrical people were already at work on the problem, with the idea of enabling the original small centres to be joined up so as gradually to work towards large centres. Dr. de Ferranti had pointed that out as long ago as 1880, and the chief reason why action had not been taken was legislation. Other nations had been allowed to get six years start of us, for the early legislation was of the most faulty description. The question of by-products was, he thought, an economic one, and would be solved by careful collaboration between the chemist and the engineer. It was said that our coal supply could only keep us going for 500 years, and that something ought to be done to conserve it as a national possession. If they looked at the question in that way they would have to consider how much they were going to spend in the way of capital and improvements to conserve that valuable material. He did not think it had been proved that large sums of public money should be spent on coal saving, unless it was perfectly clear that full interest could be earned on the money laid out in that direction.

Dr. DUGALD CLERK said that though he agreed with Mr. Merz, the thing that they must have chief regard to was the good of the country, and not any particular good that might accrue to any particular individual. But in that case, if Mr. Merz succeeded too hurriedly they (the gas-engine builders) would be wiped out of existence. (Laughter.) If they could distribute power in the way suggested they would get it cheaper, and that would be a national service. If Mr. Merz succeeded at once, then the coal-gas industries would be gone. But he thought they would find that we were a people of compromise; we never took a complete logical scheme, and he therefore still hoped that the gas engine and the steam turbine might be able to exist together.

Prof. BONE said that so many and such varied points had been made that he would ask them to excuse him attempting to summarise the discussion. The Association should be well satisfied with the results of the Committee's first year's work. They wanted to make their effort in the coming year as fruitful as possible, in order that next year they might submit a report of a more final character.

AN AMERICAN HOMILY ON ELECTRICAL ORGANISATION.

OUR trans-Atlantic friends have a way of expressing themselves, which is all their own. For the characteristically American comments which follow, we are indebted to a recent issue of the *Electrical Review and Western Electrician*. We leave them in the pure and unadulterated original form as selected by our contemporary from the house organ of the Trumbull Electric Manufacturing Co. We agree with our contemporary that they contain food for thought, though, by gum, some of it may require a good deal of chewing. Some of the remarks are, of course, platitudes, but others are very suggestive, and not confined in their application to the other side of the Atlantic. Our exchange, in introducing the contribution, says:

"It is generally conceded that at the close of the European war there will be necessary a complete readjustment of trade conditions and a concerted effort on the part of American manufacturers to meet the keen competition which will arise. The gospel of co-operation is an old story to the electrical industry, but at no time is co-operation in its fullest sense more essential than at present."

The one real thing that awes a politician is organisation. Personal appeals or opinions roll from the average political back as water from the duck.

Organisation is collective co-operation.

A collection of men who assemble under a name is not an organisation unless there be a tie that binds—co-operation (the give and take) is that tie.

Members of a given association no more form an organisation than do members of a town unless the spirit and sense of community interest impresses itself upon their business thoughts and acts.

There is a lot of hocus-pocus about many alleged organisations.

Standardisation is the essence of organisation.

Common counsel must prevail and local prejudices must be subordinated. General concern must strongly influence private interests and considerations, if an organisation is to accomplish its ends. The possible or even assured individual benefit of to-day must yield to the co-operative benefits of the future if any organisation is to accomplish more than a negation of its objects.

We have a number of organisations among the various branches of the electrical field—among jobbers, contractors, central stations, engineers, and manufacturers.

Each has an object—many objects. Each has its needs, demands, hopes, faults, advantages, handicaps, and virtues. Each is promulgated to help its members through common counsel, and to exchange experiences and opinions.

A large part of the value of each such organisation is subjective rather than objective.

There is more work to do towards the self-improvement of the membership than in an endeavour to control the doings of those in allied departments of the field.

The jobbers have about all they can do to make themselves the

great selling powers of the electrical field without trying to lay down too many laws for manufacturers.

Contractors have too much to do in digging out business, getting out and doing their work and cleaning out the kerb-stone element to fight the "gutterer" class out of the manufacturer.

The manufacturer has a vast field to cover along lines of standardisation of lines, lists, methods, and problems of distribution without trying to play the part of Moses to the jobber and contractor.

Theoretically there should be no conflict worth mentioning between these three divisions in the electrical field. In fact, the ideal organisation would be that which combined and functionalised all three of these branches (with the central stations added) into one big co-operating whole. But heaven is not yet upon earth.

If the different branches can work together towards better understanding of, and respect for, each other, heaven will be approaching us. Old and new firms, large and small firms, should meet in common counsel and with mutual respect.

Of course, this all sounds very nice.

There are some methods and men you cannot respect and will not tolerate. They should not be permitted in an organisation which stands for other things.

I have seen jobbers try stunts that would make their fellows in the jobbing game "sick abed." When one plays a mean trick on a manufacturer, or on a contractor, he is automatically an enemy to his fellow jobber, and they should censor him more severely than do the men he has ill-treated.

Internal, mutual discipline is as important in an organisation as is the mutual exchange of courtesy.

Manufacturers who ignore trade standards and disrupt legitimate business conditions, or try so to do, become automatically the enemy of every department in the field, because every department, in the end, is adversely affected.

Back of a very large percentage of trouble arising between members of an organisation can be traced the lack of cost knowledge.

Particularly is this true among manufacturers.

But when we contemplate the action of certain jobbers and contractors, we feel that their own particular divisions have much to contend with on this line.

The cost of doing business is only one factor.

Business organisations need to realise that conditions are changing rapidly—never to be the same again. There is no *in statu quo*.

There are still those among jobbers, contractors and manufacturers who refuse to recognise the changes that time has brought, and will continue to bring, and who desire to be let alone to do business in the same old way, and who spend time inveigling against laws and restrictions, supervision and control, and other conditions come to stay.

This all applies in its modified form to the electrical industry. For years profits were large—demand no greater than supply—whereas to-day (barring the present conditions which, we all know, are temporary), there is plenty of supply, plenty of copper (don't worry), whereas to-day profits are strictly normal or subnormal—the field is plenty crowded.

We men must be prepared for the readjustment days to come—we must keep our credit sound, keep our leaks closed, and be ready to face new conditions through which the ill-equipped and financially weak member cannot navigate.

Our various associations must be organising, teaching bodies, and we must prepare to meet world competition and readjustment of we know not what a nature—"after the war."

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Published expressly for this journal by MESSRS W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 12,487. "Magnetic compasses." A. J. HUGHES, H. HUGHES & SON, and S. G. STANLEY. September 4th.
- 12,490. "Alarm for automatically announcing cutting-off of electric current." J. W. YOUNG. September 4th.
- 12,495. "Radio-telephone transmitter systems." L. DE FOREST. September 4th. (U.S.A. September 4th, 1915.)
- 12,517. "Dry batteries." BRITISH EVER-READY CO. & A. H. SHEPPARD. September 4th.
- 12,528. "Electric generators and electric motors." J. SHEPHERD. September 5th.
- 12,533. "Circuit cut-out switches for aerial machines." H. B. BENTLEY and THE BIRMINGHAM AIRCRAFT & MOTOR CO. September 5th.
- 12,545. "Incandescent signalling lamps for ships, &c." DAVEY & CO. and T. F. H. JAMES. September 5th.
- 12,549. "Spark plug for internal-combustion engines." T. C. SUTCLIFFE. September 5th.
- 12,552. "Electric arc lamps." H. B. CLAPP & W. S. SIMPSON. September 5th.
- 12,558. "Electromagnetically-operated horns." W. H. EDWARDS and H. LUCAS. September 5th.
- 12,561. "Dynamo-electric machines for combined electric lighting and ignition for motor vehicles, &c." B. BROOKS & W. HOLT. September 5th.
- 12,566. "Electrolytic excitation." W. BLACKMORE, C. I. SYNDICATE, A. HOWARTH, & H. C. JENNINGS. September 5th.
- 12,580. "Apparatus for electrical precipitation of suspended particles from gases." A. MOND (Schmidt). September 5th.
- 12,609. "Wireless control systems." M. TOCCHIO. September 6th.
- 12,616. "Automatic telephone systems." THE AUTOMATIC TELEPHONE MANUFACTURING CO. (Automatic Electric Co.). September 6th.
- 12,624. "Systems of electric motor control." BRITISH THOMPSON-HOUSTON CO. (General Electric Co., U.S.A.). September 6th.

- 12,646. "Electrical advertising device or sign." H. F. GILL & W. E. GRANT. September 6th.
- 12,685. "Insulating material resembling vulcanite." T. S. CHIVERS and C. MAKTER. September 7th.
- 12,687. "Electric furnaces." J. O. BOVING. September 7th.
- 12,704. "Apparatus for producing unidirectional electric currents." F. RIVIER. September 7th.
- 12,710. "Aerials for wireless telegraph or telephone systems." C. D. J. DUNNING. September 7th.
- 12,737. "Electric sparking plug." A. E. CONEY, H. L. CONSTABLE and P. H. SANDS. September 8th.
- 12,758. "Shoes or sockets for electric cable terminals." W. T. HANLEY'S TELEGRAPH WORKS CO. & W. S. WAKFIELD. September 8th.
- 12,781. "Telephone systems." A. E. RINKKE & WESTERN ELECTRIC CO. September 9th.
- 12,782. "Telephone systems." A. E. RINKKE & WESTERN ELECTRIC CO.
- 12,793. "Magnets for lighting automobiles and starting internal-combustion engines." J. BETHENOD & E. GIRARDEAU. September 9th. (France, October 21st, 1915.)

PUBLISHED SPECIFICATIONS.

1914.

- 33,075. REGULATING MEANS FOR ELECTRICAL INSTALLATIONS. Soc. Anon. des Etablissements L. Biscot. November 25th. (November 26th, 1913.)

1915.

- 10,667. ELECTRIC ALARM OF CALLING DEVICES USED IN RECEIVING APPARATUS AND MORE PARTICULARLY IN WIRELESS RECEIVING APPARATUS. A. H. MORSE and Indo-European Telegraph Co. July 22nd.
- 12,000. ELECTRIC SUPPLY SYSTEMS FOR USE WITH INTERNAL-COMBUSTION MOTORS. E. C. K. MARKS (Motor Ignition & Devices Co.). August 19th.
- 12,103. ELECTRIC DISTRIBUTION SYSTEMS. F. E. FRAMPTON & Callender's Cable & Construction Co. August 23rd.
- 15,304. CONTROLLERS FOR ELECTRICALLY-DRIVEN VEHICLES. P. S. TURNER. October 29th.
- 16,151. WIRELESS TELEGRAPHY. Marconi's Wireless Telegraph Co. & R. D. RADFORD. November 16th.
- 17,008. ELECTRIC STARTERS FOR INTERNAL-COMBUSTION ENGINES. B. BROOKS and W. HOLT. December 3rd.

1916.

- 2,065. SECONDARY OR STORAGE BATTERIES. H. WADE (Ford, B.). February 11th, 1916. [101,170.]
- 2,409. ELECTRIC RAZORS AND THE LIKE. G. H. J. HORAN & A. W. GAMAGE, Ltd. February 17th, 1916. [101,171.]
- 3,114. MEANS FOR REGULATING THE VOLTAGE OF A DIRECT-CURRENT DYNAMO. E. SCHNEIDER. March 1st, 1916. [101,175.]
- 6,603. SPARKING PLUGS. K. E. L. GUINNESS. May 8th, 1916. [101,197.]
- 8,533. ELECTRIC FURNACES OF THE ELECTRODE TYPE. H. J. KITCHEN and T. BAUMFORTH & CO. March 10th, 1916. (Divided application on 3,598/16.) [10,201.]

The numbers in brackets are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

Lightning Danger of Trees.—A U.S. Consul in Germany reports that recently statistics have been collected in different parts of Germany as to the danger of different varieties of trees being struck by lightning. The result has been the following percentages:—Oak, 32.1; larch, 9.5; fir, 3.8; pine, 1.8; Scotch fir, 0.9; birch, 1.4; beech, 0.3; and alder, 0.0.

The character of the soil is an important factor, among others, as to the lightning danger. Trees growing in moist soils and along the courses of rivers and brooks, and in the neighbourhood of ponds, are especially exposed to the danger. Trees with deep penetrating roots are more readily struck than those with shallow roots nearer the surface. As proof of this is the greater frequency of the apple tree being struck than the pear in the same orchard. It is also stated that the poplar stands first in danger before the oak, elm, ash, gum, and pear tree. Together with the beech the least attractive to lightning are chestnut, maple, alder and mountain ash. Between these two groups stand the apple, cherry, linden, and walnut.

During thunder storms it is advisable, therefore, to avoid oaks, poplars, all varieties of pine, willows, elm, and pear. If shelter is taken under a tree, which is always dangerous, it should not be under one standing alone. The planting of trees which attract lightning is recommended in the neighbourhood of houses, especially poplars, partly to prevent the possibility of "the rebounding of the lightning." It is well to provide such trees with metallic rods, to make them really effective conductors of lightning.

Economy in Lubricating Oil.—As the result of an inquiry set on foot in Germany, with a view to economy in the use of lubricating oil, it has been found that the cylinders of steam engines require a supply of oil per hour represented by the expression $r \cdot d \cdot \pi$, in which d is the diameter of the low-pressure cylinder in metres, r the stroke in metres, π the revolutions per minute, and r a coefficient depending upon the type of engine, the system of lubrication, and still more, the skill of the attendant. The unit by which the oil is measured is not stated. The values found for r vary between 1.275 and 1.633, and apparently the latter figure need never be exceeded, whilst a value of unity, or even less, is believed to be attainable. The formula agrees with practical results where the attendants are skilful and attentive, but in many cases the consumption of oil has been found to exceed by 30 to 90 per cent. the calculated value (using $r = 1.6$). Consequently economies have been put in hand, and the result has been a general reduction of consumption of oil—47 per cent. in the case of cylinders and 61 per cent. in the case of bearings. Thus Germany has been able to dispense with the importation of lubricants from Russia, representing in 1909 a value of 1½ millions sterling.

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ENGINEERING DURING AND AFTER THE WAR.

A HIGHLY successful meeting was held at the Mansion House on Wednesday last week under the presidency of the Lord Mayor. It was organised conjointly by the B.E.A.M.A., the British Engineers' Association, and other bodies, and the great engineering and scientific societies, the Ministry of Munitions, the Board of Trade, and other Government Departments, as well as many other interests, were represented either on the platform or in the body of the hall. Many speeches were delivered regarding the indispensable service which engineering had rendered to the Empire during the operations of the last two years. Appreciation was expressed, in the form of a resolution, of the great national service rendered by the munition workers of the country, and the meeting hoped that permanent remunerative employment would be secured for these by the vigorous economic development of the engineering industry after the war. The engineering industry—nobody knows it better than do our readers—has rendered absolutely indispensable service to the Empire, and that fact alone would justify an appeal to the nation on its behalf, but the knowledge that in the future that industry will inevitably possess fundamental importance as the basis of defensive power and of prosperous economic development, strongly supports the claim for special recognition in any reform of a national and imperial commercial policy. By almost unanimous consent to-day such a reform must include patriotic support of British engineering by all public and private users of plant and machinery throughout the Empire. Of this principle the Mansion House meeting enthusiastically approved. One other matter urged by the meeting was the immediate appointment of a Ministry of Industry in order to further the practical application of the proposals of the Paris Economic Conference.

It may be remarked that there is nothing new in such recommendations and appeals. That is perfectly true. The engineering reader needs no educating on these matters at this date, but there are others upon whom it is most necessary that we should make a timely but lasting impression, and a demonstration of this character, in such a place, and with a series of weighty speeches which have been well reported in the newspaper Press, can hardly fail to have that effect. It may seem to be unlikely that the services rendered by engineering will be overlooked when we come to review the various factors which have enabled us to win the war. Our present legislators and Government departments have very good reasons for knowing what that assistance has been in all branches of the Services; millions of workers, too, by reason of their activities, have been brought to know it; and certainly all who

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are engaged in the practical operations of the war know that not for the doings of engineering workers at home they would not have been able to achieve their successes on the sea, in the air, and on land. But a vague sort of recognition will not suffice, and what the industry desires is that such recognition shall assume a practical shape in the interests of the nation. In order that all the manufacturing capacity now at our command may be employed after the war, giving a means of prosperous livelihood to returning soldiers and sailors and to present munition workers alike, there must be a safeguarding and encouragement of British industry throughout this country and the whole of the Empire.

The Lord Mayor, in a characteristically appropriate speech, remarked that Germany, which made so many miscalculations, had also overlooked our undeveloped engineering industries. "Before the war engineering was simply one department of commerce—one means for earning wages and dividends. British engineering to-day is recognised to be not merely a trade, an industry, but the main bulwark of European liberty." If our engineering industries were undeveloped to the fullest extent before the war it was largely due to lack of organisation, but to-day they are developed because organised and extended for the purposes of war, and they must never again be permitted to fall into an "undeveloped" condition when the bands of Government control fall away and they are entirely free to handle normal contract work again. If they are the main bulwark of European liberty in these days of war, they will be no less important from the point of view of Empire defence and as a means of employment for the millions of the Empire in the days that follow. We have upon our shoulders a national responsibility for finding employment after the war. To find "work for all" we must find work for all the factories in our midst to-day. In that way we may go far to help to secure the industrial harmony which will be so great a desideratum. The Lord Mayor advocated that steps be taken at once to arrange the general terms of an industrial truce for five years, enabling British engineering to perform a leading part in "the most astonishing era of mechanical progress in the history of the world." Alderman and Sheriff G. A. Touche, M.P., also urged the need for preparing to give employment at good wages to returning soldiers. We must support our home industries instead of buying from present enemies, and if he had his way, we should establish "barbed wire entanglements through which no German dumper could crawl." British bankers must help to extent British trade and help to obtain orders for British goods. In this connection the important report of Lord Faringdon's Committee, published on another page to-day, is of great interest. Mr. C. P. Sparks, one of the later speakers, mentioned that the policy of the Institution of Electrical Engineers was that the first thing necessary was to protect the home trade if we were to secure success in other markets, and if an effective barrier were set up we should have an impetus for securing additional trade affording employment. Sir Oliver Lodge, who spoke a little earlier in the meeting, briefly urged the claims of science, and said that we ought to recognise the union and interaction between science and engineering. We had been too poverty-stricken in our dealings with the development of scientific discovery and invention, and with the trial of new things. Discoveries were waiting to be made, and there were young men ready to work hard at making them, but they must have the means. A little lavishness here and there was really wise. It was in that way that important engineering, chemical, and other organisations had succeeded; also by sending men out all over the world to find the right materials and to solve problems. During the war the Government

had discovered the use of scientific advisory committees. Those committees were doing good work, and they should be put on a proper basis and continued. They should consist of young men with eyes for novelty and with plenty of energy, and they would have to be paid—say, playfully remarked Sir Oliver, the salary of a Member of Parliament. Other speakers included the Lord Mayor of Manchester, who, reminding us of Joseph Chamberlain's advice to "Think Imperially," gave a new watchword which might with advantage be posted prominently in Westminster when Parliament resumes—"Think Decimally," also Mr. Wilfrid Stokes, chairman of the British Engineers' Association, and Mr. George Terrell, M.P. (of the B.E.A.M.A.). But to our way of thinking the most timely contribution of all was that of Mr. G. H. Roberts, M.P. (Lord Commissioner of the Treasury), who, as a son of an agricultural labourer, knew from experience something of the causes which lay at the root of industrial unrest. What a lamentable error we shall all fall into if, after the enemy in war is silenced we allow the guns of industrial strife to boom in our midst when all the urgent work of rehabilitation, the clamour of the world for manufactured goods, and the adoption of adjusted trade policy bring an abundance of work to occupy our factories. We must not ignore the warnings; we must calmly note the plain facts of the situation and recognise that they call for the most anxious thought if we are going to guard against serious strife. It is all very well to indulge in pious hopes that public feeling would not permit general strife to occur, but to act thus will be but to let things drift into danger. The situation must, as far as possible, be prepared for in advance, so as to avoid a colossal calamity.

Spokesmen representing both Capital and Labour have been making suggestions for an understanding; what is urgently needed is that these suggestions should develop immediately into *pourparlers*, a powerful and representative conference, and a definite agreement or compact be entered into as far as is practicable in the absence of many men with the Forces. Mr. Roberts, probably bearing in mind the appeal of the Lord Mayor for a five years' industrial truce, devoted his speech entirely to the question, and he was listened to with a seriousness and sympathy which augured favourably. He believed that unless we could establish a reasonable period of industrial harmony the British Empire would rest upon very shaky foundations. Politically they had recognised a truce—minor differences which set man against man before the war were abandoned as comparatively trifling when the interests of the country were at stake. The national unity must be preserved after the war, or the coming years would be years of decline. The war had to be paid for, and neutral nations, profiting at our expense, would be better equipped to pursue competition, while we should be in a less favourable position, with the exception that the war had awakened us in a way that nothing else could have done. It had shown us what could be done by means of co-operative action. As one who had advocated the just claims of Labour for a generation, he frankly and sincerely asked engineering employers to remember that if Labour had had its failings, they could not ignore their own failings when they asked the working classes of the country to assist them by co-operating. A friendly understanding should be encouraged—the atmosphere was now favourable owing to our common losses—they must not wait, "Do it now!" It was for the employers to make the approach, and such as himself would be willing to help. They must remember that the working classes did not voice grievances in mere wantonness—they had such grievances. Human society must be based on better and more elevated principles. There would never be another opportunity like the present for facing the matter. He was prepared to say to his class when they were

properly treated, "You are expected to give your best without regard to restrictive conditions." Mr. Roberts fully realised the importance of increased output, and he knew that the workers could give it, but the problem of securing increased production was not so simple as some people might express it. They had to face the apprehension of the workers that increased output would lead to glut and unemployment. Personally, he believed that increased output would increase the selling power of the nation. We should all work to prevent as far as we could the cyclical fluctuations in trade, and so make employment fairly regular throughout the year for the whole of the working classes. In order to do that, one thing that was essential on both sides was goodwill. There are many other essentials, too—but that by the way. He knew that the workers would demand a restitution of the relaxations that they had agreed to during the war, in the interests of the State, but that need not prevent engineering employers from entering into negotiations now.

If the Mansion House engineering meeting had yielded nothing more than this voice of warning and appeal from a leader of Labour to leaders of industry it would have been well worth while. We believe that the great majority of the workers, as well as the employers, are heartily sick of industrial strife. If the workers can be induced to understand the position as Mr. Roberts knows it, and give an increased output which will strengthen our manufacturing and trading position, and if employers can be induced to sympathetically enter into the natural desires of the workers for better conditions, and to fulfil their responsibilities towards them as well as to their shareholders, the greater part of what is necessary in order to secure a long period of industrial prosperity will have been done. We have to remember that Labour has no love for a body of shareholders. To him it is a soulless, heartless company, devoid of human feelings, with an insatiable thirst for dividends, until perhaps he becomes a shareholder himself sharing in the profits, and, maybe, somehow in the losses. Here we introduce the touch of nature which may make them kin, though we recognise that co-operative working has often failed because the profit divided among the workers has amounted to less than a trifling advance in wages, and the working of the principle has been defeated. The problem seems to resolve itself into the need for finding a basis upon which the fair and just proportions of wages for Labour and profit for Capital respectively should be calculated. It may be that there will be many thorny questions raised by such an inquiry, inasmuch as both Capital and Labour must be sustained in decency if we are to have satisfactory and prosperous industry, with its just wage-earning and its fair dividends. But notwithstanding all the difficulties, we agree with Mr. Roberts that these need not stand in the way of immediate negotiations, and we trust that his invitation to the employers to approach Labour on the matter will be taken advantage of without delay.

Rubber. EVENTS in rubber circles have been more interesting, and the hints thrown out in various quarters as to the market being imparted a sharp fillip have certainly received some confirmation, but this has been brought about by special circumstances, or in connection with the filling of special requirements on behalf of Russia, to which country considerable quantities are now being shipped which are destined to reach the port of Archangel prior to the close of navigation. For some time past some difficulty has usually been experienced in obtaining permits for export, but on this occasion the authorities

appear to have afforded every facility, and there is no doubt that considerable quantities of the product have been taken care of, so that the position of spot rubber has temporarily improved. Interested support, possibly to some extent in connection with share operations, tended to assist the market upward, but there has been really no change in fundamental conditions, and since the urgent demand has been fairly well satisfied the market must be expected to fluctuate, although it is generally surmised that the price of fine plantation rubber will not break below 2s. per lb., which remains to be seen. Prices now stand at about the same level as they did this time last year, when the warehouse stocks were comparatively small, and big tonnages were being diverted to American ports, but indications this year are highly obscure. For one thing the industrial outlook is not so good as it was then, so that it is rather doubtful whether the upward movement which took place over the last three months of the past year will this year repeat itself.

After meeting Russia's needs the general trade demand is again subdued, and manufacturers seem in no hurry to anticipate their requirements. There is some fear at any rate that spot supplies will once again accumulate, for the shipments from the East continue on a liberal scale in consequence of the heavy production as testified by the excellent returns of output disclosed by the estates for the past month. Some months ago there were no signs of excessive supplies, but the rate at which the shipments have been going on, and the takings by consumers have shrunk, there is now no mistaking the fact that there is a palpable surplus which can hardly be worked off except by keeping prices at an attractive level. The home stocks are something over 9,000 tons, and cannot be expected to be much reduced unless consumers are willing to carry larger reserves. An unhealthy feature is that the Eastern estates, for some reason or other, are still reluctant to negotiate new orders for forward delivery except at their own prices, showing a premium over the value of spot delivery. This arbitrary policy seems rather inconsistent with the existence of unwieldy supplies on the spot. Were there any inducement afforded to consumers to operate ahead, the market would doubtless be imparted a little more activity, but as it is, considerable quantities of plantation rubber continue to be landed on this side unsold, which naturally bars the way to a revival of confidence. The comparatively high price of fine hard Para is misleading, chiefly owing to the limited tonnage of this product available.

The Federation of British Industries. ACCORDING to the daily Press, a circular has been issued by Mr. F. Dudley Docker, president of this Federation, from the offices, 51, Lincoln's Inn Fields, W.C., inviting

firms to apply at once for membership. The organisation, as our readers know, has been formed for the purpose of providing a body capable of representing the interests of British manufacturing and producing industries, and it is for every reason important that it should be made as strong and completely representative as possible. The list of members of the Executive Council includes the following:—Sir Vincent Caillard (Vickers, Ltd.), Mr. F. R. Davenport (Willans & Robinson, Ltd.), Sir R. A. Hadfield (Hadfields, Ltd.), Mr. Henry Howard (Stewarts and Lloyds), Mr. Godfrey Isaacs (Marconi Co.), Mr. E. Manville (Daimler Co.), Mr. F. J. Nettlefold, Mr. Wilfrid Stokes (Ransomes & Rapier), and Mr. A. W. Tait (British Aluminium Co., Ltd.). Full particulars of the objects of the Federation can be obtained from the Secretary, Mr. R. T. Nugent, at the above address. The subscription is £100 per annum until June, 1919.

MUNICIPAL TRAMWAYS ASSOCIATION CONFERENCE.

ON Thursday morning, last week, the fifteenth annual meeting of the above Association was opened at the Surveyors' Institution, Great George Street, S.W., and although no comparison can be made with pre-war gatherings, yet there was quite a satisfactory muster of members.

Mr. Peter Fisher, of Dundee, this year's President, after welcoming those present, announced with regret that Mr. A. L. C. Fell (L.C.C. tramways), who had been ill for some time, had had a relapse (which we understand will necessitate his taking a six months' voyage), and a resolution expressing sympathy with Mrs. Fell was passed by the meeting.

Mr. Fisher's Presidential address followed; we append an abstract of his remarks.

Mr. McElroy's paper on the subject of passenger transportation in large cities (which we also reproduce in abstract), and a short discussion, occupied the remainder of the morning.

The paper is an interesting contribution to a subject which will, no doubt, sooner or later require the careful consideration of the authorities of our largest cities, and that it did not attract more speakers in the discussion is probably evidence that the "saturation point" in surface passenger transport has reached an appreciable stage in only one or two instances in this country.

Mr. McElroy's suggestion to provide "parallel routes by forming new streets and widening others at considerable cost," is probably not intended to be of general application; its possibility or otherwise seems to depend very much on the map. In any case the expensive duplication of routes to take care of "rush" traffic may be a costly expedient if we have ultimately to fall back on the electric railway—the ideal, though most expensive, method of dealing with traffic peak loads electrically.

A new tramway route in a populous city has a habit of building up its own traffic, and it seems possible that the new route might in a brief space of time be no better off than the original one.

A rough estimate of the financial features of such a parallel-route scheme would be a valuable addition to the paper, as also would an alternative estimate of the cost of relieving existing routes during rush hours by means of electric or other buses, running in adjacent thoroughfares.

American authorities have not, so far as we are aware, given much time to the study of the motor-bus in relation to surface traffic problems, and in this country the bus authorities have left the rush-hour traffic problem severely alone, so that we have no practical data as to the capabilities of the bus in this respect. We agree, however, with our indefatigable friend, Ald. Fred. Smith, of Liverpool, that the paper ought to have appealed to a wider circle than it apparently did.

In the afternoon the paper by Messrs. Holford (Salford) and Clough (Bury), on the "Utilisation of Tramways for Goods Traffic," was read and discussed.

The subject has always been an attractive one in South Lancashire, where the map is studded with manufacturing towns, little and big, interlinked by tramways of a uniform gauge, and there are other areas where similar conditions exist to a considerable extent.

The authors give a brief history of the subject, but we notice that they do not refer to the earlier proposals of Mr. A. H. Gibbings, at a time when the indispensable links between the inland towns and Liverpool were being constructed by the South Lancashire Tramways Co. Mr. Gibbings read a paper on "The Carriage of Goods on Electric Tramways" before the Manchester section of the I.E.E., in the early part of 1903, in which he discussed the problem as regards South Lancashire.

In the discussion, Mr. Mozley (of Burnley) contested the view that tramways have no powers to construct lines into yards of mills, warehouses, &c., and pointed out that the general adoption of the system of railless battery-trolley

wagons, of the Bradford type, would involve obtaining fresh powers from Parliament: Mr. McElroy rather doubted the wisdom of tackling the general question of goods carriage in view of the progress made with steam or other vehicles.

The meeting adjourned at 3.30 p.m., when special buses were in attendance to convey the members to the Milman Street Training Depot of the London General Omnibus Co., where, under the guidance of Mr. Blain, the features of that establishment were demonstrated, in much the same way as on the occasion of the visit of the Tramways and Light Railways Association, which was described in our issue of July 7th last.

On Friday morning the annual business meeting was held, Mr. Mozley (of Burnley) being elected President for the coming year and Ald. J. Miles, J.P. (of Bolton), Vice President.

The membership includes 112 managers and assistants, 76 local authorities, and one honorary member. The total income of the Association for the year was £373, the year's surplus being £32, and the balance in hand (excluding the reserve fund) £228.

The recommendation of the Sub-Committee of the Advisory Committee of the Board of Trade that, after the war, all Government departments, local authorities, and statutory bodies entrusted with the control of moneys raised by taxes or rates should be under legal obligation to purchase, so far as possible, only goods produced within the Empire, was discussed; the Executive Council agreed with the principle enunciated in a resolution submitted by the Council of the Incorporated Municipal Electrical Association, viewing with deep concern the recommendation.

An amendment to delete the paragraph from the report was lost, and the report was adopted.

On Friday afternoon, through the courtesy of the L.C.C., a trailer-car was available for inspection on the Embankment; the Council possesses 158 of these cars, practically all of which have been constructed from the chief officer's design.

These cars weigh unloaded 6 tons 5 cwt. each, and will accommodate 30 inside and 18 outside passengers, the seating being of the cross type.

The weight of the car is carried by rubber-padded coil springs on swinging links connected to long laminated springs which rest on a seating on the top of the axle-boxes.

The underlying principle of the automatic brake gear, which is spring controlled, consists in maintaining a constant relationship between the pull on the draw bar and the pressure on the shoes.

By the adoption of radial ball bearings in the axle-boxes, the tractive effort at the draw bar, on the level, has been reduced from 38 to 17 lb. per ton of load.

A very simple type of automatic coupling is employed.

The visitors were subsequently conveyed in special cars to the Council's Central Repair Depot and generating station at Greenwich, while another party visited Bexley to inspect the Woods-Gilbert rail planer in use on the local tramways.

Practically the whole of the repair work on the L.C.C. cars is carried out at the repair depot, which is, we believe, the most extensive one of the kind in the country.

As many of our readers are aware, the Greenwich tramway power station is gradually being re-equipped with turbine plant, and at present there are installed four 5,000-k.w. and two 8,000-k.w. turbine sets, while two of the original vertical-horizontal Corliss reciprocating sets are still available for duty, though these will in the near future be superseded by turbine plant.

Part of the boiler installation, utilising the two chimneys whose aspirations were cut short at the instance of the Observatory authorities, is now operated in conjunction with a mechanical-draught installation, resulting in a considerably increased evaporation from a section of the plant.

The following is an abstract of the Presidential address:—

THE annual report of the Executive Council shows that a large proportion of the work of that body during the past year has been in relation to problems arising out of the war, i.e., supply of tramway tickets, tramway tire supplies, retention of tramway employees. Munitions of War (Amendment) Act, 1916, classification of tramway material, women as tram-car conductors, Lights (Vehicles) Order, 1915, British trade after the war, and disabled soldiers and sailors.

In connection with the Munitions of War (Amendment) Act, 1916, your Council were successful in getting the term "munitions work" extended to cover "tramway facilities." No fewer than 44 municipal tramway undertakings are up to this date certified under the Act, and many others are authorised to issue Class "B" Priority Certificates to facilitate the delivery of supplies for maintenance.

It is not always realised by the average man that tramways are to-day playing a very important part in the national crisis in carrying workpeople from their homes to the factories and *vice versa*. It is therefore very gratifying that the Government have realised the great importance of tramway undertakings and have given them such facilities as enables them to keep going.

The past year has not been fruitful in developments and extensions so far as tramways and other passenger-carrying facilities are concerned. The most outstanding features of the year are the readjustment of tramway fares and stages, the employment of females on a large scale, and the introduction of volunteer labour for driving, the latter innovation having been introduced in Birmingham, Newcastle, and Bradford, where 320 auxiliaries are employed with quite satisfactory results.

In several cases changes have been made whereby the average fare per passenger has been materially increased, and in all these cases additional revenue has been the result. Strange as it may seem, some authorities have actually been considering the decreasing of fares and the cheapening of tramway facilities.

Present conditions provide ample justification for suggesting that the existing low fares should be adjusted so that the increased costs can be fully met. While the accounts of most municipal tramway undertakings look fairly satisfactory, still it must be admitted that much necessary expenditure is only suspended till the end of the war.

There are now 8,609 females employed on tramways as follows:—8,433 as conductors and 176 as drivers.

Some idea as to the part tramways are taking in the great conflict may be obtained from the following figures:—

Number of municipal tramway employes who have joined His Majesty's Forces	20,905
Percentage of total number of employes	38
Number of men who have left municipal tramway undertakings to join munition factories	1,893
Percentage of total number of employes	3½
Amount paid to dependents of employes serving with His Majesty's Forces	£854,619
Average allowance per man per week	10s. 7½d.
Amount collected on cars for various national and other objects	£43,800
Amount contributed by municipal tramway employes to various relief funds	£36,070

What of the future? Changes will come. The war certainly will not only be an interruption of what formerly existed. What will be the precise nature of the problems which, when they emerge, must be boldly faced, no one can forecast. It is a matter still in the region of conjecture.

The history of municipal tramways is a history of progress and improvement. Sometimes we were tempted to think that everything had been done which could be done, and yet in tramway enterprise, as in all other departments of human affairs, there is no such thing as finality.

Simultaneously with the cessation of hostilities various problems relating to our employes will present themselves. For example, the question of war wages and bonuses, and the position to be taken up regarding our men who may be in receipt of pensions but still able to perform certain duties.

The development of tramways from a passenger-carrying point of view has occupied our attention almost entirely in the past. Now the other point of view, *viz.*, transit, such as tramways can offer for goods, should have our fullest consideration.

In the days to come, when economic competition between nations will in all probability be even fiercer than in the past, transit will undoubtedly play an important part. Relaxation of restrictions and regulations may be necessary, but when national interests are involved there should be no difficulty in this respect.

Railways are crowded with traffic of all kinds, and considerable complaint is heard all over the country regarding the delays that are taking place. It is therefore just a little surprising that the Government have not seriously considered the usefulness of the various tramway undertakings for the carriage of munitions and general merchandise.

Some Notes on Passenger Transportation in Large Cities.

Abstract of paper by MR. J. M. McELROY (Manchester).

SYSTEMATIC studies of the passenger transportation requirements of the large cities in this country have not in the past been undertaken with that thoroughness which has been characteristic of many cities abroad, particularly in America. Town-planning schemes and the making of provision for future transportation requirements are really part and parcel of the same problem, and should be considered together.

As cities grow, due to the gradual increase in population, and as the riding habits of the people develop, it becomes

more and more difficult to make the channels of passenger transport equal to the ever-growing demands.

There is a constant migration of the population from the inner to the outer zones, and this is greatly accelerated by every extension and improvement in the means of transit. Suburban districts rapidly become urban, and new suburban districts in the outlying areas are always in process of formation. Smaller towns and districts on the outskirts are drawn into closer touch with the cities, and a greater community of interests is being established over a gradually widening area.

Every extension of the means of transit into the outer zones adds to the difficulties of handling the traffic in the central zone, and in time the congestion becomes so acute that the city authorities realise that they are face to face with the inevitable traffic problem.

Some years ago a student of traffic questions, having

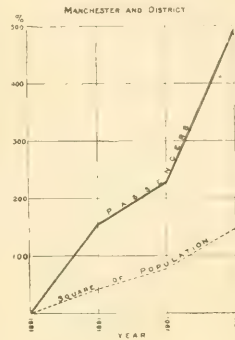


FIG. 1.

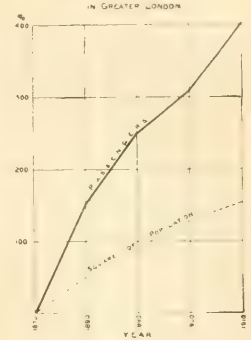


FIG. 2.

analysed the statistics of a number of European cities, found that on the average the number of passengers carried increases in the same ratio as the square of the population.

This rule is approximately true as regards American cities, but it does not appear to be true as regards British cities.

The curves in fig. 1 show the percentage increase of the passengers carried, and the square of the population in Manchester and the surrounding districts during the past three decades; fig. 2 shows similar information as regards Greater London; figs. 3 and 4 show the facts as regards Greater New York and Boston.

Many factors tend to accelerate the normal growth in a particular city. Quite apart from the question of the increased facilities; and the introduction of general improvements in the means of transit—which are always followed by

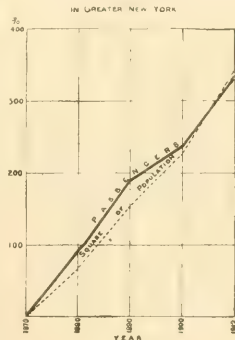


FIG. 3.

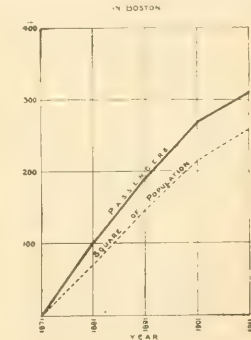


FIG. 4.

a rapid rise in the number of passengers carried—the factor as to the fares charged, and the changes made therein from time to time, has a most important bearing on the subject. Comparative statements as to the number of passengers carried tend to be misleading because they do not indicate the average distance travelled by each passenger.

The ultimate volume of passenger traffic which can be dealt with by facilities which use the street surface is limited by the capacity of the arterial routes near the central parts of the city. When the traffic on these routes approaches the saturation point then additional arteries must be opened out or other transit facilities provided.

The new facilities which may be provided are (1) Railways —(a) in shallow subways, (b) in deep level "tubes," (c) on elevated structures; (2) shallow subways in the congested areas into which the surface cars can be run.

Many other lines have not waited until the saturation point of the surface facilities has been reached before underground or overhead railways have been constructed; time saving has been the main factor which has led to the construction of many city railways.

Experience shows that the provision of shallow subways for surface cars cannot be justified owing to the great cost of construction and the comparatively small amount of traffic which can be passed through them.

Underground lines of any description can only be justified by a dense traffic demanding the operation of high-speed trains run at very close intervals, and such lines should be so laid out that they can be worked in conjunction with the surface lines, which should gather the local traffic and feed the underground lines.

It is not at all likely, having regard to the general experience, that private enterprise will be willing in future to shoulder the great outlay involved in the provision of underground facilities.

The average cost per route mile of existing underground and elevated railways in Greater New York is £564,313, in Chicago £372,563, in Philadelphia £455,167, in Boston £684,063, and in London (taking the Central London, City and South London, Great Northern and City, and London Electric Lines) £664,230.

In New York the total outlay on the underground and elevated lines—when the extensions are fully completed—will be £137,000,000. The expenditure on the extensions, undertaken in recent years, will be £68,000,000. This capital is being provided roughly half and half by the city and by the operating companies. The companies are to get out of the revenue all their operating expenses and 6 per cent. upon

seating capacity and its ability to cope with traffic of a widely fluctuating character, will be utilised where heavy peak loads have to be catered for. On the other hand, where the volume of traffic is not great, or where there is a steady traffic flow throughout the day, motor 'buses will probably prove to be the more suitable vehicles. In some instances it may be found to be advantageous to run the two types of vehicle along the same routes.

The aim should be to use the highways as channels for passenger transport to the best possible advantage, and the most efficient means of doing this can only be decided upon in any particular case by a study of the traffic characteristics.

Attempts have been made to show the relative efficiency of the two types of vehicles—trams and motor 'buses—by comparing the average load. It has been pointed out that "the average load of a tramcar with 74 seats is 10½ passengers and of the motor 'bus with 34 seats is eight passengers, and, therefore, the relative efficiency of the motor 'bus is almost twice as great as that of the tramcar."

The relative efficiency of the two types of vehicle cannot otherwise be gauged than by their ability to cope with the volume and flow of traffic in particular cases.

Fig. 8 shows the loading of a typical tramcar during a full day's continuous running on the Palatine Road route, Manchester. The car has a seating capacity for 75 passengers. The diagram also shows the seating capacity of a motor 'bus. The tramcars have the whole of the seating accommodation available in all conditions of weather; in bad weather the outer seats of motor 'buses are nearly always empty.

The average number of passengers carried per car mile on the tramcar shown on the diagram was 14. The fallacy of using

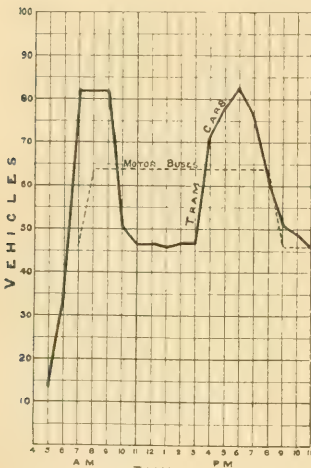


Fig. 5.

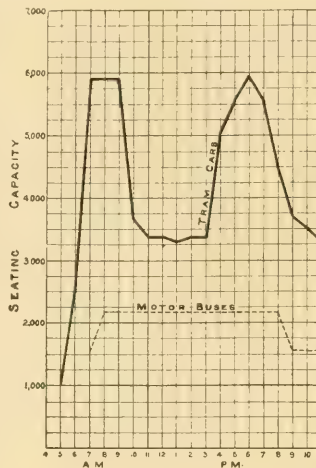


Fig. 6.

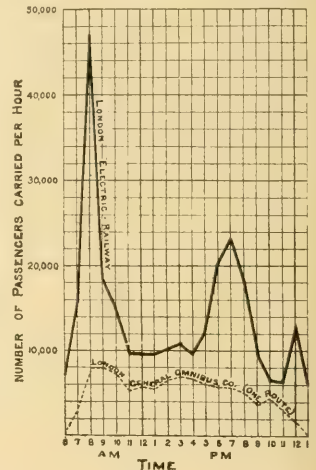


Fig. 7.

their investments, and out of the balance the city is to get the interest on its investment plus 1 per cent. for sinking fund, and if there is any profit after these payments have been made it is to be divided equally between the city and the companies. But the city authorities are not looking for profits. They are determined to provide adequate travelling facilities—and so important a duty on the part of the municipality do they consider this that they have made up their minds to do it properly, even if it entails a charge upon the rates of the city.

In London—where all the capital for the underground railways has been found by private enterprise—the amount available for dividends on the ordinary capital was only sufficient to pay just over 2 per cent.

In studying the problem which we are now faced with in Manchester—where several of our arterial routes approaching the centre of the city have practically reached the saturation point—I came to the conclusion that the proper course was to improve and make more efficient the existing surface lines by opening out parallel routes, by forming new streets and widening others at considerable cost, and also by adopting tramway terminals near the heart of the city, the latter being necessary on account of the narrowness and bad lay-out of the central streets.

The necessity of utilising the streets to the fullest advantage involves the question as to the most suitable means of surface transit, having regard to the traffic requirements.

An abstract discussion as to the relative merits of tramcars and motor 'buses, without references to the particular purpose for which they are intended to be used, is likely to be very misleading. Each type of vehicle has its peculiar advantages, and will be utilised for handling that class of traffic for which it is best suited. The tramcar, on account of its greater

this figure as a measure of the car's efficiency is too obvious to need comment.

Figs. 5 and 6 (kindly prepared for me by Mr. A. L. C. Fell) show what the tramcars and motor 'buses are doing respectively to meet the traffic demands on a typical route in London. Fig. 5 shows that the motor 'buses make no attempt to deal with the peak between 7 and 8 a.m., but obviously cater for a steady all-day traffic.

Fig. 6 shows the relative seating capacity of the tramcars and motor 'buses referred to in fig. 5.

Fig. 7 shows the fluctuating character of the loading on the London Electric Railways and on one route of the London General Omnibus Co. Here is an illustration of the ability of the railways to handle heavy peak loads and the lack of capacity in the case of the motor 'buses.

The making of proper provision for handling the rush-hour traffic will always be the difficult part of the passenger transportation problem. It involves, and will continue increasingly to involve, a large expenditure of capital and comparatively high operating costs.

It is on account of this that competition by separate companies for the steady all-day traffic by means of vehicles which can be run on the public streets at a relatively small capital cost, and which escape many of the obligations placed upon those who cater for the peak loads, is unfair and should not be permitted.

The right to operate public service vehicles, acquired by merely obtaining an annual licence, is archaic, and new legislation dealing with this matter is urgently needed. Concessions to use the public streets, if granted, should carry with them obligations in the public interest, with corresponding security and protection for the operators.

It is becoming more and more clearly recognised, by all

those who are qualified to judge, that the public interests are best served by making the facilities for city passenger transportation a monopoly—a monopoly subject to the control of the city authorities, who should possess full powers either to provide and operate the facilities themselves, or, if they think fit, to grant franchises to private companies to do so, subject to control and regulation in the public interest.

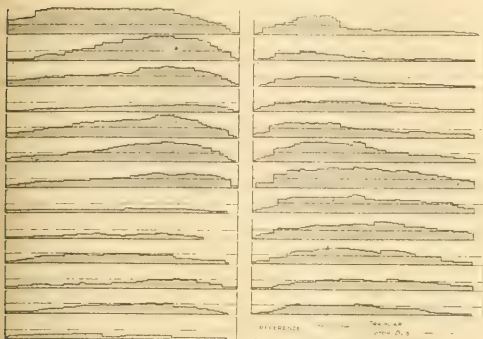


Fig. 8.

The world's experience has shown that every city should have a permanent authority directing the initiation and carrying out of all schemes for new transit facilities, in order that there may be continuity of policy, and that the future needs of the city and the surrounding districts over a wide area may be properly looked after.

DISCUSSION.

Coun. H. GORDON (L.C.C.), in opening the discussion, said some years ago he found, when on the Continent, that the travelling habit was much more extensively developed in continental cities than in London, and that tramway construction was more extensive per head of population. He thought it was a fallacy to suppose that there was any real connection between journeys per head and population of cities. He had studied the problem of relieving traffic congestion in the centre of our cities, and arrived at the conclusion that none of the proposed means would be effective. Experience in Paris and London showed that crowded thoroughfares became no less crowded by the provision of underground electric railways. He did not think they should be troubled about that, as it was an indication of prosperity; he thought, however, that a great deal could be done by the proper regulation of traffic. They ought to use the most suitable vehicle for transport, and it was known that the tramway car, relative to its carrying capacity occupied the lesser space. The flexibility of the 'bus was a myth when it was considered how that flexibility interfered with the regular flow of traffic. The tramway could not efficiently carry the railway peak load, and, on the other hand, the motor 'bus was excellent for isolated journeys. The unified control of London underground railways and 'buses should be extended to the tramways as well, and all should be controlled by a public authority.

Coun. BARROW (Birmingham) said he wished to emphasise the importance of the tramways working in with the "town planning" department. Several schemes of town planning were in being at Birmingham, and roads of 100 or 120 ft. wide were provided for. The traffic problem of the centre of Birmingham had always been a difficulty, and a special committee had been appointed to deal with it.

Ald. F. SMITH (Liverpool) said it had been perfectly clear to them some years ago that they could improve on German methods in Liverpool. They were faced with traffic developments in Liverpool in the future, but he doubted whether the result of working hand in hand with the town planning people would not result in the transfer of tramway profits for road construction, &c.

Mr. J. B. HAMILTON (Leeds) said he had brought the subject of passenger transportation in cities before them two years ago, and he had no doubt there must be a central authority to exercise control. He agreed that they appeared to be approaching a condition of saturation in large cities, but it was perhaps unfair to accuse them of lack of foresight in view of the phenomenal increase in traffic in recent years. Now that they realised the position there should be co-ordination amongst the authorities and public control by the municipality of all passenger transport facilities.

Mr. McELROY, in replying to the discussion, said that sooner or later the arterial roads would approach saturation point, and then the problems he had mentioned would have to be faced. He urged them to make financial provision in all large cities in connection with their tramways to meet the possible developments of the future.

A PROPOSED BRITISH TRADE BANK.

THE Committee which was appointed by the Board of Trade some months ago to investigate the question of financial facilities for assisting British trade after the war, has acted with businesslike promptitude in reporting its conclusions and making its recommendations. That this Committee has found it possible to complete its work earlier than have those which are concerned with particular industries is probably due to the fact that after the discussion that the matter received in the years preceding the war there was little difficulty in estimating the needs of the case and in focusing the views of the majority of responsible opinion. But probably also it has been considered that the findings in regard to this matter should in any case be decided before other committees published their conclusions, inasmuch as future policy in regard to financial facilities may have a more or less important effect on all of those industries. It will be remembered that Mr. Runciman, in the House of Commons, referred to the possibility of "additional institutions" having to be set up if the existing banking institutions, of which we were nationally so proud, found it impracticable to handle more extensively what we have for years come to know as industrial banking business. It was therefore as well that so many banking authorities and financiers were members of the Committee. The recommendations that they make are so framed as to aim at the better support of British enterprise in after-the-war competition with the enemy. It is proposed that a British Trade Bank, under Royal Charter, be formed without delay, so that the preliminaries may be completed before the war is over, and that its operations be especially conducted with a view to assisting our overseas trade. It is considered that it will not unduly interfere with existing banks, banking houses, or financial institutions, but will fill a gap between the home banks and the colonial and British-foreign banks and banking houses, and will develop facilities not provided by the present systems. Its chief features would be as follows:—

1. It should have a capital of £10,000,000. The first issue should be from £2,500,000 to £5,000,000 upon which in the first instance only a small amount should be paid up, but which should all be called up within a reasonable time. A further issue should be made afterwards, if possible, at a premium.

2. It should not accept deposits at call or short notice.

3. It should only open current accounts for parties who are proposing to make use of the overseas facilities which it would afford.

4. It should have a foreign exchange department, where special facilities might be afforded for dealing with bills in foreign currency.

5. It should open a credit department for the issue of credits to parties at home and abroad.

6. It should enter into banking agency arrangements with existing Colonial or British-foreign banks wherever they could be concluded upon reasonable terms, and where such arrangements were made it should undertake not to set up for a specified period its own branches or agencies. It should have power to set up branches or agencies where no British foreign bank of importance exists.

7. It should inaugurate an information bureau in close touch with the Commercial Intelligence Department of the Board of Trade.

8. It should endeavour not to interfere in any business for which existing banks and banking houses now provide facilities, and it should try to promote working transactions on joint account with other banks, and should invite other banks to submit to it new transactions which, owing to length of time, magnitude, or other reasons, they are not prepared to undertake alone.

9. Where desirable, it should co-operate with the merchant and manufacturer, and possibly accept risks upon joint account.

10. It should become a centre for syndicate operations, availing itself of the special knowledge which it will possess through its information bureau.

11. It should receive Government assistance, being appointed to carry through foreign commercial and financial transactions in which the Government may be interested.

The Committee considers it desirable that the British Trade Bank should receive as much official

rought as possible without coming under Government control:

The Institution should, for instance, be asked to instruct its representatives in contact with all commercial establishments abroad with clear instructions to them that the Institution has no substantial concern enjoying the full confidence of the Government, and similar instructions should be given by the Board of Trade to their Trade Commissioners in the Dominions."

The Committee did not consider it necessary to take much evidence, as that which had been put before other Committees, which have not yet reported on their trades, on the same subject, was put at its disposal. The report contains the following statements:—

It is desirable that we should state clearly our definitions of banking facilities in the British sense, and of what we would call by the wider name of financial facilities. The former are limited to those which can be provided without a "lock-up" such as would impair the liquidity of funds and deposits at call and short notice. For this reason the usual practice of bankers here is to confine their advances as a rule to a currency not exceeding a few months. By financial facilities we mean, generally speaking, those which would involve a longer currency than this.

A careful study of the evidence above referred to, and our own knowledge of banking arrangements and facilities, lead us to the conclusion that there exists to a considerable extent at the present time in this country the machinery and facilities for the finance alike of home trade and of large overseas contracts, and for carrying through much of the business which has been done by foreign banks. The British banks afford, we believe, liberal accommodation to the home producer. British bankers are not shy in making advances on the strength of their customers' known ability and integrity, and the charges for accommodation are, we believe, often lower than the corresponding charges in foreign countries. Similarly, the colonial banks and British-foreign banks and banking houses render immense assistance to British trade abroad, and certainly in the Far East, and in many parts of South America British banking facilities do not fall short of those of any other nation. We find also that in the case of large contract operations British contractors, with the assistance of financial houses, have in the past been ready to provide large amounts of capital and to take considerable risks in connection with the operations which they have undertaken.

Our arrangements, however, are faulty in our not co-ordinating many of the facilities mentioned in the previous paragraph. We recognise also that the British manufacturer may be frequently in want of finance of a kind which a British joint stock bank with liabilities as above described could not prudently provide, whereas the German banks in particular seem to have been able to afford special assistance at the inception of undertakings of the most varied description, and to have laid themselves out for stimulating their promotion and for carrying them through to a successful completion.

We conclude, therefore, that there is ample room for an institution which, while not interfering unduly with the ordinary business done by the British joint stock banks, by Colonial banks, and by British-foreign banks and banking houses, would be able to assist British interests in a manner that is not possible under existing conditions.

Such an institution might in many ways be beneficial to the development of British industry and manufactures. It might, in certain cases, after careful examination, agree to make advances for the extension of existing manufacturing plant, or perhaps for the amalgamation or co-ordination of certain works, so as to reduce the cost of production. It would assist these works to obtain orders abroad, and give them reasonable financial facilities for executing these orders. It should give a preference in matters of finance to orders which are to be executed in this country.

Such an Institution could also take a leading part in the inception of transactions and assist in connection with the machinery of overseas business. In the case of German manufacturers it frequently happens that on the board of the manufacturing company there is a representative of a bank, and there seems little doubt from an examination of the information which is available that the German banks have exercised an amount of control over the manufacturing concerns in which they are interested, which would not be possible, even if it were desirable, in the United Kingdom. A large number of our manufacturing undertakings are wealthy concerns, and would not tolerate for one moment interference by bankers in their affairs, and, indeed, would probably resent any inquiry into the nature of their business arrangements. Such manufacturing concerns, however, do require assistance when they transact overseas business. Take as a single instance the case of a Midland manufacturer selling goods to Italy. The Italian buyer has been accustomed to long credit, and if long credit is refused the business will probably be impossible. The manufacturer sells goods for, say, £50,000, and the payment of that price would leave him with a considerable margin of profit, but the offer of the Italian buyer to pay him the equivalent of £50,000 in lire at six or twelve months is not attractive. He would much rather accept a lower figure than £50,000 for a clean cash transaction in sterling,

and it is in connection with such business as this that an institution of the kind contemplated would be liable to act as intermediary (taking part of the whole of the financial liability) with profit to itself and satisfaction to the manufacturer.

Or to take another case, that of a contractor who has entered into a contract with a foreign Government, payment being made as works proceeded, such payment being possibly in paper in a foreign currency, the contractor in that circumstance would willingly share his profit with an institution which would be responsible for the finance of the securities receivable by him.

It would be essential in conducting business with manufacturers and merchants, that the Institution should draw and accept bills, and it should generally be in a position to undertake credit operations. It might be well to provide that a certain portion of uncalled capital, or a portion of paid up capital (if it is deemed wise to have all called up) should be reserved against this class of risk.

If an Institution is formed to carry out transactions of the kinds indicated above, it follows that it must be equipped with knowledge of affairs in the countries with which it may do business, and its managers must, by personal visits, acquaint themselves with the conditions of business in all important foreign centres. It must have either branches or agencies in those countries, and in this connection the exceptional position held by British-foreign and Colonial banks should be fully availed of. Instead of having to organise, as was the case with German banks, new subsidiary undertakings, the Institution would largely use, under agreement, the existing banks and the facilities which they can afford.

The Institution must be equipped with an up-to-date information department, and this will of necessity play a large part in its usefulness and financial success. This might properly be called a Bureau d'Etudes, independent of the Commercial Intelligence Branch of the Board of Trade, but in close touch therewith and under agreement entitled to all possible facilities. That such a bureau is essential has been made abundantly clear by the evidence given by witnesses we have heard, and also by the evidence given before other committees. It would not necessarily deal only with schemes in which the Institution proposed to take financial interests, but might be made a centre for investigation of projects on behalf of others, and a considerable revenue might be obtained thereby. Chambers of commerce and joint stock banks which were disposed to help valuable clients, would no doubt avail themselves of the opportunities it would afford for information. One of the chief objects of the bureau, for instance, would be the organisation and keeping up to date of returns as to the status of firms abroad. It should also obtain the earliest information from abroad about new business openings, large contracts offering, State and other loan and issue proposals, &c. If it were found that foreign firms were securing business in competition with British firms, or were developing business that British traders were leaving alone, the causes should be at once investigated. The periodical journals abroad of the Institution's managers and representatives would supplement the information that would be gained through diplomatic and official channels.

The bureau would also have to undertake the examination of industrial projects. This would be a costly business, as it would be necessary to have upon its staff men whose opinion upon technical questions would enable it to investigate thoroughly matters brought up for consideration. It would, however, avail itself of the services of the eminent consulting engineers, consulting chemists, &c., whom we possess in this country.

It is absolutely clear that the personnel of the Institution would call for great discrimination. It seems to be generally agreed that the lines upon which a joint stock bank is constituted would not be applicable in the case of the new concern.

An executive committee consisting of a whole-time chairman and three managing directors would appear essential. (There would probably be three distinct departments, financial, industrial, and commercial. No doubt there would be overlapping between the departments, but this would be immaterial.) They would draw good fixed salaries, and would be entitled to a substantial share in profits. There should be a general board of directors, composed of men with banking, financial, industrial, and commercial knowledge, and in close touch with the leading industries of the country.

Nearly as important as the board would be the general staff. It is fair to assume that women will in the future take a considerable share in purely clerical work, and this fact will enable the Institution to take fuller advantage of the qualifications of its male staff to push its affairs in every quarter of the globe. Youths should not be engaged without a language qualification, and after a few years' training they should be sent abroad. It could probably be arranged that associated banks abroad would agree to employ at each of their principal branches one of the Institution's clerks, not necessarily to remain there for an indefinite period, but to get a knowledge of the trade and characteristics of the country. If industry is to be extended, it is essential that British products should be pushed, and manufacturers, merchants, and bankers must combine to push them. It is believed that this pushing could be assisted by the creation of a body of business young men in the way above described.

In this connection it is perhaps worth pointing out that at

the close of the war there may be a considerable number of educated young men who will not be willing to settle down again to the humdrum of an office, and from these it should be possible to select a number who would be desirous of going to the Colonies and foreign countries to push business on their own account. If the case of labouring men, the Government are contemplating the establishment of land settlements, &c., at considerable expense, and similarly it has been suggested that Government assistance might be given to the class above-mentioned, who would probably require the advance of some capital to enable them to make a start. The Institution might act as agent for the Government in this connection. The reluctance on the part of young men to go abroad in recent years has been brought to the Committee's notice, and they think it is very desirable that the spirit of enterprise should be encouraged and that an incentive should be given to them to set up in business in foreign countries.

In the case of young men with some little means of their own, the Institution should be willing—after careful examination of credentials—to grant larger and longer credits than have been customary with existing banks. The principle of becoming special partners in a business for a period of years will be well worth the consideration of the management when the Institution is formed.

The evidence perused by us indicates the necessity for fuller financial facilities for home industries, especially in connection with the enlargement of works and the financing of contracts, and where it is demonstrated that a lock-up of capital for an indefinite period is not involved, assistance might be provided by the Institution to meet these requirements.

If financial assistance is given by the Government to undertakings in connection with what are known as "key" industries, the business should, if possible, be done through the medium of the Institution, and it should be appointed an agent for carrying through foreign commercial and financial transactions in which the Government may be interested.

Foreign banks have, in most of their operations, adopted the course of forming syndicates to undertake any business of considerable magnitude. They have headed such syndicates and they have taken the labouring oar in connection with investigations. The members of the syndicate have generally included other banks, and associated with them have been those who were particularly interested in the class of business proposed to be done. These syndicates are formed after the first superficial inquiry has satisfied the banks that there is apparently a good business to be done. Directly this point is reached the expenditure in connection with thorough investigation is on account of the syndicate. If the business is ultimately proceeded with the profits or losses on the wind-up of the business are shared *pro rata* after allowance to the bank for management. Some such procedure should be followed here. It would enable the Institution to undertake business of a comprehensive character, and its "inprimatur" would have value when issues were made to the public.

Many new undertakings intrinsically sound have been issued in the English market. The capital has been based upon estimates of expenditure made by reputable engineers, but owing to unforeseen circumstances the actual cost has far exceeded those estimates, and, as a consequence, further capital has frequently had to be raised at higher rates of interest and in a form (such as prior lien bonds) which has had a disastrous effect upon the securities originally subscribed for by the public. An Institution issue, whether of debentures or shares, should be an assurance to the public that until final completion there would be no risk of the priorities given at the time of issue being interfered with by pre-preference creations.

We are of opinion that there are strong reasons why the bank should be formed without delay, so that preliminaries may be completed before the war is over. Our enemies are sure to make at the earliest moment strenuous efforts to regain their position in the world of commerce and finance, and it may well be that, when peace comes, unemployment may be rife at home unless new markets are exploited. It seems to us desirable, therefore, to ascertain in advance the requirements of foreign countries and the whereabouts of raw materials for our industries.

We believe that a bank constituted upon the above bases, with efficient management, should not only be a great boon to British trade, but should prove a commercial success.

AMERICAN ELECTRICAL EXPORTS.

We give below the figures relating to electrical exports from the U.S. in May and June, for which we are indebted to recent issues of the *American Electrical Review and Western Electrician*.

The figures for May show a total rate in excess of any previous month. The total value of electrical shipments last May was nearly 91 per cent. over that of May 1915 and nearly 17 per cent. over that of February, 1916, which was the highest monthly figure previously recorded. The exports for June exceeded in value those of June, 1915, by nearly 54 per cent., though showing a decrease of some 8 per cent. from the record total of May, 1916.

To what extent the electrical export trade is increasing in volume as well as value it is difficult to state, since the Government reports give the numbers of articles shipped for only four electrical classes. For the classes these numbers compare as follows:

Articles.	Numbers exported in			
	May, 1916.	May, 1915.	June, 1916.	June, 1915.
Electric fans	2,609	2,013	1,577	3,751
Ac-coups	1,777	46	35	1,177
Carbon-filament lamps	79,474	60,496	35,541	74,689
Metal-filament lamps	798,499	297,104	802,640	385,773

In the following table are given the detailed figures for last May and June and for the corresponding months a year ago:

Articles.	Numbers exported in			
	May, 1916.	May, 1915.	June, 1916.	June, 1915.
Batteries	\$157,997	\$79,418	\$152,876	\$119,999
Dynamos or generators	183,534	84,153	145,965	191,464
Fans	33,528	28,838	24,831	43,000
Insulated wire and cable	292,086	302,029	290,151	253,247
Interior wiring supplies, &c. (including fixtures)	38,393	131,600	36,885	70,915
Lamps—Arc	2,539	1,200	156	1,826
Carbon-filament	9,833	7,593	4,198	11,432
Metal-filament	140,649	42,232	139,833	75,530
Meters and other measuring instruments	79,641	67,813	72,540	41,214
Motors	428,964	209,014	321,147	283,923
Telegraph instruments (including wireless apparatus)	16,187	2,968	8,564	1,522
Telephones	335,675	57,090	189,965	44,342
Transformers	173,988	23,217	55,847	70,543
All other	1,572,175	764,844	1,712,396	836,061
Total	\$3,177,600	\$1,862,200	\$3,100,141	\$2,047,081

The following table gives a detailed comparison of the last two fiscal years ended June 30th in each case:—

	Electrical exports in	
	1914-15.	1915-16.
Batteries	\$367,116	\$1,393,836
Dynamos or generators	2,043,134	1,465,961
Fans	258,309	856,729
Insulated wire and cable	1,918,850	3,157,238
Interior wiring supplies, &c. (including fixtures)	753,351	818,985
Lamps—Arc	30,984	16,693
Carbon-filament	101,923	144,872
Metal-filament	473,149	1,282,039
Meters and other measuring instruments	440,916	776,381
Motors	2,815,744	1,931,974
Telegraph instruments (including wireless apparatus)	76,371	148,536
Telephones	1,149,361	1,329,346
Transformers	624,182	960,193
All other	8,152,141	13,970,236

A comparison of the electrical totals for the last four fiscal years is given below, the year 1912-13 having the preceding highest total:

Fiscal year.	Electrical exports.
1912-13	\$3,967,722,846
1913-14	35,000,441
1914-15	14,571,507
1915-16	30,254,020

The foregoing figures do not include electric locomotives, which are listed separately. During the fiscal year 1915-16 there were shipped 64 such locomotives valued at \$451,344. In 1914-15 these numbers were 43 and \$324,178. In 1913-14 they were 48 and \$437,152 respectively.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Commutator-Slotting Tool.

A writer in the *Electrical Review and Western Electrician* has found that a good and handy tool for cutting down high mica between commutator segments can be made as follows:—

Take a piece of hack-saw blade 2 in. long—a piece with fine teeth is preferable—and grind it down if too thick to go between the

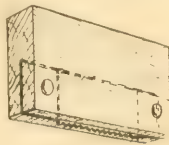


FIG. 1.—COMMUTATOR-SLOTING TOOL.

segments. Next take a piece of wood 3 in. long, 1½ in. wide, and 0.75 in. thick, and saw a slot the length of it with a hack-saw deep enough so that the 2-in. piece of saw protrudes ½ in., or more if desired, when it is inserted in the slot. Bore a hole through the wood piece on each end of the piece of saw, as shown in sketch, put in stove bolts, and tighten. This tool can be used on a commutator without removing the brush gear or end casting.

The Sterling Staff-Signalling System.

Facilities to enable the staff of any large works to locate each other at any moment during working hours have for years been badly needed, and although telephones are installed in nearly every works, they do not satisfactorily fulfil the requirements of a busy staff moving about from workshop to workshop.

Suppose that Mr. A., a mechanical engineer, is going his rounds of the various shops, covering his duties. At the moment he happens to find himself in the tool room discussing the condition of a new tool. He is suddenly urgently required to attend to a job in the machine shop. How is he to get in touch with him without loss of time? Until recently the most practical method was to go to the nearest telephone, ring up the works central exchange, and ask the operator to try and locate Mr. A. by ringing round to all departments; alternatively, messengers were sent hurriedly through the works.

Both these methods appear antiquated compared with a patented system which we met with when recently visiting the Sterling Telephone Co.'s extensive works at Dagenham. The company has devised an ingenious system of luminous lamp signals fitted at numerous points throughout the works. A bank of five differently coloured electric lamps is fitted in a prominent position at each of

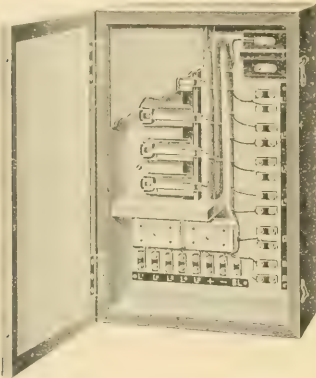


FIG. 2.—CONNECTION-BOX OF STERLING STAFF-SIGNALING SYSTEM.

20 different points in the various shops. A cable connects each point with the works central telephone office. A bell is fitted close to each bank of lamps, or, in the case of a noisy shop, an electric hooter is employed. The central telephone operator is provided with a board fitted with 20 pushes and a special control switch.

When Mr. A. is wanted, the central operator cuts in the control switch and pushes the button corresponding to Mr. A.; her work is then finished for the moment. The bells and hooters in each shop now ring and continue automatically and intermittently to do so until Mr. A. observes that he is required; he then immediately goes to a telephone which is located near the bank of lamps, and calls up the works central, which puts him through to the party desiring to speak to him.

The system is so arranged that 20 different colour combinations can be produced on the bank of five lamps; thus it is that Mr. A., to whom, say, the colours red-blue-yellow have been assigned, knows at a glance when he is wanted. All that is required to make the system perfect is to instruct each member of the staff to glance at the bank of lamps directly the bell or hooter sounds.

It will readily be seen that an enormous saving of time is afforded by the "Sterling staff-signaling system"; any member of the staff can immediately locate any other, irrespective of their position at



FIG. 3.—BANK OF COLOURED LAMPS.

the time. It would be well worth while for works managers to pay a visit to the Sterling Co.'s works, where they will receive a full explanation of the system. We are informed that the company is prepared to undertake similar installations, provided they are required for munition works. It is obvious that the system is equally applicable to hospitals, and other public institutions.

Concrete Poles.

A new method of making reinforced-concrete poles is described in *Concrete* by L. R. Allison. The poles are composed of one part Portland cement to three of sand and gravel, poured into forms in which the reinforcing rods are supported; the forms are then locked in a machine and revolved at a suitable speed depending on the diameter of the poles, with the result that all voids are filled and a hard, smooth surface is obtained. Obviously the greatest compression is at the point of greatest radius—i.e., the external surface, where it is most needed. After about half an hour the mould is withdrawn from the machine and left to stand for 24 hours; the pole can then be handled safely, and after

further setting in the open air, keeping the surface well moistened, is completed. The reinforcement consists of twisted steel rods equally spaced round the circumference at a distance of $\frac{1}{4}$ in. from the outside, the rods being held in place with wire loops. The poles are hollow from end to end, the diameter of the hole being at least 3 inches. The base and capital of lighting standards are cast separately by the centrifugal process, the former being provided with a cut-out box having a concrete cover. The foundations are cast in position, reinforced with $\frac{1}{2}$ -in. twisted steel rods, and the poles are securely anchored to them. The hollow core of the pole accommodates the electric conduit leading to the lamp at the top; when this is in place, the core is filled up with cement grout. Poles of this type are largely used in Californian towns.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

To Go—or Not to Go?

In agreement with the true statements by "Balanced Up," and referring to "North-East Coast's" reply, in which he draws attention to the assertions of eminent men that power station and sub-station operation constitute a field of activity for semi-skilled and unskilled men, I am prompted to draw attention to the conditions existing in a certain electric supply company which in the past has obtained the services of many young trained engineers by the "valuable experience," and alluring prospect of advancement described in its advertisements. This revelation by "North-East Coast" that such "valuable experience" simply consists of semi-skilled and unskilled work, coming from a gentleman who, I presume, occupies an influential position, and originated by the eminent men mentioned in his letter, is apt to be prejudicial to engineers who have sacrificed time and money in station work training. In common with others adopting electrical engineering as a profession, I find, after an experience covering a period of nearly ten years in the technical, constructional, testing, and operative branches that the result of my attraction to this supply company's "valuable experience and alluring prospects of promotion" consists of a so-called salary, or, to be exact, mere pittance, coupled with duties now described as semi-skilled or unskilled. Being prevented, through no fault of my own, from applying my ability to better advantage, during a time when the nation's leaders are urging trained men to give the country the utmost benefit of their skill, I, with many others, am hoping that the military authorities will shortly, by substitution, transfer us from our semi-skilled and unskilled positions to a more useful sphere of activity. I would also like to add that the policy of cheap labour, irrespective of ability, promotes discouragement, consequently reducing the efficiency of the individual engineer, with an increase in the old Capital *versus* Labour feud. This state of affairs does not appear to be a very sound basis on which to meet the enemy in after-the-war competition.

Industrial Conscript (Single).

The Wire-Drawing Industries.

Your remarks in a recent issue under the heading of "The Wire-Drawing Industries" may perhaps do something to waken up the High-Conductive Copper Association out of the lethargy which it has sunk into during recent years. It is not to be expected that individual wire firms will be disposed to grapple with this serious growth of foreign aggression while they are members of an association which, while it purports to look after their own interests, still clings to its out-of-date conservative methods when outside competitors have successfully adopted the measures required to put customers' interests first and their own second.

The scope and purposes of the H.C.A. are confined to purely selfish endeavours to prevent internal competition among the big firms in order to keep up prices. If instead, or in addition, it devoted its chief attention to organising a sound policy for frustrating the methods of the German and other foreign wire firms by adopting some of the means by which the latter have become serious competitors in Great Britain and elsewhere, it would be guaranteeing its own success with far greater certainty than by assuring itself that its members are not cutting each other's throats by underselling one another. The fact that the new small firms are doing so well is simply because they creep in under the markets which the H.C.A. firms never condescend to look for, or even suspected the existence of. I know one German firm which did more trade with this country three years ago than probably any two H.C.A. firms did in their entire foreign trade.

Its success was due to the fact that it looked after its customers thoroughly, and instead of merely communicating with them through the post (as the English firms would have done) it sent its agents round to its customers to ensure the

attention which all buyers expect and look for. Apparently it is beneath the dignity of the H.C.A. firms to adopt a similar attitude!

The H.C.A. is probably unaware that there are other new small wire firms which would be started at once but for the difficulty of obtaining the rolled copper for drawing down from the big firms. While the H.C.A. is able (at present), because of the monopoly it enjoys through the shutting-out of foreign competition, to prevent other small wire firms being started, by refusing to sell them the rolled copper for drawing down, and thus preventing home competition, it is acting as a monopolist in two ways, *i.e.*, by preventing others from trading where there is legitimate trade to be done and by adopting no proper means of gaining that trade itself. Consequently, the surplus must be going elsewhere—probably to America. This position, however, will cease immediately after the war is over, and then the H.C.A. will have to devise a more up-to-date policy of doing business, and cast overboard many of its present antiquated and unenterprising methods.

Herbert Worthington.

Preston, September 22nd, 1916.

LEGAL.

MUNITIONS COURT CASE.

THE Oldham Munitions Tribunal last week heard a complaint by a firm of manufacturers of electric accumulators in the Ashton district, who summoned two labourers for failing to obey orders. According to the assistant works manager, the men were employed in the casting department, and on the 11th inst. they should have left that department to work on a blast furnace, but they refused and went to the office and asked for their wages. A representative of the National Union of General Labourers said the men were told by the foreman there was no further work on their own job. At the casting work their ordinary time was 49 hours per week, and the average wage £2 4s.; but the blast furnace job meant they would have to work from 80 to 88 hours for the same wage. They asked the foreman if there was any other work they could do, and, receiving an answer in the negative, asked for their discharge certificates. Both men now said they were willing to go back to their ordinary work, but a representative of the firm said they could not take them back on the same work, as they had not the material for them to work on.

Mr. James Hodson (chairman) said there had been no evidence to show that the men refused to obey orders. Before men were removed from one class of work to another the men were entitled to establish a new contract, and the men could not be moved without their consent. The case would be dismissed.

GERMAN ELECTRIC PATENT FOR CLEANING BOILERS.

In the Patents Court, on Friday last, Messrs. J. C. McQuitty, Ltd., of the Albert Engineering Works, Belfast, applied for a licence to use the German patent 3,117 of 1911 for an electric hammer for removing the incrustation in boilers.

Mr. McQuitty described the method on which the hammer works. To the electric motor is attached a flexible tube, having at the other end a hammer-head. The hammer-head does not itself strike. It contains a series of cogged wheels which are electrically driven, and when the hammer-head is brought in contact with the incrustation these tap the scaling as they perform revolutions at the rate of 7,500 taps a minute. The electric energy required is not great. The electric motor is simply coupled to the lighting or power supply of the works, and the result is an efficient mechanism, which is a notable time-saver and performs the work ordinarily done by four men. It gets over the ground rapidly, does not mill, chip, or injure the plating, and, by reason of the flexibility of the tube, reaches awkward places and out-of-the-way corners where it is impossible to make an effective blow with an ordinary hammer. It is known as the Van de Voorde patent. Mr. McQuitty pointed out that it was invaluable for munition works and for naval engineering purposes, and could be used by an unskilled workman.

Mr. McQuitty said his company was a limited company, privately constituted, having only three shareholders, and their business had always included that of millwrights and boiler scalers. He had already made two of these electric hammers experimentally, and he proposed to commission the Westinghouse Co., of Manchester, to provide him with the electric motor. He had never had any engagement with the patentee. He was in negotiation with him before the war broke out, but the negotiations fell through on a question of method of payment. The two experimental hammers which he had made worked quite efficiently. He had some trouble at the beginning because of the inadequacy of the specifications, but he had repaired their omissions, and there was certainly an original element in the hammers as he proposed to put them upon the market. In a further statement, he said he did not know that anyone else was making this type of hammer. There was no English manufacture. The Germans, before

the war, and before the prices of material went up, asked £22 10s. for the hammer.

When the Controller asked Mr. McQuitty if he would pay a royalty of 5 per cent., the applicant rejoined that he thought 25s. royalty on each hammer made would be excessive considering the amount of experimental work he had had to do in perfecting the thing, and the fact that he desired to sell it at as cheap a rate as possible. He only got 20 per cent. profit at the present time on his labour in work he did for the Government.

The Controller: An ordinary manufacturer's profit is 25 per cent., and you are entitled to place your royalty on the top of that. The Controller said the applicant must pay to the Public Trustee a royalty of a sovereign on every machine made, and the Court would then recommend the Board of Trade to grant him a licence.

WAR ITEMS.

Exports to China.—The "London Gazette" for September 22nd contains further lists of persons and bodies in China and Liberia to whom exports may be consigned.

Silvertown Employés War Relief Funds.—In connection with these funds, we are informed that £1,500 has been collected to date, and regular donations have been made to the Prince of Wales's Fund, British Red Cross Society, Belgian Relief Fund, Serbian Relief Fund, and the Anglo-Russian Hospital at Petrograd.

Claims Against the Enemy.—The Public Trustee has prepared and issued several documents explaining how claims should be made on behalf of British subjects against enemy subjects and enemy Governments. Our readers do not need to be told how important it is for them to make their claims, and to do so in the proper form. The bill against Germany has to be prepared, it will be a colossal sum, and the work of the Public Trustee Office will be simplified if its instructions are properly complied with. Communications on the matter have to be addressed to the Public Trustee (Trading with the Enemy), Kingsway, W.C., but forms can also be obtained at the Manchester Office, Albert Square, Manchester. It should be noted that shareholders in English companies owning property in enemy territory should not make claims in respect of their individual holdings, as the companies should, of course, make the necessary claims in their corporate capacity.

A Siemens War Savings Association.—Some years prior to the outbreak of war a number of the employés of Messrs. Siemens Bros. & Co., Ltd., formed amongst themselves a Thrift Club, which has had a successful career. As a branch of the club, a War Savings Association has been organised at the Woolwich works under the name of "The Bowater War Savings Association." Its management is exclusively in the hands of a committee of employés, which committee is solely responsible for exact and regular administration. Since the inception, in June last, this Association has progressed well, the membership having increased from 500 to about 1,400, and, up to the present, nearly 4,000 War Savings Certificates have been purchased under the Government Scheme No. 2A, by which all subscriptions, as soon as they are paid, are converted into War Savings Certificates, these being allotted to each subscriber in priority of completed subscription as and when the full value has been paid.

Exemption Applications.—At the Guildford Tribunal, the Woking Electric Supply Co. appealed for its chief clerk (29), the only male clerk left. It was stated to be essential that there should be a man in charge with technical knowledge and an intimate acquaintance with the locality. Appeal dismissed.

When the Imperial Tramways Co. applied to the Stockton-on-Tees Military Tribunal last week for the exemption of a clerk on the ground of indispensability, the manager (Mr. Freshwater) said the company were straining every nerve to release all men possible. They had from 70 to 90 lads in their employ from 16 to 18 years of age whom they were training as motor-men and in other capacities. The moment these lads came of military age they were given their leaving certificates, and the recruiting officer was notified. Exemption until January 1st.

At Maidstone, the Corporation tramways manager appealed for a number of men. Three drivers and a turner were given conditional exemption; and another driver, a clerk, and a blacksmith were refused any time.

West Kent Appeal Court has dismissed an appeal for exemption filed by Mr. G. W. Ironsides (34), electrician, Anerley.

The East Kent Appeal Court has adjourned, for the purpose of obtaining a certificate from the Ministry of Munitions, an appeal by Mr. E. Hunt (27), assistant electrician at the Faversham Cotton Powder Works.

Bromley (Kent) Tribunal, on September 20th, granted three months' exemption to Mr. Rilev, electrician, Walter's Yard, and to his electrical machinist, F. Johnson.

Wm. C. Wheeler, electrician, in the employ of Mr. F. H. Norman, Moor Park, Much Hadham (Herts.), has been given

exemption until October 7th, with no further appeal without permission.

At Maidstone, on the application of the electrical engineer to the L. & D. Ry. S. Fry Smith, conditional exemption was granted until October 1st. Forth, trade union in the electricity and electrical work. A. I. Berridge, shift engineer, also obtained exemption until December 30th for a substitute.

Mr. W. W. Wynn, Bechillan Sea, appealed for his floor. Exemption, passed for lamp duty abroad necessary to the business. On condition that he joined the Volunteer Training Corps floor was exempted.

The Chairman and District Tramway Co. appealed for three motor-men and a switchboard attendant. It was stated that five wounded soldiers had been trained as drivers, but it was found that when left to themselves they lost their nerve, and they had to leave the work. Conditional exemption was allowed with the consent of the military representative.

A month's exemption, in order to find a substitute, has been granted by Walton-on-Thames Tribunal to F. G. Fuller, electrician to Mr. W. K. Marriott, Moorlands, Cobham.

Before the Warwickshire Appeal Court, the Military appealed against exemption until October 1st granted to Horace Walter Gilbert, electrician and wireman, Rugby, and against exemption granted to a charge hand at the Rugby Urban Council's refuse destructor. The former case was put back for further consideration, and the latter appeal was allowed, the exemption being limited to October 1st.

At Weymouth, Percy W. Child, electrician, was appealed for by Messrs. Brooking & Co., engaged on a Corporation housing scheme. A month was granted, with no further appeal without consent.

An appeal, at Sheffield, by Mr. W. Johnston (35), electrical engineer, has been refused for the result of a medical examination, and one by Mr. Ernest Jones (33), electrical engineer, has been disallowed.

Before the Essex Appeal Court, Messrs. Taylor, Walker and Co., Upminster, appealed for Albert Robert Barry, their electrician, who was medically rejected when the war broke out. The appeal was dismissed, and consent to go to the Central Tribunal was refused.

Before the Essex Tribunal, Mr. Frank Marwood Burley, electrical engineer, of Southend-on-Sea, appealed for exemption. He said that he was 35 and single, and that his business consisted of putting electrical fittings into houses, and so it was the whole of his capital. He had contracts running, and if he had to close it would be absolute ruin to him. Eighteen months ago he offered to enlist, but then he had someone to take charge of his business. The appeal was dismissed, and a month's grace allowed.

Messrs. Smart & Brown, electrical engineers, Erith, appealed to the West Kent Appeal Court for the exemption of two fitters, aged respectively 20 and 19. Col. Atkinson agreed that the company was doing important Government work, but he could not agree to such young men being indispensable. The appeals were dismissed.

On the ground that he was doing public service in his occupation, Exeter Tribunal has granted exemption until the end of the year to A. Dicker (37), ticket inspector on the Exeter Corporation tramways.

At Honiton, on September 21st, the engineer and manager of the local electric works, appealed for exemption. It was stated that he had total charge of the works, and was the only procurable electrician with sufficient technical knowledge to manage the machinery. He was originally starved, and was in a certified occupation. Appellant was directed to go to the Medical Board and report the result.

At Caterham, on September 21st, Mr. S. B. Howard, manager of the local branch of the Urban Electric Light Supply Co., Ltd., appealed for a stoker and mechanic, aged 28. The Chairman said the Tribunal considered the man in a certified occupation, and conditional exemption would be granted.

Dover Corporation, on September 23rd, appealed for exemption for a driver of an electric scavenging vehicle, who had already had six months, and could not be replaced. The Advisory Committee did not assent. A month was allowed to obtain a substitute.

At Bolton, last week, an appeal was made by a local firm on behalf of a man employed in the making of horse shoes, but the appeal form also stated that the man in question was employed as an electrical engineer. It transpired that he was working as an engineer in the daytime, and at the horse shoe business every night and on Saturdays and Sundays. The Clerk said the firm employing the man in the daytime at his regular work had appealed at Turton for him and had been unsuccessful. It would be a peculiar position if the Bolton Tribunal allowed the claim in respect of the man's spare time job. The appeal was disallowed.

At Oldham, on September 21st, temporary exemption until December 1st was granted to an electrical engineer and contractor, who is 30 years of age, and said he was doing work for the tramway department, which was work of national importance. The whole of his life's savings were at stake if he had to go away on Army service.

At the Aberdeen City Military Tribunal, Messrs. J. Blaikie and Sons, Ltd., asked for exemption for an apprentice electrical engineer and a blacksmith. Mr. H. J. Gray, advocate, stated that before the war the firm had 62 employees, and 31 were now left, 28 having joined the Army or Government service.

The firm had been experiencing trade grievances in connection with employing men at electrical work who were not electricians. Mr. McDonald said the Electricians' Trade Union had caused a great deal of trouble. The Chairman: It is an unreasonable attitude to take up in these times. Mr. Gray pointed out that the firm could not overtake the work with the men they had. Mr. McDonald thought the Union was meeting all the difficulties it could. The Chairman asked whether a discharged soldier, though a skilled mechanic, could get employment as an electrician. The manager said the Union would not accept a man unless he had served his apprenticeship to that particular trade. The Chairman: That is a disgraceful state of matters. The apprentice electrical engineer's claim was dismissed, with a recommendation for one month, and the blacksmith got temporary exemption for two months.

Referring to the above, the Branch Secretary of the Union has denied that any unreasonable attitude has been taken up by it in this matter; he regards the remarks by several members of the Tribunal as being quite uncalled for. "We have done all within our power to keep matters going smoothly. All our members are either on work of national importance or at the front. The real grievance is this: While our members are being called to military service, workers employed on alien trades are called to do electrical work. These industrial aliens are eligible for military service. We ask any fair-minded individual to think over this point and then consider whether our protest is reasonable or not."

At Burnley Tribunal, last week, Mr. Mozley, tramways manager, applied for the exemption of three employees, a cashier and two general clerks, aged 30, 28, and 24. Mr. Mozley said they had now got to that stage where they were only left with three clerks, who were the seniors of the staffs. They had lost 10 men for the Army, and four had left for other occupations. The Chairman: Cannot you get women clerks? — It takes a good many years to reach senior positions, where they supervise and check the work of juniors. The Tribunal granted exemption to the end of the year to the senior clerk, two months to the second, and refused in the case of the third.

The Northumberland Appeal Tribunal, sitting at Newcastle, dismissed the appeal of Frederick Nicholls, aged 22, single, who had been a commissioned officer in the Army, had resigned, had entered the employment of Messrs. Armstrong, Whitworth & Co., had been debadged, had gone to a munition factory as timekeeper and checker, and was studying wireless telegraphy at night. Appellant asked for temporary exemption until January 1st to enable him to undergo a Government wireless examination.

At Southwark, Messrs. Alexander Hawkins & Co., electrical engineers, of London Road, S.E., applied for the exemption of their manager, who previously had been granted an extension. The firm had only asked for the exemption of four men, 15 having joined up. They had tried to get someone to take the man's place, but had failed, although they had advertised extensively. The Mayor said some effort must be made to replace this man, as big operations were going on. Mr. Hawkins said if they were not entirely engaged on Government work he would not have appealed. He had been in the firm's employment for 15 years. One month's exemption was granted to enable the firm to replace the manager.

Mr. F. Freshwater, manager of the Teesside Electric Tramways, in applying at the Stockton Tribunal for the exemption of a clerk, said the man was so indispensable to the company that he was working from early in the morning until late at night. Exemption until January 1st was granted.

At the Richmond (Yorks.) Military Tribunal, a civil engineer who had been engaged for two years at the local military camp, applied for an exemption to enable him to proceed to India to act as assistant engineer in electrical works near Bombay. The engineer there was a single man, and had joined the Colours. Appellant was 32, and had been passed for general service. A strong man was required for the Indian post as there were great risks of fever. If he got the exemption he thought the emigration officer might issue a permit for him to leave the country. The Military representative expressed the opinion that the authorities would not permit such an active man, passed for general service, to go abroad. Exemption until January 1st was granted.

At the City of London Tribunal, Messrs. W. Grantham and Sons, builders and decorators, appealed on behalf of C. H. Dalton, the only electrical engineer in the firm's employ, who was stated to be essential to the business. The Military representative said that the man had registered as a carpenter, but this was explained by Mr. Dalton, who said that he registered as an electrical engineer, but he also put on the paper that he was a carpenter as he was engaged as carpentry instructor at a technical school. Mr. Lister, for the firm, said that if Dalton went they would have to close that department. The Chairman said that the man was a carpenter, and his employers were not electricians. They were described as builders. The case would be disallowed.

At the Stockton-on-Tees Military Tribunal, when the management of a local cinema theatre appealed for a 19-year-old electrician and cinema operator, the Chairman asked how they could send married men into the Army and exempt a man such as applicant. Exemption until November 1st, for arrangements.

The Skelton and Brotton Military Tribunal granted exemption until January 1st to a linesman in the employ of the local Council's electric supply undertaking.

The Rochdale Tribunal has granted conditional exemption to A. Worrall (29), motor-man, and T. Mason (36), wireman, who were appealed for by the Corporation tramways department; and temporary exemption until the end of October to J. E. Kershaw (35), traffic clerk, also appealed for by the department. H. Holden (32), employed in a local mill and, at week-ends only as a motor-man on the Corporation tramways, appealed, and was exempted until the end of November. An appeal by Messrs. Fryer & Hartley for Thos. Hartley (34), electrical wireman and fitter, was withdrawn, the man having now been badged.

At Rawmarsh, on September 22nd, the general manager of the Mexborough and Swinton tramways, was appealed for by the company, and it was stated that the whole of the tramways and the electric lighting were under his control. Conditional exemption was conceded, and also to an electrician engaged at the tramway shed, the only man left to repair wires and cables.

Exemption has been refused to E. C. Stow, electrician, of Halstead, Sevenoaks, appealed for by Mr. J. Russell.

Sevenoaks Tribunal has granted four months' exemption to John Fink (31), electrician to Messrs. S. Young & Son.

Before the Berks. Appeal Court, Mr. R. H. Cain (32), electrician in the service of Princess Hatfield, of Foliojohn Park, Windsor, appealed against refusal of exemption. The Princess also appealed, but exemption was refused.

At Newport (Isle of Wight), Mr. E. W. Tyler, electrical engineer, appealed for his son, Mr. A. Q. Tyler (31), the only man left to do electric light fitting. He said that two sons were serving, and a third was called up for October 1st. Conditional exemption was given.

At Ryde, on September 18th, Messrs. Ashton & Holt, electrical engineers, appealed for Wm. White (24), the only mechanic left. The appeal was dismissed, and the firm were given leave to go to the Hants. Tribunal.

At Ventnor, on September 18th, L. J. Boxall, of the staff of the Isle of Wight Electric Light & Power Co., was conceded a certificate of conditional exemption.

At Shanklin (Isle of Wight), on September 20th, Mr. H. Kuping, electrician, was granted conditional exemption on remaining in the Volunteers. The same exemption was conceded to Chas. W. Spencer, apprentice with the Isle of Wight Electric Light & Power Co., his occupation being held to be a certified one.

On the appeal of the Corporation tramway manager (Mr. G. Webster), Rochdale Tribunal has allowed exemption until November 30th to F. Travis (28), traffic clerk.

The Wetherby Tribunal, last week, refused the application—but not to be called up before October 15th—of a butler to Major G. E. Lane-Fox, M.P. (who is on active service). It was stated that the butler had the responsibility for the whole of the electric lighting and heating plant, being the only man left in the house. There was a nominal staff of 86 men, including the Hunt servants; of these 47 had joined the Colours.

At the West Riding Appeal Tribunal, last week, a partner in a private telephone company said last year the two partners realised that one of them would have to go, so it was arranged that the appellant, who had certain domestic responsibilities, should remain to run the concern and the other partner should go. The appeal for exemption was allowed.

At Morecambe, Mr. H. B. Atkinson (29), electrical engineer, said he was now working single-handed, having the assistance of only a boy of 15. There was no other electrical engineer in Morecambe, apart from the borough engineer. He had been in business eight years, and all his capital was invested in it; he had about 50 installations to attend to in the town. In answer to Dr. Waterson (Military representative), who questioned the work having to be sent out of the town, and suggested that the borough electrical engineer could do it, Mr. Atkinson said that would be a contravention of the law. A little "breeze" occurred when Mr. Ibbotson, the borough accountant, attempted to explain the position of the borough electrical engineer and private work. Conditional exemption was granted.

BUSINESS NOTES.

Trade and Other Conditions in the Argentine.—U.S. Vice-Consul J. S. Calvert, of Buenos Aires, reports that during 1915 American sales to Argentina "increased greatly along certain lines as the result of the absence of competition from some of the belligerent powers. A great deal of this business will probably be kept after peace is declared, as the attention of American manufacturers seems finally to have been directed to this market, but, in some instances, there have been some unfortunate shipments from the standpoint of quality, and in others harsh terms of payment have been exacted to the considerable annoyance of the Argentine firms involved, resulting in general criticism. The situation is not gloomy, however, as the prospects for retaining the business already developed have been made brighter to a considerable extent by the fact that quite a number of American firms last year

established in Buenos Aires branches or properly accredited agencies, showing themselves really serious in their desire to enter this market. The practice of relying upon irresponsible or uninterested representatives and, worse still, upon the mailing of catalogues, seems to have died out among American firms really inclined to build up their trade with Argentina. The cardinal rule in exporting goods to this country is that they must be shipped exactly as ordered; no substitution is tolerated. But during the year the Consul's attention was directed several times to cases where the merchandise received was not according to samples submitted when orders were given. It is hardly conceivable that any great number of American manufacturers would, if properly advised by their representatives, fill any orders from this country unless they were in a position to send the exact kind and quality of goods ordered, and nothing else, better or worse."

Mr. Calvert gives in tabular form comparative percentages of imports from the United States in 1913 and 1915. American electric wires and cables which were nil in 1913 were 14.3 per cent. of the total in 1915; various machinery stood at 13.5 per cent. American in 1913, but was 31.9 in 1915; iron and steel wire increased from 40 per cent. to 93.7 per cent.; and steel rails from 21.6 per cent. to 61.7 per cent.

"Iron, steel, and other metal products were imported in smaller quantities than usual in 1915. Very little new construction of any kind took place, and the policy of retrenchment caused by the crisis of 1913 and prolonged by the outbreak of the war was continued. The United States, however, got a fair share of the business, and increased materially its exports to Argentina of sheet iron and steel, tin plate, and wire."

The report later states that during 1915 trade between the United States and Argentina developed to a considerable extent in articles in which in former years the trade was negligible. Among them may be mentioned miscellaneous machinery and machines, chemicals, and automobiles.

"A great deal of this business will be permanently held, and may be, in fact, increased. . . . Miscellaneous machinery, machines, implements, devices, and specialties, not specifically mentioned, form, it is believed, quite a large part of the total imports from America. At any rate, these articles are seen in ever-increasing numbers in the shop windows and stores of Buenos Aires. Their good quality seems to be generally accepted, the only hindrance to their more extensive sale being the high and uniform prices that are charged for them in the shops. Taken as a whole, the year 1915 was a very good one for American trade in Argentina, and the prospects of its continued growth are favourable."

Mr. Calvert, in referring to industrial and economic conditions, says that despite its large exports the country has not yet regained its former economic position. Conditions are steadily improving. The value of goods imported during the year was small, and stocks were allowed to get low. There is a much brighter outlook for 1916, and "it is confidently expected that from now on the situation will improve, that business in all lines will grow, and that soon the country will find itself in a much sounder condition than prior to the panic of 1913, which was brought on largely by speculation and injudicious promotion. A good sign of the gradual improvement is found in the drop in the number of commercial failures during 1915."

"The raising of funds on long terms for Governmental purposes or important private projects is still a matter of securing outside capital, and the restricted amount of European capital available is not sufficient for the rapid development of the country's resources, nor, in fact, for the completion of some works in course of construction. During the year the question of obtaining American capital to replace the European aroused considerable interest among the Argentine public, and, as a matter of fact, reached a concrete form through the action of American bankers in placing several loans for the Argentine Government. There has not been, however, so far as can be learned, any considerable investment of American capital in private undertakings."

The report says that the latest telephone census shows that there are 71 establishments in the Republic, with a capital of £2,951,086, employing 4,494 persons at a total wage of £390,640 per annum. "In Buenos Aires two systems are in operation—the *Compañía Unión Telefónica*, and the *Compañía Cooperativa*. The former, which is the largest, also maintains exchanges in Rosario, Bahía Blanca, La Plata, Córdoba, and other cities of the Republic. It is understood that efforts are being made to secure a concession for the installation of a new service, using automatic instruments of American make, in the city of Buenos Aires."

For Sale. MESSRS. WHEATLEY KIRK, PRICE & CO. have issued a catalogue of electric cables, fittings, etc., that are being sold by tender by order of the Controller of Tunnels, Bristol, London.

Patents and Alien Enemies.—Application has been made to the Board of Trade to avoid or suspend Patents Nos. 11,536/13 and 11,615/13, granted to the Farbfabrikation vorm. F. Bayer & Co. for the vulcanisation of caoutchouc by Mr. A. Smith, of Excelsior Works, Clayton, Manchester, who has also applied for the grant of a licence in respect of patents Nos. 12,777/13 and 12,661/14, granted to the same firm for vulcanising processes.

A Kingsway Insurance Office. In the past the whole of the electrical business of the British Electric and Electrical Insurance Co., Ltd., was carried on from Michael Lodge, 1, Kingsway, London, W.C. This has now been transferred to Manchester and all business is now carried on from there. It will readily be appreciated that in the case of business in London and other centres situated at a distance from Manchester, the passing on of notices and the carrying out of communications respecting an electrical breakdown, or the discussion of complicated technical points, is a tedious and costly process. The company, which is already so well known to steam and electrical plant users, and particularly to our readers, by reason of the excellent reports of breakdowns that we were annually permitted to publish until comparatively recently, has struck out progressively, in order to obviate the above disadvantages, and thus better meet the requirements of its increasing business in the London area, by opening a larger office than formerly in London, with a complete staff for dealing with the inspection and insurance of all kinds of electrical plant. We paid a visit to the premises, which are in a thoroughfare which is becoming more highly charged electrically as the years pass by, and would have been more so by now with the completion of the G.E.C. new offices if the war had not interfered at Imperial Buildings, 50, Kingsway, W.C. The nucleus of this enlarged department has been placed in the hands of Mr. H. Llewellyn T. Foster, M.Inst.C.E., M.I.E.E., formerly the chief electrical engineer of the company at their head office at Manchester. Mr. Foster, in the course of somewhere about 30 years' experience of British electrical machinery and plant, has naturally accumulated a very wide practical experience of many types of manufactures which stands him in excellent stead in dealing with insurance questions in connection therewith, and he, with his staff of inspectors, will be available in readiness for handling matters of emergency with expedition and skill. Mr. H. F. Taylor, formerly secretary to the company, has been appointed to take charge of the new London office, and with him is associated Mr. W. J. Walsh as assistant manager. These two gentlemen have likewise migrated from Manchester. Considering the difficulties of securing workers in war-time, the matter of engraving a suitable office staff has been well handled, and with every modern office equipment, and an excellent system of electrical illumination, a good start has been made in setting a new organisation to work amid congenial surroundings.

The German Cable Makers' Syndicate.—The agreement of the Syndicate of Cable Makers, to which all the large German electrical firms belong, would nominally expire with the end of September. Negotiations, however, have been proceeding with a view to a further provisional extension of the Syndicate for a period of six months, a definite prolongation being postponed until after the war. The situation of new business under existing conditions is characterised as very quiet. It is also reported that the Syndicate of Makers of Insulated Conductors has been renewed until the end of June, 1917.

Concordia Electric Wire Co., Ltd.—A notice, dated September 20th, issued by the secretary of this company, announces, by direction of the Public Trustee, that a British syndicate has purchased the shares vested in him under the powers conferred by the Trading with the Enemy Amendment Act, 1916. Pending the reconstitution of the board, no orders will be recognised by the company unless they are issued on the official order forms of the company, signed by Mr. R. Belcher, one of the existing directors, and countersigned by Mr. Leonard Thornton, the secretary.

Book Notices. *Whittaker's Arithmetic of Electrical Engineering.* London: Whittaker & Co. Price 2s. net.—This is the third edition of a useful collection of examples examination questions, &c., many of which are worked out in full. In the new issue two new chapters have been inserted, dealing respectively with electricity supply economics and illumination, and a considerable addition has been made to the number of exercises.

The Indicator Handbook. By C. N. Pickworth. Manchester: Emmott & Co., Ltd. Price 3s. net.—This, the fifth edition, has been brought up to date, and a note has been added on recording indicators which are actuated electrically. The book is one of those which merit the title of "standard" works, and is indispensable to the user of the indicator.

"The Fan, including the Theory and Practice of Centrifugal and Axial Fans." By C. H. Innes. London: The Technical Publishing Co., Ltd. Price 8s. 6d. net.

Trade Announcements.—It is officially announced that the Board of the BRITISH MANNESMAN TUBE CO. has been reconstituted, and the directors are now:—Mr. Richard S. Guinness (chairman), Sir Robert Balfour, Bart., M.P., Sir Hugh Bell, Bart., and Mr. G. Hethey (managing director). Mr. Hugh W. Dunn will continue to act as secretary.

Mr. F. J. Roden has resigned his position as a director of the E.S. Co., Ltd., of "The Light House," 233, Tottenham Court Road, W., and his interest in the business has been taken over by Mr. E. Cecil Beman, the managing director, who will be entirely responsible for the direction and control of the company.

Messrs. GEORGE ELLISON, of Birmingham, have removed their Yorkshire Branch Office from Sheffield to Standard Buildings, City Square, Leeds.

Mr. EDWIN T. LINDOW, electrical engineer and contractor, has removed to 87, Parkhurst Road, Holloway, N.

Bankruptcy Proceedings.—THOMAS BROOKES, Hales-owen, electrician at munition works.—First meeting, September 29th, public examination, October 25th.

The Electrical Company's Stock for Sale.—MESSRS. WHITFIELD, KIRK, PRICE & Co. are offering for sale by public tender the business, British trade connections, and stock of the Electrical Co., Ltd. Full particulars are given in our advertisement page 350 today.

Catalogues and Lists.—CARRON CO., Carron, Falkirk. New seasonal catalogue of electric heating appliances. In the course of 24 pages, illustrated, particulars and prices are given of various designs of luminous radiators, electric stoves, electric fire interiors, electric fires, Carron elements, dog grates, and electric fireplace suites. Several new models are shown, but the particular feature of the list is the Carron electric fire interior.

MESSRS. CRENDEN CONDUITS CO., LTD., Chester Street, Aston, Birmingham.—Leaflet illustrating new designs in electric fires, for which the London agents are Messrs. Baxter & Caunter, Ltd.

Trade with Russia.—A representative of the British Board of Trade has arrived at Nijni Novgorod with the object of establishing direct trading relations between the Russian and British markets. For next year's Fair, the British Board of Trade will organise an exhibition of British manufactures which can be exported to Russia. *Times.*

The *Daily Chronicle* says that at present two representatives of the Indian Government, Messrs. Blake and Chadwick, are in Petrograd on a special mission of study and inquiry into the possibilities of future trade intercourse between Russia and the Indian Empire.

Private Arrangements.—J. W. SIMPSON, 5, King Street, Margate, electrician. A circular, dated September 25th, has been issued to the creditors herein by Messrs. Poppleton, Appleby and Hawkins, of 4, Charterhouse Square, E.C., stating that Mr. Simpson has consulted them respecting his affairs, as they are representing several of his trade creditors, and in order to protect the estate, the debtor, on the advice of his solicitor, has executed a deed of assignment to Mr. E. H. Hawkins, as trustee for the creditors, in consequence of one execution having been levied and others pending. As a result of negotiations with the execution creditor, a satisfactory arrangement has been made whereby the execution will be withdrawn on terms, and it is proposed that the estate shall be wound up under the deed, an offer having been made for the purchase of the stock and fixtures by private treaty. The other assets consist of book-debts, which the trustee will collect, and in three months' time it will be possible to close the estate and distribute a dividend. The debtor states that his unsecured liabilities amount to £363 and the assets to £255, subject to preferential claims of about £100. The largest trade creditors have approved of the arrangements that have been made.

LIGHTING AND POWER NOTES.

Aldershot.—The electrical engineer has been instructed to present a full report on the present position and future requirements of the electric light undertaking.

Bedford.—LOAN SANCTION, &C.—The Finance Committee reports that application has been made to the L.G.B. for sanction to borrow £4,900, in connection with the electricity undertaking, and that sanction has been granted for £4,072. It will, therefore, be necessary to include in the revised estimate the sum of £828, the amount disallowed, to meet which the Committee recommends that the present increase of 5 per cent. on the electric light charges be increased to 10 per cent., until further notice. The recommendation was referred to a Committee of the whole Council. The Committee stated that inquiries were being made by contractors regarding a supply of energy for lighting, power and cooking purposes for a new factory, and when it was ascertained what would be required and what the firm would be prepared to pay, the matter would be laid before the Council. The engineer has been directed to make house connections in all cases he deemed proper, on condition that the whole capital expenditure in connection therewith should be borne by the applicants.

Bispham.—PRICE INCREASE.—The U.D.C. has decided to increase the charges for electricity from October 1st, owing to the increased cost of production as follows:—For lighting purposes by 1d. per unit; for other purposes by 20 per cent.

Canada.—The Attorney-General for Ontario has rejected an application of the Electrical Development Co. for permission to take action in the Ontario Courts as to the right of the Hydro-Electric Commission to undertake the proposed Chippewa-Niagara development. It is also stated that the Province of Ontario would oppose any application to the Dominion Government for disallowance of legislation passed by the Ottawa Legislature last session.

Colombia.—The Municipal Council of Zaragoza Department of Antioquia has been authorised to raise a loan of £3,000, for the installation of an electric power plant and the construction of an aqueduct.

The Municipal Councils of Mosquera (Cundinamarca) and Concepcion (Antioquia) are borrowing £2,000 and £1,000 respectively for electricity purposes.—*Board of Trade Journal.*

Crayford.—PUBLIC LIGHTING.—The P.C. has approved of a draft five years' agreement with the West Kent Electric Co. for lighting the roads on the new estate at Barnes Cray.

Continental.—**SPAIN.**—Application has recently been made for a concession to utilise the water power of the River Cadagua, in the Valle de Mena (Province of Vizcaya), for the generation of electrical energy for lighting and power purposes in the town and district of Nara.

The Sociedad Anonima Portland Iberia has set up a very complete Portland cement factory at Castillejo, some 60 miles distant from Madrid, on the River Tajo, whose waters are utilised in connection with a hydroelectric station, to drive the plant, which is capable of an output of 60,000 tons of cement yearly. The specifically cement-making plant has been supplied by the firm of F. L. Smith, of Copenhagen; the hydroelectric and electric plant by E. Grasset & Co. and Brown, Boveri & Co. There are three groups of Francis turbines, driving Brown, Boveri alternators. The pressure of the alternators is 3,150 volts, raised for transmission to 30,000 volts, three-phase. The electromotors are coupled direct to the machines they drive. They are non-synchronous motors of Brown, Boveri make.—*Industria e Invenções.*

NORWAY.—The town authorities of Drammen have voted 1,073,000 kroner for various works, with a view to utilising additional power from the commune's power station at Labro.

The municipal authorities of Alesund have voted a sum of 528,300 kroner for the building of a hydro-electric station on the Spilkevik River, the erection of transmission lines, &c.

The commune of Fjeld has decided to expend 300,000 kroner on an electric supply scheme.

The district authorities of Grytten have arranged to purchase the Stavemfos waterfall and erect an electric generating station.

Compton.—**E.L. PROPOSALS.**—The Electricity Committee of the Oldham T.C. has expressed its willingness to meet a deputation from the U.D.C. to discuss the question of supplying electricity to the district. The request of certain local manufacturing firms that Oldham should supply the electrical energy required at Shaw station for a loading crane was supported by the U.D.C., but the Corporation cannot see its way to supply the station alone owing to the small demand. It is understood that the residents of Shaw are anxious to obtain a supply of electricity, and the Corporation is evidently prepared to make the necessary arrangements provided suitable terms can be arranged with the U.D.C.

Croydon.—The Electricity Committee has decided to accept the offer of Messrs. Callender to lay a new H.T. feeder from the generating station to the sub-station in Southbridge Road, the total cost, with provision for public street lighting, being estimated at £1,535, which is to be charged to reserve.

Dover.—**PRICE INCREASE.**—The T.C. has decided, in order to meet expenditure, to increase the price of current supplied to private consumers, the tramway, and for power by 3d. per unit, and for heating from 2d. and 1d. to 2d. and 1½d.

Haslingden.—An anonymous donor has forwarded a cheque for 50 guineas for the purchase of an electrical machine for use in the message department of the Auxiliary Military Hospital during the war, and afterwards for private use by Miss Harrison, the masseuse at the hospital.

Heston and Isleworth.—The electrical engineer reported that the estimated loss of revenue through the non-lighting of the street lamps in the September quarter was £244, and the net loss £174. The Council agreed that the works department should bear half the loss.

London.—**STOKE NEWINGTON.**—There was a surplus of £1,023 on the year's working of the electricity undertaking; £500 has been allocated to reserve, £500 to reduction of rates, and the balance carried forward.

The Finance Committee has received a claim from the Inland Revenue authorities for £350, excess profits tax in respect of 1915, based on a three years' average.

POPULAR.—The Electricity Committee has considered a report by the engineer on extensions required to meet increasing demands, the installation of an additional 6,000-KW. set is estimated to cost, under present conditions, £76,500, of which £64,750 would be chargeable to loan account. As an alternative the engineer suggests linking-up with the L.C.C. tramway generating station at Greenwich, which would involve a capital expenditure by the Council of about £8,100. The Committee stated that if this scheme is adopted it would be of advantage to both undertakings, the peak of the load at the two stations occurring at different hours; the engineer is to continue negotiations with a view to its adoption. The Committee recommends the provision of a Lee recorder on the turbines in the old engine room. The Committee arranged for the provision of an electrical exhibit—jointly with Stepney B.C.—at the National Economy Exhibition at the People's Palace.

Acting in collaboration, the engineers of the Poplar and Stepney Borough Council electricity departments have got together a very attractive exhibit, comprising lighting fittings, motors, vacuum cleaners, and a great variety of heating and cooking apparatus, representing most of the well-known makers. Electric irons, of which a considerable number are used in these districts, form a prominent feature of the show, the ease with which they are coupled up to a lampholder and put to good service being demonstrated by a young lady. It is remarkable how a living exhibit of this kind appeals to the passing crowd. Actual demonstrations of the cooking of cakes, boiling water, &c., are also given. The engineers in charge of the stand report that good work is being done in educating the public to a due appreciation of the convenience and other advantages of electricity in heating and cooking

—the lighting speaks for itself: in addition to the local visitors many West-End residents have called at the stand, a fact which emphasises the importance of efficient collaboration between all the metropolitan supply undertakings—for this East-End exhibition is thus directly benefiting the West-End supply authorities, at no cost to the latter, and the service should be reciprocated. Clear evidence is afforded by the exhibits of the progress that is being made in the design of heating and cooking apparatus. Poplar having led the way in connection with "halfpenny units," it is pleasing to record that excellent results are being obtained; the lighting charges have not been increased during the war, and the power charges, in spite of the great cost of coal, have only been advanced 10 per cent.

KENSINGTON.—The B.C. has been recommended to agree to the proposal of the Notting Hill Electric Lighting Co. Ltd., to increase the charge for electric current by a further 10 per cent., bringing the price to 6d. per unit.

Ormskirk.—The B. of G. has decided to ask the Chloride Electrical Storage Co. to put the battery in order, under the terms of the maintenance agreement, and is to employ Mr. Gibbs, who has been appointed consulting engineer, to superintend the work.

Rawtenstall.—**LINKING UP.**—The engineer recently reported that the original scheme for the supply of electricity to Haslingden had been amended in order that Rawtenstall electricity undertaking might be linked up with the Acornington undertaking. A larger cable has been laid, and additional switchgear will be necessary; application is to be made to the L.G.B. for sanction to borrow £400 for this work.

Rochdale.—**WORKS EXTENSIONS.**—At a meeting of the Gas and Electricity Committee the Works Sub-Committee reported against the recommendation of the borough electrical engineer that the full scheme of electricity works extensions and improvements (recently suggested as desirable by an expert adviser), should be carried out, and the report was adopted. The full scheme was estimated to cost £60,000; the smaller scheme, now in hand, is estimated to cost £10,000.

Shipston-on-Stour.—A meeting was held on September 21st to consider the desirability of taking over the plant of the Electricity Co. and amalgamating the concern with that of the Gas Co. It was announced that the directors of the Gas Co. would be pleased to amalgamate if the proposals were considered to be suitable. A provisional Committee was appointed to go thoroughly into the matter.

Southampton.—The question of coal storage at the electricity works is causing difficulty, and the Committee is approaching the Railway Co. to extend its sidings. In connection with a new arrangement for dealing with the ashes in the boiler-house, it will be necessary to install an elevator similar to the one now at work. The engineer reports that cable faults developed in the Western Shore Road recently, between the West Station and the works, and near the Baths; it was found that continuous flooding by sea water had caused deterioration of some of the cable, and the engineer has been authorised to renew it at a cost of nearly £300. The Committee authorised him to carry out the works suggested.

Walton-on-Thames.—**PRICE INCREASE.**—The B. of T. has informed the U.D.C. that it has consented to the varying of the maximum prices in the local Electricity Supply Order, the price for September 30th to be 7d. per unit.

West Ham.—**PRICE INCREASES.**—The E.L. Committee has decided to recommend a general increase in the rates charged for electricity. The engineer has arranged for the rewinding by the contractors of the 5,000-KW. turbo-alternator which failed, and is to make arrangements for the repair of No. 6 engine.

Wigan.—**LOAN APPLICATION, &c.**—The T.C. has decided to apply to the L.G.B. for sanction to borrow £11,038 for a cable to connect Hindley and Ince to the Corporation generating station, and to provide transformers and switchgear.

At a special meeting of the T.C. on Wednesday last week, the chairman of the Electricity Committee, in proposing the adoption of the minutes of that Committee, stated that it had been found imperative to terminate the appointment of the electrical engineer, and further tendered his own resignation, if it was considered that he was partially responsible for the situation which had arisen.

TRAMWAY and RAILWAY NOTES.

Blackpool.—**TRAFFIC RECORDS.**—Figures presented to the Tramways Committee, on September 21st, show that during the four weeks ending September 14th the receipts were £18,906, compared with £14,967 last year, an increase of £3,939, or nearly £1,000 a week. The receipts per car-mile reached the high figure of 2s. 10½d., an increase of 4d. From April 1st to September 14th the receipts were £65,508, compared with £53,379, an increase of £12,129. The passengers carried numbered 10,230,229, compared with 7,884,432, an increase of 2,345,797. The takings per car-mile were 2s. 2½d., an increase of 2½d.

Cardiff. A *TRUCK*.—On Saturday last a car was proceeding along the line when the overhead trolley arm set the car on fire. The car was a new one, and the fire was caused by the trolley arm striking the top of the car, igniting the face of the car.

Clayton-le-Moors. The Lanes, and Yorks, Railway Co. has been granted a R.O.F. for an extension of time until June 15th, 1917, for the completion of the works authorized on the Clayton-le-Moors branch. The works are to be completed in the district of Clayton-le-Moors U.D.C., Burnley R.D.C., and in the Borough of Burnley.

East Ham. HALFPENNY FARES. The Council has decided the raising of the halfpenny tramway fares and stages; in view of the fact that up to the present the L.C.C. have not arrived at any definite decision on this question, further consideration has been deferred, and the Mayor, the Chairman of the Tramways Committee, and the Corporation have been appointed to attend any conference of the metropolitan boroughs that may be convened on this question.

Glasgow. At its last meeting the T.C., by a large majority, decided to increase the working hours of the tramway employees from 11 to 14 per week, except in the case of permanent labourers, mains and cable labourers, and red-leaders, in whose case the hours were raised to 16, and to pay a wage bonus of 2s. to the men and 1s. to the women. It was explained by ex-Ballie Montgomery, the convener, that even this increase did not bring the employees up to the standard of the working hours in similar undertakings. For the extra three hours it was proposed to pay time and a half. The addition to the wages bill would be £44,408, and the net cost, allowing for the value of the three extra hours' work, would be £25,393. The increases represented an advance of 41 per cent. on the wages since June, 1914.

It was reported at the T.C. meeting that altogether 1,391 women had been engaged, 630 had resigned, and 85 had been dismissed; there were now 1,385 women on the cars, of whom about 150 were employed as drivers.

Lowestoft. The tramway receipts for the four weeks ended July 22nd totalled £631, comparing with £801 for the corresponding period last year. To September 9th the receipts were £6,809, as compared with £8,739. The Tramways Committee has recommended that £750 be provided in the borough rate on account of the deficiency; it has been decided that from October 1st the cars shall cease running at 8 p.m. The tramway manager has been instructed to employ women drivers if necessary.

Oldham. FEMALE LABOUR.—Six female car cleaners have now been put on for night shift work at the sheds, in addition to the female car cleaners who work through the day. The manager reports difficulty in getting suitable women as car conductors, and he told his Committee that Manchester and Preston appeared to be experiencing the same difficulty.

Rochdale.—The Tramways Committee has refused an application by the local branch of the Tramway and Vehicle Workers' Union for an increase of wages for the workers in the tramway department.

COLLISION.—Two cars came into collision on the Spotland route on Sunday night, and considerable damage was done to both of them. The drivers were injured, and had to be taken to the infirmary.

Rotherham.—COLLISION.—On Saturday last, as a result of a collision between two cars on the Dalton section of the Corporation tramways, five women and two children were slightly injured.

Swansea.—TRAMWAY LEASES.—The B.C. has received a recommendation of the Tramways and Electric Lighting Committee that new leases be granted by the Corporation to the Swansea Improvements and Tramways Co. of (a) the tramways included in the tramway lease dated October 23rd, 1906; (b) the light railways and electrical equipment included in the light railway lease dated October 23rd, 1906; and (c) the tramways recently constructed under the Swansea Corporation Act, 1912, and that the existing tramway and light railway leases should be surrendered. For the sake of economy the Council resolved that one new lease be granted, and that if such a course is not practicable the three new leases be granted.

Norway. A contract has been concluded, through the firm of A. B. Laurentzon, with the Western Electric Co., for the building of a new telephone exchange in the town of Hamar.

Science in France.—The French recognition of the need for a closer harnessing of science in the service of electricity is shown by a recent decree signed by the President of the Republic. In his covering letter to the President, the Minister of Commerce, Industry, and Telegraphs states that the war has exercised a real influence on the rapidity of the progress accomplished in the last two years in telegraphy and telephony; it has led scientists and technicians, whose labours were formerly directed elsewhere, to occupy themselves with problems raised by these subjects and radiography. It has also definitely affirmed the need for a collaboration of science, industry, and the public services. Hence it is useful to call for the assistance of eminent scientific and technical persons for the settlement of such problems as are raised by telegraphy and postal equipment, and that their services to this end should be retained permanently. Then follows the indication of the creation of a single Technical Committee, in six sections, in the room of the several Committees formed at various periods previously. It is incidentally remarked that the staff of the Administration of Posts and Telegraphs has grown from 75,000 in 1895 to 135,000 at the present time.

Telephone-tapping. On September 25th, charges of unlawfully having plans and telephone-tapping apparatus in his possession, which had been preferred against John Yearly, an inspector of works, were withdrawn by the military authorities, who ascribed the incident to Yearly's carelessness and inquisitiveness.

Wireless Telegraph Patent Decision.—The all-important "valve" patents have been occupying the Courts of the United States for a considerable time in an action brought by the Marconi Co. against Dr. Lee De Forest for an infringement of their Fleming patents, and a counter-action by De Forest claiming damages for infringement by the Marconi Co. Judgment was given last week in favour of the Marconi Co. Dr. Fleming's patents were declared to be master patents, not anticipated by De Forest or anybody else. The De Forest action was held to be an infringement of the Marconi Co.'s Fleming patents.

The Atlantic Communication Co. of America, a subsidiary company of the Telefunken Co. of Berlin, has infringed a number of patents in order to obtain a possible wireless service across the Atlantic, and fearing an action by the Marconi Co. against it which is pending, recently purchased the De Forest patents for the sum of \$150,000.

Dr. Fleming's "valve" and many infringements of it, have been largely responsible for the developments in the reception of wireless telegraphic messages over long distances. It was the introduction of these "valves" which gave a value to the Poulsen system, and has been principally responsible for such success as the Germans have obtained both abroad and at home in wireless telegraphy. We are informed that the experiments recently carried out in wireless telephony in the United States, which gave sensational results, were achieved solely by the use of the Marconi Co.'s Fleming valve patents.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—SYDNEY.—January 22nd, 1917. Electrical plant (converter, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.*

MELBOURNE.—September 29th. City Council. Insulated and H.D. copper cables. See "Official Notices" September 8th.

October 17th. For the Deputy P.M.G. (1) Sleeves and tapes (Sched. No. 1,355), and (2) 3,100 stay- rods, with low tighteners (Sched. No. 1,355).

October 18th. Victorian Government Railways. Electric time releasing mechanisms for automatic signalling (Cont. No. 30,343).
November 1st. 50,000 yellow flame arc carbons.*

December 11th. City Council. Supply and erection of coal transporter plant. See "Official Notices" September 15th.

PERTH.—November 8th. P.M.G. Accumulator parts (Schedule 527 W.A.).*

SOUTH AUSTRALIA.—November 15th. P.M.G.'s Department. Automatic switchboards and all associated apparatus, for telephone exchanges, Brighton and Glenelg.

Grenada.—October 31st. The Government of Grenada, British West Indies, is inviting proposals for supplying electricity for lighting and power in the town of St. Georges, Grenada, and residential suburbs within a radius of three miles. Plan and particulars, £2 2s. Tenders to Colonial Secretary, Grenada, British West Indies.

Halifax.—September 28th. L. and Y. Railway. Twelve months' supply of steel sheets (Siemens and electrical), schedule 51. Mr. Warino, stores department, Osborne Street, Manchester.

Johannesburg.—Municipal Council. Twelve gross of carbon brushes for electric motors. (Contract No. 178).*

TELEGRAPH and TELEPHONE NOTES.

Breakage of Insulators.—During the hearing of a case at Oldham Police Court, in which a boy was summoned and fined for damaging insulators on the telegraph poles, it was stated that about 1,000 insulators at Oldham had been broken during the past 12 months.

New Zealand.—The Telegraph Money Order Service, which was instituted on July 1st last with certain of the British Overseas Dominions, will be extended on October 2nd to British Guiana and New Zealand. The transmission of the telegrams of advice at the deferred rates reduces the charges by one-half.

New Zealand.—WELLINGTON. October 14th. Public Service Stores Tender Board. 1,000 magneto-extension bells, 1,000 ohms.*

Paris.—October 2nd. Four lots of rubber-insulated telephone cables. Particulars from the Direction de l'Exploitation, Téléphone 2^e Bureau, 103, Rue de Grenelle Paris.

October 2nd. Nineteen lots of paper-insulated, lead covered electric cables (one lot relates to the transformation of old material). Particulars as above.

October 7th. Thirty-three lots of porcelain or glass double and single belt insulators. Particulars as above.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Faversham.—T.C. 500 tons of Welsh coal for the electricity works. Messrs. Davis. £2 1s. 6d. per ton.

Glasgow.—Tramways Committee. Tenders accepted:—

A.L.R. Cable, Perth, Ltd.
Chilled-iron brake blocks. Miller & Co.

Johannesburg.—The Town Council Works Committee proposed to accept an offer of the South African General Electric Co. to let on hire an electrically-driven vehicle for street-watering purposes for £10, plus £12 for a driver, and £15 for amazing, charging, oiling and greasing—total £37. To mount a 450-gallon tank with a sprinkler on the vehicle will cost £6 10s. The purpose of the Committee is to make a comparison of cost between horse and motor-driven traction.

London.—PORTLAND.—The Electricity Committee reports having invited tenders from 15 firms for the provision of ash-handling plant at the generating station, but two tenders only have been received, nearly all the firms being fully occupied with war work. Only one of the tenders received is complete. The most complete scheme is that of Messrs. Strachan & Henshaw, of Bristol, at a total estimated cost of £3,855. An alternative scheme for loading into wagons only, with grab, but allowing in construction for eventual extension in accordance with the complete specification, has been obtained, the estimated cost, exclusive of foundations, being £1,419. With the foundations, the total cost of the scheme is estimated at £1,600. The plant is necessary to enable the motor-wagons obtained for removal of ashes, and now loaded by manual labour, to be fully and economically utilised. The Committee recommends that ash-handling plant, as specified, be obtained and erected at a total estimated cost of £1,600.

SOUTHWARE.—The Electric Light Committee has accepted the following tenders for coal:—Messrs. G. Hinchcliffe & Co., supply during 12 months of 7,000 tons Midlands 14-in. slack, at 21s. 11d. per ton; and Messrs. E. Foster & Co., supply during 12 months of 2,000 tons West Cannock 2-in. slack, at 22s. 5d. per ton.

New Zealand.—WELLINGTON.—The following tenders have been accepted by the Public Works Department:—

Rubber-copper wire and cable, £2,149. S. Brown, Ltd.
Brass ball, 14½ in. diameter, £1,000. Harrison Electro-Technical Co., Ltd.
Insulated cable, £2,876. Turnbull & Jones, Ltd.

New Zealand Shipping and Commerce.

Southampton.—The contractors for installing electric light at the Eastern District School have written stating that when tendering they had a favourable offer for tubes, fittings, &c., which has since been withdrawn, and in the circumstances they must withdraw their tender or increase the amount by £55. A sub-committee is considering the matter.

Tenders accepted for coal for the electricity works:—

Usher & Co.—1,800 tons Bolsover 14-in. slack, 23s. 6d. per ton.
Cory Bros. & Co.—1,400 tons Istock D.S. nuts, 27s. 6d. per ton.
Stewart & Co.—300 tons Stockingford nuts, 27s. 6d. per ton.
Bradbury & Co.—300 tons Measham nuts, 28s. 2d. per ton.

NOTES.

On Setting the Clocks Back.—Mr. F. Hope-Jones, M.I.E.E., M.Brit. Hor. Inst., kindly sends us the following hints on the proper method of restoring our clocks and watches to the paths of probity and rectitude:—

Many millions of clocks and watches will be set back an hour on Saturday night at the end of the month, and there is no doubt that some damage and much inconvenience will be caused by careless handling of them, particularly in the case of striking clocks.

Watches and time-pieces—the latter easily distinguishable by the fact that they have but one key-winding hole—can be turned back an hour without fear of damage, because the hands are spring-tight upon the axles of the wheels.

Striking clocks are of two kinds, one in which the hourly programme is dictated by a snail and rack, and the other which accomplishes it by means of a "dividing" or "locking" plate. In the latter, when you turn back the hands you do not carry the

striking part with them, and if they are once out of phase with the striking, they will not right themselves.

If you are in doubt as to which of the two classes your striking clock belongs to, and none but a professional watch and clock maker or an expert amateur is likely to know, it will be well to treat all striking clocks in the same way and either stop them for an hour and then start them again, or set them forward 11 hours. The latter course is recommended as being the easiest and least likely to interfere with their internal arrangements. But you must be careful to give them time to strike after each hour and between the quarters if necessary.

Employees' time registers and workmen's time recorders of all kinds, on the other hand, must be stopped for an hour and restarted, otherwise the typewriting mechanism will be put out of phase with the clock.

When daylight saving was introduced in May last, it was said that electric clocks had come into their own, and it was certainly a great boon in some thousands of business establishments, factories, and institutions to be able to set on all the clocks in a few minutes by merely pressing a lever in the master clock.

But there is no such automatic device in electric clocks for setting the clocks back, and the controlling pendulum should be stopped for an hour and then set going again. Of course, on board ocean liners, where the clocks are changed daily, "Synchronome" installations are provided with special facilities for the purpose. On turning the hands of the master clock back, the dials throughout the ship are short-circuited and have to wait until the hands of the master clock have reached the place from which they were moved, automatically switching in the others again. It has never been suggested that daylight saving justifies this device being fitted to ordinary installations; however, it is no small advantage to be able to stop and start large groups of electrical impulse dials by dealing with their master clocks, and the Synchronome Co. will set 5,000 to time by this means in London alone. To sum up:—

Watches	...	...	Set the hands back.
Non-striking clocks	...	...	Set the hands back.
Striking clocks	...	...	Set forward 11 hours and allow plenty of time for them to strike.
Employees' time recorders	...	...	Stop for an hour and restart.
Electric clocks	...	...	Stop for an hour and restart.

The Changed Outlook of Labour.—Mr. Stephen Walsh, M.P., chairman of the Works Section of the English Conciliation Board, speaking at Wigan, on Saturday, said that our own people had often been set aside while positions of trust and responsibility had been given to Germans; but wherever the Germans went they had not merely been carrying on their freedom of trade; they had at the same time been carrying on an accursed system of spying in our midst, which had almost led to the undoing of the nation. British fairplay was proverbial all the world over, and we had carried it to such a degree under the guise of trade that there had been traitors in our midst who had almost destroyed the kingdom and all that it stood for. After the horrible facts which the last two years had given us, surely it was the lesson of common sense, not to speak of high statesmanship, to develop our own resources in our own land. Why should we always make ourselves the dustheap and the dunghill of the whole world? There was a thousand and one things which we could just as well produce in our own land, or in the Dominions affiliated with us, instead of being dependent upon the foreigner. —*Morning Post*.

Liverpool Electrical Dispute.—A long drawn out dispute between the Liverpool Master Builders' Association and the Liverpool branch of the Electrical Trade Union seems at last to be on the way to settlement. The friction arose out of a demand on the part of the men for increased wages, reduced hours, and various minor concessions. Arbitration was at length agreed upon between the parties, and the Rev. H. Bunnicke is acting as arbitrator, his decision to be final. He is now in Liverpool-taking evidence with the object of ending the deadlock. —*Liverpool Post*.

A Lamp-Filament Breaker.—A device for breaking the filaments of incandescent lamps which are returned into its supply department, has been constructed by the Boston Edison Co., and is in regular use in the local lamp division. Among the thousands of incandescent lamps returned as having been burned out by customers are many which, though not entirely useless, are, nevertheless, unfit for further service. To prevent purchasers from sorting the lamps and reeling those with filaments intact, a means of breaking the filaments of lamps of sizes up to 250-watt tungsten was sought. As a result, an apparatus was constructed consisting of a laminated U-shaped electromagnet with a gray sufficiently wide to admit a large-sized lamp between its jaws. A quick-acting lamp socket is arranged between the jaws of the U and is supplied, in series with a resistance, from a 220-volt A.C. circuit. In addition to this fixed resistance, another can be switched-in in parallel. When a lamp is pushed into the socket the effect is to break the filament instantly. The resistance in series with the lamp prevents short-circuiting on the 220-volt main in case of an occasional defective base. If, as sometimes happens with very large tungstens, the filament breaks and welds near the leading-in wires, the second resistance is thrown in, thus allowing more current to flow, and invariably breaking the filament. The direct-current field is left on continuously while operating. With this apparatus filaments are broken as rapidly as the lamps are inserted in the socket and placed to one side, and the lamp is in no way injured, nor is the blackening of the bulb increased.

Steel Conductors for House Wiring. Judging by an examination of the *Electrician* of 1914, the use of iron and steel wires for house-wiring, which originated in Germany, is still in vogue. It is difficult to attribute the attraction of the Iron Wire to the fact that it is cheaper than copper. As we pointed out in our issue of June 5th, the use of iron wire is a very bad example of this practice in view of the small currents required nowadays for domestic lighting circuits. Our American contemporary suggests that the use of iron wire may possibly be a much more satisfactory means of reducing the cost of wiring than the concentric system, which was recently rejected in the United States with great enthusiasm, but appears to have given very disappointing results as regards economy. We hope that the Wiring Rules Committee of the I.E.E. will take the subject into consideration as it is a matter of no little importance to our own electrical industries.

American Glass for Lamp Bulbs. The glass used in making electric light bulbs is a very special kind of glass that must withstand sudden changes in temperature and also great pressure. Heretofore it has been thought that only glass made with a certain amount of potash was suitable.

The outbreak of the war cut off the supply of potash from Germany. However, recently the research chemists of the General Electric Co. have succeeded in producing a glass for making electric light bulbs by replacing potash with soda in the glass mixture. This glass has proved greatly superior to the old potash glass; so much so that potash glass will no longer be used. *Continued*

Applications for Provisional Orders.—The Board of Trade has addressed the following letter to the Parliamentary Agents Society:

I am directed by the Board of Trade to state that they have under consideration your letter of September 8th, submitting on behalf of the Society of Parliamentary Agents certain representations for a modification of the notice issued by the Board last year to the effect that applications for Provisional Orders would not be entertained except in cases when extreme urgency existed.

The Board realise that the position has altered since the issue of the notice in question, particularly in the direction indicated in the circular letter issued by the Local Government Board on August 28th last, and in these circumstances the Board of Trade will be prepared to entertain applications for Provisional Orders in the ensuing session when it can be shown that the establishment of works under the schemes proposed will be proceeded with as soon as practicable after the termination of the war.

In determining whether an application shall be allowed to proceed, the Board will have particular regard to the considerations as to how far the exercise of the powers will provide an outlet for labour or for the utilisation of plant and machinery which have been provided for the purposes of the war.

The Board will be prepared to consider proposals before any expenditure is incurred in respect of the publication of notices, &c., and to intimate whether, in their view, a *prima facie* case has been made out for the promotion of the application subject to consideration of objections.

The Board are, however, of opinion that it is undesirable that proposals shall be put forward which are likely to provoke serious opposition, or to prove unduly costly to promote.

I am to add that the policy of the Board in dealing with these applications may be subject to further modification in the event of a change in the general situation due to the war.

I am, Sir,

Your obedient Servant,

C. Hipwood.

Fatality.—The *Times* states that a Belfast electrician, named Gerald J. MacErlane, was killed at the Inver Bleach Works, Larne, on Saturday, owing to his clothes becoming entangled in the machinery.

Electro-Harmonic Society.—The first smoking concert of the season will be held at the Holborn Restaurant (King's Hall), on Friday, October 13th, at 8 p.m. The other events in the programme for the season are as follows:

Ladies' Night ...	Monday, November 20th.
Smoking Concert ...	Friday, December 15th.
Smoking Concert ...	Friday, January 5th.
Ladies' Night ...	Monday, February 12th.
Smoking Concert ...	Friday, March 16th.

Educational Notes.—UNIVERSITY OF LONDON, UNIVERSITY COLLEGE.—Prof. J. A. Fleming, F.R.S., will deliver a public lecture on "Long-distance Telegraphy and Telephony," on Wednesday, October 18th, at 5.30 p.m., and a course of six lectures on "Long-distance Telephony," on Fridays at 5 p.m., beginning October 27th, 1916. The public lecture is open without fee or ticket. The course is open to non-members of the University; application for tickets of admission to it should be made to the Secretary.

THE POLYTECHNIC SCHOOL OF ELECTRICITY, Regent Street, W.—The evening classes in electricity, electrical engineering and physics commence on Monday next, under the charge of Mr. W. Hibbert, A.M.I.E.E.

The Restriction of Output.—The Sheffield correspondent of the *Engineer* writes as follows on this important subject:—"The question of munitions output is often discussed in a way that would lead one to suppose that the idea of restriction was dead and buried. I was speaking with a director this week regarding prospects for Sheffield three after the war. He knows the situation

in and out and through and through. His opinion was that everything depended upon the attitude of the men. The best men amongst trade union leaders, he believes, are quite to be depended upon to advise the workers wisely, but there is the other element to take into consideration, which poisons the minds of many of the workers, with the result that output is seriously restricted. 'You must remember,' he added, 'that after the war, output is going to be the great question. The German workmen earned, before the war, less than our men, worked longer hours, and turned out more per man.' There is, of course, no suggestion of lower wages in this country to meet the difficulty, but the output will have to be quickened. The war has speeded things up, but few realise how much latent energy there still remains if certain men would only utilise it. They could do it without injuring their health in the slightest or shortening their lives by an hour. The director with whom I was speaking is of opinion that trade unionists everywhere will have to recognise the truth that a man must be free to turn out as much as he reasonably can in a given time, and that his earnings must be according to his merits. The policy of measuring the work of a man by the ability of the slowest is one that has been holding us back industrially, and therefore commercially. In future a man must be at liberty to put in his best work, and employers must place no restriction upon the earning possibilities of such a man. That will be the sort of profit-sharing that will not only appeal to the men themselves, but will bring out the best men and multiply the output. The other day I had an opportunity of chatting with a munition worker, who had seen things that amazed him. A short time ago he was a tradesman; now he knows far more about shells than do many men who have worked among them all their days. 'It is not,' he said, 'so much what the trade unionists tell the men to do, as what some of the trade unionists agree amongst themselves to do. For instance, there was a certain part of a shell which these men declared they could only make at the rate of 15 a night shift. Well, you could go to sleep half the night and do 15 easily. A proof of what I say is that just recently a youth—he was not much more—made 65 during a night shift, and felt none the worse for it. Take another operation in shell making. The trade unionists said they could only do a dozen a day, but a youth the other day did 30 without any particular exertion, whilst anybody could do 20 in the time.' It is not in that spirit that wage possibilities will be increased after the war. If the workers do not co-operate with the employers about the enterprise of the latter in entering new markets abroad, whether they be Russian or any other, their efforts will be futile. The interest of the employer is the interest of the worker, and where that is not so, trade union leaders may quite be trusted to present the case of the men."

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place, S.W.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, October 2nd.—Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10, Signalling Class. Recruits' Drill, 6.25–8.

Tuesday, October 3rd. School of Arms, 6 7. Lecture, 7.15. "Development of the Soldierly Spirit." The Adjutant. Range Practice.

Wednesday, October 4th. Instruction Class, 5.45. Platoon Drill, Platoon No. 3. Range Practice.

Thursday, October 5th.—Platoon Drill, Platoons Nos. 5 and 6. Range Practice.

Friday, October 6th.—Technical for Platoon No. 10, Regency Street. Squad and Platoon Drill, No. 9. Signalling Class. Recruits' Drill, 6.25–8.25.

Saturday, October 7th.—N.C.O.'s Class, under Company Commander W. D. Bentley, 2.30.

Sunday, October 8th. Entrenching, Parade Victoria Station (S.E. & C. Railway). Booking-office, 8.45 a.m.

Note.—Members who have not yet obtained their Cards of Membership should apply to the Adjutant on Tuesdays or Thursdays.

MACLEOD YEARSLEY, Adjutant.

Institution and Lecture Notes.—Iron and Steel Institute.—At the autumn meeting of the Institute, Sir William Beardmore, chairman, stated that it was proposed by the Council to form Committees to report on new developments in the iron and steel industry, and that a Research Committee should be appointed to make suggestions and give advice. It was hoped by these means to encourage a greater interest in the affairs of the Institute. The Council announced that the Privy Council had sanctioned the new by-law providing for the expulsion from the Institute of members who were subjects of a country at war with the United Kingdom.

Institute of Metals.—At the autumn meeting, last week, Sir G. T. Bellby was re-elected president of the Institute.

The Faraday Society.—The Society will hold a general discussion on "Refractories" at its first autumn meeting, the date of which is provisionally fixed for Wednesday, November 8th, 1916. The discussion will be presided over by Sir Robert Hadfield, F.R.S., President of the Society, and the opening paper will be read by Dr. J. W. Mellor, of Stoke-on-Trent. Suggestions are invited from those specially interested in the subject as to any particular aspects which they would like ventilated or discussed, and those who are desirous of contributing to the discussion, or who wish to show any exhibit at the meeting, are invited to communicate with Mr. F. S. Spiers, Secretary of the Faraday Society, 82, Victoria Street, Westminster, S.W.

Appointments Vacant.—Shift engineers for the St. James and Pall Mall Electric Light Co., the Malden U.D.C., and the Scottish Central Electric Power Co., Ltd.; borough electrical engineer and manager for Wigan (U.D.C.). See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—Mr. A. C. CRAMB, borough electrical engineer, reported to Croydon Borough Council on Monday that the main part of his work as honorary district manager of the Croydon area of the Metropolitan Munitions Committee had now been completed. Part of a letter received by Mr. Cramb from the Committee ran as follows:—

Your willingness at all times to give effect to the wishes of the Board (of Management), and the thoroughness with which the work of your district has been carried out, has been highly appreciated by them, and has considerably assisted them in carrying out their important functions. The Board also wish to thank you for your kind promise to render them assistance at any time in the future.

In a further letter to the Council, the Committee expressed gratitude for Mr. Cramb's untiring efforts and whole-hearted devotion to the work.

Thirty-one applications were received for the appointment of tramway manager at West Ham in place of Mr. Moffet, resigned, and seven candidates were interviewed. Mr. M. L. SIATERY, traffic manager, L.C.C. Tramways, for the past 51 years, and previously at Oldham, Blackpool, Blackburn, and other places has received the appointment.

General.—*London Gazette Notice.*—Territorial Force, Royal Engineers. Tyne Electrical Engineers: Sergeant RICHARD OWEN PORTER, from Devon Fortress R.E., to be Second Lieutenant (on probation).

After 14 years' service in the electrical branch of the chief engineer's department of the London County Council, Mr. H. G. HOAD is resigning to take up an important position with Messrs. W. C. Tackley & Co., Ltd., electrical and mechanical engineers of 28, Blythe Road, Kensington, W. Since he entered the Council's service in 1902, Mr. Hoad has carried out a very large number of electrical installations at the various offices, schools, institutes, museums, lodging-houses, &c.

Roll of Honour.—The following is a list of men from Simplex Conduits, Ltd., who have been killed in the war:—

Betts, A., Worcester Regiment (brass shop), France.
Bodfish, H., Warwickshire Regiment (foundry), France.
Ireland, J., Warwickshire Regiment (enamelling shop), France.
Mousley, E. A., R.A.M.C. (stores office), Egypt (died of wounds).
Parker, G., Warwickshire Regiment (fittings shop), France.
Robbins, S., Worcester Regiment (fuse department), France.
Swarbrick, D. H., Warwickshire Regiment (purchasing department), France (Somme).
Fowkes, P. F., Royal Engineers (Manchester office) (died training at home).
Lock, W. A., R.F.A. (general office), France.
Lilford, B., Warwickshire Regiment (general office), France (Somme).

The following have been wounded:—

Bulk, N., Warwickshire Regiment (heating department), France.
Birtley, A., Warwickshire Regiment (purchasing department), France.
Boulton, C., Wiltshire Regiment (general office), France (Loos).
Baird, G., Scottish Horse (Glasgow office), Gallipoli.
Cain, J., Warwickshire Regiment (foundry), France.
Quinney, J., R.F.A. (fuse department), France.
Raison, F., Lancashire Fusiliers (forwarding department), France.
Gough, M., R.G.A. (foundry), France.
Aldrich, Warwickshire Regiment (foundry), Gallipoli.
Howell, W., Middlesex Regiment (foundry), France.
Wooland, R., Warwickshire Regiment (forwarding department), France.

Lieutenant W. H. STUART GARNETT, who was killed at a flying school last week, was, according to the *Times*, the second son of Dr. William Garnett, and brother of the principal of the Manchester School of Technology. He was 34 years of age, and for a time was a practical engineer, and "brought out a remarkable text-book on the turbine."

Sapper JOHN BRUNTON, R.E., 21 years of age, who was at an electricity works at Grangemouth before the war, has died from wounds.

Second-Lieutenant D. K. COOPER, Northamptonshire Regiment, reported missing, aged 22, was an electrical engineer with the Portsmouth Corporation.

Rifleman NORMAN BROCKLEY, King's Royal Rifles, reported wounded, was employed by Messrs. Catons, electrical engineers, Oldham.

Private RICHARD MITCHELL, North Staffordshire Regiment, who has fallen in action, enlisted whilst on the staff of the Hanley Corporation electricity works.

Corporal J. H. RICHARDS, Royal Warwickshire Regiment, who has been wounded, is an electrical engineer, and was formerly on the Torquay Corporation electricity works staff. He was recently awarded the Military Medal for gallant conduct.

Private W. FOTHERGILL, Royal Warwickshire Regiment, formerly with Messrs. Willans & Robinson, Ltd., of Rugby, has fallen in action.

Corporal FRANK THIRTEWOOD, Oxford and Bucks. Light

Infantry, killed in action, enlisted in September, 1915, whilst in the cost statistics department of the British Thomson-Houston Co., Ltd., Rugby.

Private NEWELL, Royal Fusiliers, who is reported killed in action, after being missing since August 7th, last, enlisted early in the present year. He was formerly in the drawing office of the British Thomson-Houston Co., Ltd., Rugby.

Private JOSEPH NUTH, R.A.M.C., who has died from dysentery at Salonica, was formerly engaged at the Corporation electricity works at Tunbridge Wells. Before going to Salonica he served at the Dardanelles and in Egypt.

Sergeant J. D. SUTTON and Sergeant A. J. L. MOORE, Oxford and Bucks Light Infantry, both of whom were on the staff of the British Thomson-Houston Co., Ltd., Rugby, have been wounded.

The Norwich Electricity Committee reports that Mr. A. J. RANDALL, for many years employed in the electricity department, has recently been awarded the Military Medal for conspicuous bravery in laying and repairing telephone cables under heavy shell and rifle fire, and was decorated by the General Commanding before the whole Brigade. The Council is recording on its minutes its appreciation of Mr. Randall's action and of the honour accorded to him, and the Mayor is conveying to Mr. Randall an expression of the Council's appreciation.

Private HARRY HUGHES and Corporal JOSEPH GORDON, both of the Lancashire Fusiliers, and formerly in the employ of the Lancashire Electric Power Co., have been killed.

Bombardier J. PALLS, of the R.F.A., formerly employed by Messrs. Dick, Kerr & Co., Ltd., Preston, has been wounded.

Private E. PEARCE, of the King's (Liverpool) Regiment, reported wounded and in a convalescent camp in France, was formerly engaged as an electrical engineer at Blackpool.

Staff-Sergeant HOWARD BRAMALL, formerly employed at the British Westinghouse Works, Trafford Park, has been awarded the Military Medal.

Obituary.—Sir GEORGE FRANKLIN.—We regret to record the death, which occurred suddenly on Saturday last, at the age of 63 years, of Sir George Franklin, of Sheffield and London, who was chairman of the National Telephone Co., Ltd., in the period immediately preceding the transfer of the telephone system to the Post Office. We gather from one of the financial dailies that Sir George joined the board of the National Co. in 1892, after having arranged the acquisition of the telephone business of the Sheffield Telephone Exchange and Electric Light Co., which Messrs. Taskers initiated in Sheffield. The electric light system was taken over by the municipality, and the telephone exchange was eventually absorbed by the National Telephone Co., when Sir George joined the board. On the death of Mr. Gaine he assumed also the office of general manager, a dual position, which was probably only rendered possible by the able assistance given by the engineer-in-chief and the general superintendent. As president of the company, Sir George acquired from the start the confidence of the shareholders, and was especially successful in his conduct of the annual meetings, his statements being invariably clear, practical, and businesslike. He became president in 1906 in succession to Sir Henry Fowler, and occupied that position until the undertaking was taken over by the State on January 1st, 1912. Sir George was president of the Constantinople Telephone Co., chairman of the Telephone Development Co., and of the United River Plate Telephone Co., and a director of the British Thomson-Houston Co.

Mr. RICHARD PRICE WILLIAMS.—The *Times*, in recording the death of Mr. Richard Price Williams, an old railway engineer, says that when the telegraphs were taken over by the State in 1871 the railways successfully contended that their property in the telegraphs and wayleaves should also be purchased under the "Gladstone" purchase clause of the Regulation of Railways Act, 1844, and Mr. Williams was entrusted with the preparation of most of the claims, the satisfaction of which cost the Government some £3,000,000.

Mr. T. A. BELL.—The death occurred on Thursday last week, suddenly, of Mr. T. A. Bell, electrical engineer, Bradford. Mr. Bell, who was 48 years of age, carried on, in conjunction with his brother, Mr. L. A. Bell, the business of Charles Bell, electrical and hydraulic engineers, of Joseph Street, Bradford.

Mr. GORDON DAVIES.—The death has taken place, suddenly, of Mr. Wm. Gordon Davies, traffic manager of the Chatham and District Light Railways Co. He was 69 years of age.

NEW COMPANIES REGISTERED.

McLeod & Sons, Ltd. (114,891). This company was registered on September 20th, with a capital of £2,000 in £1 shares, to take over the business of manufacturers of ships' telegraphs and nautical instruments, marine, mechanical, electrical, and general engineers, and compass adjusters carried on by J. Y. McLeod and T. W. McLeod as McLeod & Sons at 15, Cheapside, Liverpool. The subscribers (with one share each) are: J. Y. McLeod, 15, Cheapside, Liverpool, nautical instrument maker; T. W. McLeod, 15, Cheapside, Liverpool, nautical instrument maker; A. W. Jones, 41, Castle Street, Liverpool, accountant. Private company. The number of directors is not to be less than two or more than five; the first are J. Y. McLeod (managing director) and T. W. McLeod. Registered office: 41, Castle Street, Liverpool.

Mr. GEORGE WATSON, presiding at the annual meeting, held in London on September 15th, said that the report showed some improvement, the total receipts having increased by £164, while the total expenses fell by £8,068. The debentures issued in 1904, totaling a balance of £291,000, in addition to which there were issued £50,000 debentures as collateral security against the loan outstanding.

The very substantial reduction in working expenses had been obtained by a rearrangement of the services given to the public; by the adoption of wood fuel, and by keeping a very strict watch upon all expenditure, but the physical condition of the property and the efficiency of the service had in no way suffered from the economies which had been effected. In fact, rather more money was spent last year on the upkeep of the track, car bodies, and trucks than during the previous year. They were still continuing to use local wood for fuel, and during the year had used practically nothing else: The price of coal delivered in Manaus was now about three times as much as before the war, and the coal bill in normal times used to amount to over 15 per cent. of the whole operating expenses. The serious effect of the change would therefore be readily seen, and instead of a large increase in the generating cost per unit they found that the unit of electricity cost exactly the same as it did in normal times. The most serious item of the profit and loss account was the loss on exchange, which this year amounted to £13,093, as against £6,180. The average rate at which they brought money from Manaus during 1914-15 was 13½d., as against nearly 16d. for the previous year. The result for the past year had been substantially more unfavourable. The conditions in Brazil, although improving in many ways, did not reach a point at which exchange might be favourably effected. The scarcity of commercial bills, the increase in the issue of paper, and the small amount of imports seriously affecting the revenues of the country, all tended to keep down the sterling value of the milreis. His reasons expressed a year ago for expecting exchange to remain comparatively steady still held good, and while the present arrangement for funding the Brazilian debt continued he considered that exchange should remain steady. The balance of trade continued to be in favour of the Republic, and the Government had displayed during the last year, and were still displaying, a very gratifying tendency to avoid waste in national expenditure. He had recently seen in the newspapers that that tendency was not confined to national expenditure, but that even officials had agreed to accept a lower remuneration during the present crisis. Since the end of the fiscal year a marked improvement had taken place in exchange, and the average rate for the last four months had been about 12½d. The chairman referred to the company's claim against the State Government for public lighting, and the effect of the rubber industry upon the company's affairs.

French Electrical Companies.

The Compagnie Electric Maritime records net profits totalling £21,000 for 1915, as compared with £25,000 in the previous 12 months, and £20,000 of the former has been distributed among the shareholders. The accounts of the *Société d'Electricité de la Seine* for 1915-16 show net profits amounting to £73,000, as compared with £35,000 in the preceding year. It has been decided to pay a dividend of £2 per share, as against £1 10s. in 1914-15.

The Société des Appareils Electriques Gricolas reports net profits and balance forward of £29,700 for 1915-16, as contrasted with £20,800 in the previous year, and £9,100 in 1913-14. A dividend at the rate of 5s. 7d. per share has been declared, this comparing with no distribution and 4s. per share in the two preceding years respectively.

The Maison Breguet, which has abstained from publishing accounts since the outbreak of the war, has convened a general meeting of the shareholders for October, when accounts for 1913-14, 1914-15, and 1915-16 will be submitted. It is stated that notwithstanding the enemy occupation of the company's works at Douai, large profits have been realised, as it has been possible actively to develop working at the shops in Paris. The results obtained will permit, after writing off the value (£64,000) of the buildings, plant, and materials at Douai, of the payment of a dividend of £2 per share, this contrasting with a dividend of £1 per share paid on account for 1913-14 and £1 per share for 1914-15.

Dundee, Broughty Ferry & District Tramways Co.,—Mr. GEORGE BALFOUR, the chairman, presided at the annual meeting, when a final dividend on the preferred stock at the rate of 6 per cent. for the half-year, less income-tax, was declared. The chairman said he hoped when they met next year they would be able to record the triumph of the Allies' cause. The receipts for the year amounted to £11,825, or a decrease of £1,463 compared with the previous year. Against that decrease, however, they had a saving in expenditure after meeting the increased cost of coal, amounting to £421, making the actual decrease a little over £1,000.

Direct West India Cable Co., Ltd.,—For the year ended June, 1916, the net result of working was £14,705, as against £13,553 last year, which, with the credit to revenue account of £64,219 with which the year began, makes a total of £78,925. An interim dividend of 3 per cent., free of tax, was paid in March, also a special interim dividend of £1 5s. at the same time at which a call of £1 5s. per share was made, and a further 3 per cent., tax free, is now proposed. The balance to be carried forward is £53,399. The company's cable was interrupted between Bermuda and Turks Island for 54 days, and the insulation is still low; £7,375 has so far been paid on account of the cost of repairs; the balance has not yet been ascertained.

Halifax and Bermudas Cable Co., Ltd.,—For the year ended June, 1916, the net result was a balance of £12,745, as against £10,679 for 1915. An interim dividend of 3 per cent., free of income-tax, has already been paid, and a further equal payment is now to be made. The balance to credit of revenue account, which was last year £11,549, has had to be debited with the various items recorded in the revenue account for repairs, &c., and is now £7,710. The company's cable worked efficiently during the year, except for a few days while being repaired in the Halifax Harbour.

STOCKS AND SHARES.

TUESDAY EVENING.

These moonless nights make men think of things far from financial, and the "Special" scribe, who writes with a price-list in one hand and the hope of Zeppelin prisoners in the other, strains both ears the while, as he confuses fog signals with anti-aircraft guns, and the roar of the passing motor bus with the propeller of nocturnal raiders. The Stock Exchange markets find business themes less exciting than experiences of the Zepp. nights, and the all-absorbing desire is to have front seats for the next spectacle of a marauder descending in flames.

Nevertheless, business goes on steadily all the same. Some Stock Exchange firms find their hands full. The Treasury Scheme "B," the depletion of staffs, the rubber boomlet—all play their parts in providing members with work. The Home Railway crisis is settled once more, the men receiving twice the previous war bonus, and this time the Underground Electric Railways of London has fallen into line with the State-controlled steam companies. For a few hours the Railway market assumed a better complexion, but the recovery did not last for long enough to attract any public buying, and prices are still very dull. The £10 shares of the Underground Electric are 1/16 better at 1 13/16, on vague rumours of a possible raising of fares.

London and North-Western consolidated stock has been, and still remains, about the firmest in what is called the "Heavy" market, this being due to the partial electrification of the suburban system, which is now completed. This makes an important addition to the steadily-growing list of electrified companies, and the prophet may safely vision the time in a none-too-distant future when steam services for suburban train traffic will have ceased to be. Adaptation of the current to long distances is a matter of more time.

With the conclusion, for the time being, of the Daylight Saving Scheme, Electric Lighting shares have come in for further inquiry, although, as we have pointed out before, there are so few shares on offer that the present quotations are largely nominal; and business accordingly is quiet. London Electric preference are again better on the week; their rise to 4 9/16 represents the only change in the list since we last wrote. The manufacturing shares are good; British Aluminium ordinary have risen 1s. 9d. to 28s. on the declaration of an increased dividend. General Electric ordinary continue their improvement, rising 5s. to 143. Westinghouse preference hold their rise of last week, and Callenders are a good market at 123.

Various telegraph dividends have appeared during the last day or two. The Direct Spanish announces an interim of 2 per cent., which is the regular rate; it is thought, however, that there will be an increase in the final dividend or bonus, and the price of the shares has risen a little to 54. The 10 per cent. preference are 7½. The Direct West India Cable Co. has done less well, the net profit of £7,300 (allowing for maintenance and repairs) being £3,700 below that for the previous year; the reason for this is that there was a breakdown in the cable between Bermuda and Turk's Island, which took nearly two months to repair, and cost the company £7,400. The Direct West India Co., however, has a substantial carry-forward, and the dividend is maintained at 6 per cent. A bonus of £1 5s. per share has been declared, and a call of the same amount made. The Halifax and Bermudas Cable Co. made £700, also allowing for maintenance and repairs, against £3,100 in 1913, the decline in this case also being due to exceptional cable repairs; the dividend, however, is maintained at 6 per cent.

Oriental Telephones are better at 2 5/16. There are no changes in the Eastern group. Marconis lost 1/16. A few fluctuations in Canadians and Americans have left the prices at 19s. and 11s. respectively. Chadburn's (Ship) Telegraph Co. announces a net profit of £9,800, being an increase of £2,500, after raising the depreciation by £2,000 and setting aside an additional £6,000 as compared with last year, for income and excess profits tax. The company has declared a dividend on its ordinary shares at 8 per cent. Of course, in cases where companies are making these big reserves against excess profits tax, if it should turn out to be that the sums are over-generous, the shareholders will reap the benefit in the course of a year or two after the declaration of peace.

Victoria Falls & Power ordinary shares have been an active market between 10s. 6d. and 11s., and the preference rose to 21s. 9d. Some attention has been paid to the 54 per cent. second debentures, a little stock of the last-named having come to market at 102½. At this price the bonds look cheap,

because the security is ample, the interest payments are made free of tax, and the interest is at 10% or by purchase in the market, and the yield on the money (taking income-tax at 5s. in the £) works out to the equivalent of rather over 7 per cent. Coupons are payable on January 1st and July 1st, so that at the present time there is three months' interest included in the price.

There is no stopping the rise in British Columbia Electric Railway issues. This week the deferred has put on four points, the preferred three, the 4½ debenture stock two, and the preference one. Some of the buying is reported to be on account of New York, where, by the way, the Stock Exchange is having the time of its life, and brokers are busier than most of them have ever been before. When a single motor company in America can make over 60 million dollars profit in one year, and when the shares of a munition-making company rise from 25 to 110, no further evidence need be cited of the abnormal conditions prevailing on the other side of the pond.

Mexican affairs are drifting towards the melting-pot, and the latest news is far from happy. Some of Villa's followers are reported to have risen against Carranza; and Villa is giving further testimony to his ability to make things extremely uncomfortable for the latest President. There are no changes in the prices of the Mexican utilities. Canadians, on the other hand, are very firm, and these, with shares in the utility companies of the States, steadily improve.

Armaments are better, and certain of the Copper group have hardened. The rubber market is active and buoyant. Business is on an animated scale, and although the price of the raw stuff supplies scanty encouragement to enthusiasm, there is no mistaking the eagerness of the speculative investor to buy good shares.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend	Price	Rise or fall	Yield
	1914. 1915.	Sept. 26, 1916.	this week.	p.c.
Brompton Ordinary ..	10 10	98	—	27 11 0
Charing Cross Ordinary ..	5 5	97	—	7 1 4
do. do. 4½ Pref. ..	4½ 4½	93½	—	6 6 4
Chelsea ..	6 8	84	—	6 13 4
City of London ..	6 8	122	—	6 10 8
do. do. 6 per cent. Pref. ..	6 6	102	—	6 15 8
County of London ..	7 7	104	—	6 9 8
do. do. 6 per cent. Pref. ..	6 6	102	—	6 15 8
Kensington Ordinary ..	9 7	102	—	6 4 5
London Electric ..	4 8	93	—	6 11 5
do. do. 6 per cent. Pref. ..	6 6	94	+ ½	6 11 4
Metropolitan ..	9 9	94	—	5 9 1
do. 4½ per cent. Pref. ..	4½ 4½	93	—	7 4 0
St. James' and Pall Mall ..	10 8	93	—	6 5 6
South London ..	5 5	91½	—	6 16 1
South Metropolitan Pref. ..	7 7	92	—	6 7 3
Westminster Ordinary ..	9 7	92	—	6 12 0

TELEGRAPHS AND TELEPHONS.

Anglo-Am. Tel. Pref. ..	6 6	102	—	5 17 6
do. Def. ..	80/ 80/	88½	—	7 8 9
Chile Telephone ..	8 8	7	—	6 14 5
Cuba Sub. Ord. ..	6 5	84	—	6 8 0
Eastern Extension ..	7 8	81½	—	6 9 6
Eastern Tel. Ord. ..	7 8	145½	—	6 10 0
Globe Tel. and T. Ord. ..	6 7	124	—	6 5 8
do. Pref. ..	6 6	102	—	6 10 4
Great Northern Tel. ..	22 22	49	—	5 9 9
Indo-European ..	13 13	49	—	6 12 8
Marconi ..	10 11	94	—	8 4 0
New York Tel. 4½ ..	4½ 4½	100	—	4 10 0
Ontario Telephone Ord. ..	10 10	206	+ ½	4 6 6
United R. Plate Tel. ..	8 8	—	—	6 18 5
West India and Pan. ..	1 1	1½	—	—
Western Telegraph ..	7 8	142	—	6 8 6

HOME RAILS.

Central London, Ord. Assented ..	4 4	73	—	4 0 10
Metropolitan ..	11 11	243	—	18
do. District ..	Nil Nil	18	—	Nil
Underground Electric Ordinary ..	Nil Nil	113	+ ½	Nil
do. do. "A" ..	Nil Nil	67	—	Nil
do. do. Income ..	5 5	89	—	6 14 1

FOREIGN TRAMS, &c.

Adelaide Sup. 6 per cent. Pref. ..	6 6	41½	—	6 1 6
Anglo-Arg. Trams, First Pref. ..	6 6	48	—	7 17 2
do. do. 2nd Pref. ..	6 6	9	—	—
do. do. 5 Deb. ..	5 5	75	—	6 13 4
Brazil Tractions ..	4 4	60	—	6 11 8
Bombay Electric Pref. ..	6 6	102	—	6 14 8
British Columbia Elec. Rly. Prefs. ..	5 5	75	+ 1	6 13 4
do. do. Preferred ..	Nil Nil	60	+ 8	Nil
do. do. Deb. ..	Nil Nil	69	+ 4	Nil
do. do. Deb. ..	4½ 4½	67	+ 2	6 10 9
Mexico Trams 5 per cent. Bonds ..	Nil Nil	48	—	Nil
do. do. 6 per cent. Bonds ..	Nil Nil	86	—	Nil
Mexican Light & Co. ..	Nil Nil	19	—	Nil
do. do. Pref. ..	Nil Nil	86	—	Nil
do. do. 1st Bonds ..	Nil Nil	45	—	—

MANUFACTURING COMPANIES.

Babcock & Wilcox ..	14 15	3½	—	4 18 0
British Aluminium Ord. ..	5 7	29½	+ 1/9	5 14 4
British Inland & Ord. ..	15 17½	124	—	7 0 0
British Westinghouse Pref. ..	7½ 7½	2½	+ 1/9	5 17 0
Callenders ..	15 20	122	+ 2	8 0 0
do. 5 Pref. ..	5 5	42	—	5 17 8
Casimer-Kellner ..	20 20	—	—	6 8 8
Edison & Swan, £3 paid ..	Nil Nil	107	—	Nil
do. do. fully paid ..	Nil Nil	12	—	Nil
do. do. 5 per cent. Deb. ..	5 5	62½	—	8 0 0
Electric Construction ..	6 6	71	—	6 11 6
Gen. Elec. Pref. ..	6 6	10	—	6 0 0
do. Ord. ..	10 10	112	+ 1	6 15 7
Henley ..	24 25	162	—	7 9 2
do. 4½ Pref. ..	10 10	12	—	6 6 0
India-Rubber ..	10 10	12	—	4 3 4
Telegraph Con. ..	20 20	89	—	6 4 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 27th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ..	per lb.	1/8 ..
a Ammoniacal Sal ..	per ton	275 ..
a Ammonia, Murate (large crystal) ..	"	254 ..
a Bisulphide of Carbon ..	"	£23 ..
a Borax ..	"	£34 ..
a Copper Sulphate ..	"	£51 ..
a Potash, Chlorate ..	per lb.	2/6 ..
a " Perchlorate ..	"	2/ ..
a Shellac ..	per cwt.	128½ ..
a Sulphate of Magnesia ..	per ton	£18 ..
a Sulphur, Sublimed Flowers ..	"	£17 ..
a " Lamp ..	"	£14 10 ..
a Soda, Chlorate ..	per lb.	1/ ..
a " Crystals ..	"	1d. dec. ..
a Sodium Bichromate, cakes ..	per lb.	.. ..
METALS, &c.		
c Brass (rolled metal 2 to 12 basis) ..	per lb.	1/8 to 1/34 ..
c " Tubes (solid drawn) ..	"	1/4 to 1/34 ..
c " Wire, best selected ..	"	1/8 to 1/34 ..
c Copper Tubes (solid drawn) ..	"	1/8 to 1/34 ..
c " Bars (best selected) ..	per ton	£157 ..
c " Sheet ..	"	£157 ..
c " Rod ..	"	£157 ..
d " (Electrolytic) Bars ..	"	£138 ..
d " " Sheets ..	"	£155 ..
d " " Rods ..	"	£148 ..
f Ebonite Rod ..	H.C. Wire ..	1/2 ..
f " Sheet ..	"	2/6 ..
f " German Silver Wire ..	"	3/3 ..
f Gutta-percha, fine ..	"	6/10 ..
f India-rubber, Para fine ..	"	8/3 ..
f Iron Pig (Cleveland warrants) ..	per ton	Nom. ..
i " Wire, galv. No. 8, P.O. qual. ..	"	£36 ..
g Lead, English Pig ..	"	£21 5 ..
g Mercury ..	per bot.	£17 12 6 to £17 10 ..
g Mica (in original cases) small ..	per lb.	6d. to 3/ ..
e " " medium ..	"	3/6 to 6/ ..
e " " large ..	"	7/6 to 14/ & up ..
d Silicon Bronze Wire ..	per lb.	1/4 ..
r Steel, Magnet, in bars ..	per ton	£10 inc. ..
g Tin, Block (English) ..	"	£2 inc. ..
n " Wire, Nos. 1 to 16 ..	per lb.	2/10 ..

Quotations supplied by—

a G. Boor & Co.	g James & Shakespear.
c Thos. Bolton & Sons, Ltd.	h Edward Tilt & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	l Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	m F. Ormiston & Sons.
Telegraph Works Co., Ltd.	n F. P. Dennis & Co.

Kalgoorlie Electric Power & Lighting Corporation, Ltd.—The directors have declared a dividend on the preference shares at the rate of 4 per cent. per annum for the six months ending September 30th.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended August 25th, 1916, amounted to 2,073,598, compared with 2,042,910 in the corresponding four weeks of 1915.

Clyde Valley Electrical Power Co.—At the half-yearly meeting, held in Glasgow last week, Mr. F. C. GARDINER said that the profit for the half-year was considered satisfactory, in view of the large increases in the price of coal and cost of labour and all material necessary for carrying on the business, and the cost of repairs, due to the heavy demands made on the company for direct and subsidiary munitions work. The contracts for supply showed an increase during the half-year of 4,403 H.P., and connections to mains an increase of 7,544 H.P. It was expected that the new power station at present under construction near Cambuslang would be in commercial operation by the end of October.

United Electric Car Co., Ltd.—At the annual meeting, on September 20th, Mr. ROBERT B. BARNINGHAM stated that throughout the year their works had not been employed at anything like their full capacity. The orders for cars in progress twelve months ago had all been completed and delivered, and very few orders for trams had been received during the year. Corporations at home were holding back their orders at the present time, and foreign trade they could hardly expect. The directors had obtained all the Government work they could get, but there was not much chance for the company to share in large profits. He had good hopes that the company would be ultimately paid for the cars they had delivered, chiefly in South America, but one could not say how the purchasers, who were chiefly in occupied territory in Belgium, would come out of it all. He was satisfied that when hostilities ceased there would be plenty of work both at home and abroad.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING AUGUST, 1916.

The returns of electrical export and import business for August show a very considerable increase in value of the former as compared with the previous month, though the imports fell off in value by over £30,000 in the same period.

The total value of the exports was £553,957, as compared with £487,575 in July and £603,510 in June. The month's business included over £100,000 worth of submarine telegraph cable, while machinery, cable, lamp, and battery export values reached respectable totals, though telephonic exports were on a reduced scale. It will be noted that during the month the value of our exports to the Continent reached a high level.

The imports total for the month was £183,151, as compared with

£213,714 in July, the general falling-off in value being, no doubt, due to the steady reduction in American electrical imports into this country. The only notable exception was in the case of lamp and lamp-part imports, which reached a higher level, totalling some £50,000 in value, beside which our lamp export business cuts a very poor figure. Holland alone sent us some £36,000 worth of lamps and parts out of her total of £38,737 worth of business, and it may be noted that she now occupies the *second* place as regards value of electrical material entering this country. Japan's efforts as an importer of electrical material into Britain resulted in £5,785 worth of business, as against £4,381 worth in July.

The re-exports for the month amounted to £14,948, or nearly £1,000 better than in the previous month.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric motors and instruments.	Electric machinery.	Electro-lytic machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus, and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Sweden, Norway and Denmark ...	1,391	547	169	1,774	...	2,274	29,350	1,704	920	607	127	9,812	48,675
Netherlands, Java and Dutch Indies ...	822	9,283	1,350	34	70	50	775	...	1,289	128	4,863	432	19,096
Belgian Congo ...	...	...	109	...	...	...	...	...	...	...	...	...	...
France ...	4,288	429	1,102	217	577	172	19,876	2,757	605	470	61	1,501	32,055
Portugal ...	22	151	...	...	...	947	26	...	...	...	2,049	70	3,265
Spain, Canary Isles and Spanish N. Africa...	349	22	75	15	...	1,357	2,660	8	60	120	269	549	5,475
Switzerland, Italy and Austria-Hungary ...	300	477	105	...	...	...	6,041	...	...	68	622	785	8,398
Greece, Roumania, Turkey and Bulgaria ...	70	32	...	32	...	...	188	150	...	...	...	...	792
Channel Isles, Gibraltar, Malta and Cyprus...	109	55	15	165	...	139	140	...	...	...	17	287	927
U.S.A., Philippines and Cuba ...	849	20	265	28	...	11	310	...	158	28	31	284	1,984
Canada and Newfoundland ...	370	...	...	961	...	252	4,200	...	104	...	...	566	6,433
British West Indies and British Guiana ...	223	36	31	261	...	...	155	...	93	...	74	118	934
Mexico and Central America ...	20	405	...	...	...	...	553	...	...	...	...	31	1,009
Peru and Uruguay ...	86	362	80	77	...	557	55	...	68	...	...	379	1,664
Chile ...	318	187	62	170	...	684	908	...	30	47	2,348	35	4,789
Brazil ...	588	934	47	612	...	1,121	1,796	555	933	33	144	968	7,731
Argentina ...	498	10,875	201	1,085	...	714	2,514	78	4,379	153	1,042	4,010	25,549
Colombia, Venezuela, Ecuador and Bolivia...	...	270	...	...	...	10	672	...	...	42	...	...	994
Egypt, Tunis and Morocco ...	151	902	58	674	42	232	691	114	2,061	83	31	417	5,456
British West Africa ...	21	478	8	219	...	...	196	...	46	...	...	96	1,067
Rhodesia, O.R.C. and Transvaal ...	1,787	2,620	974	2,805	...	456	1,048	292	1,026	261	379	64	11,712
Cape of Good Hope ...	768	6,052	506	503	40	200	1,139	...	716	21	115	10,039	20,099
Natal ...	783	7,187	428	695	...	...	5,974	732	1,087	43	87	9,755	26,771
Zanzibar, Brit. E. Africa, Mauritius & Aden ...	200	119	40	481	...	...	392	...	13	...	251	426	1,922
Azores, Madeira and Portuguese Africa ...	95	469	43	20	...	166	26	72	...	...	17	37	945
French African Colonies and Madagascar...	...	42	13	...	...	...	20	...	...	...	44	...	119
Persia ...	224	...	...	...	...	...	...	...	21	...	...	...	245
China and Siam ...	938	5,851	1,381	1,565	...	1,430	3,029	...	585	90	84	2,530	17,483
Japan and Korea ...	2	...	18	...	...	36	10,179	...	486	...	2,382	94,371	107,474
India ...	2,627	13,963	3,152	3,158	175	2,106	21,061	1,221	7,798	136	3,932	842	63,871
Ceylon ...	20	161	322	382	...	...	2,344	8	169	...	256	40	3,702
Straits Settlements, Fed. Malay States and Sarawak ...	202	834	200	279	...	42	971	365	112	86	24	3,115	6,230
Hong Kong ...	145	1,857	348	231	...	1,261	1,440	...	...	24	481	77	5,864
West Australia ...	256	2,535	237	169	...	20	3,668	...	139	10	309	107	7,450
South Australia ...	123	2,529	32	71	...	63	337	43	423	...	1,129	52	4,802
Victoria ...	777	11,453	242	1,798	10	660	6,938	...	1,172	309	1,057	346	24,762
New South Wales ...	1,115	15,338	875	1,596	66	1,848	14,581	7,814	3,143	305	1,355	749	48,785
Queensland ...	63	401	...	191	...	193	840	...	1,205	103	313	48	3,357
Tasmania ...	47	...	9	171	...	...	163	...	16	...	...	20	426
New Zealand and Fiji Islands ...	832	5,449	1,679	2,162	...	1,880	3,624	2,382	1,209	16	1,709	574	21,516
Total, £	21,473	102,325	14,176	22,564	980	18,881	148,880	22,295	30,066	3,183	25,602	143,532	553,957

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	716	56	...	...	810	...	5,378	30	1,565	398	1,660	...	10,643
Holland ...	1,197	709	...	28,089	8,304	...	...	39	399	...	...	...	38,737
France ...	781	8	22	455	642	630	52	160	5,938	1,507	...	70	10,265
Switzerland ...	1,025	657	246	79	...	7,522	1,653	...	216	1,464	...	101	13,163
Italy ...	414	3,927	...	...	...	...	3,672	...	...	...	...	...	8,013
United States ...	7,153	2,005	459	5,242	2,394	2,458	17,854	46,411	6,230	3,705	2,558	...	96,469
Japan ...	1,583	...	...	1,392	2,612	...	...	...	198	...	...	...	5,785
Total, £	12,869	7,362	727	35,257	14,792	10,610	28,809	46,640	14,546	7,074	4,389	...	183,075

Additional imports.—Canada, electrical machinery, £50; batteries and accumulators, £14. Channel Islands, machinery, £12.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	2,082	2,203	...	2,918	15	1,724	4,354	...	70	465	1,117	...	14,948
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TOTAL EXPORTS: £553,957

TOTAL RE-EXPORTS: £14,948

TOTAL IMPORTS: £183,151

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

THE INSTITUTION WIRING RULES.

By DONALD SMEATON MUNRO.

(Continued from page 314.)

Rule No. 64, with three sub-divisions, finishes the subject of wood casing, and apparently one may adopt cheap casing of small size under floors and through walls, and generally act in a reckless fashion with regard to crossings and joints, yet be untrammelled by any restriction. Bunching is permitted between wires of the same polarity on final sub-circuits. Are wires from branch switches to lamps to be classed for the purposes of this rule as if always at the potential they have when the switch is closed or when the switch is open?

Rule No. 65.—A feature of the new rules is the introduction of tough rubber compound protection as a substitute for conduit or casing. The tests which this class of protector has to undergo to conform with the regulations include capability to resist abrasion, acid, oils, and alkalis. The tests are hardly stated with scientific accuracy as to the degree or period of resistance to these formidable enemies of wiring systems. But everybody knows that "cab-tire" sheathing is meant when the Institution uses the more sonorous title, and the precise degree of resistance to trouble is the very high standard set by that doughty class of covering.

It is to be hoped that no hard-faced inspector will apply the fire test specified; under using conditions "The resistance of the covering to fire is to equal or be superior to that of vulcanised rubber." Generally the vulcanised cover of cables is tucked safely away in a steel conduit, and the inspector's blow-lamp is not so deadly as it would be if tried on the neatly varnished surface of a bunch of tough rubber compounded cables cleated to a wood partition, and possibly running up to a nice dry garret.

Rule No. 66 refers to armoured wiring, and states that the metal covering, brass, copper, or the like, must be of substantial thickness. One wonders if the Stannos covering would pass muster.

Lead-covered systems are dealt with under Rule No. 68, and they are dealt with in style. The rule does not permit of lead-covered conductors beneath floors, behind wall surfaces, or on new brick or plaster. Such severity shows a very high degree of freedom from mere commercial interests on the part of the Committee, for some of the largest cable companies have been pushing such systems for years, and recommending their use for all kinds of situations. The writer has seen a whole book full of pictures of handsome buildings wired throughout with lead coverings. Personally, he felt that it was a pity; but there were the names also attached of a host of contractors, and even of consultants, who had risked the experiment.

Lead-covered systems ought not to be too much encouraged, but they are better than some of the other systems that are permitted more freedom under the rules. If such conductors were further protected by a thorough coating of bituminous compound or tape, they would be saved for a long time from the chemical elements of destruction which lie in wait for lead behind building surfaces. Of course, some of the modern systems are covered with a substance which looks like lead, and is so largely, but is stated to be a "special metal." Does that exempt such systems from the control of Rule No. 68? In this connection one remembers that some years ago it was considered necessary to specify a high percentage of pure English lead for cable coverings. Now it seems that cable makers desire to get away from the very name of lead for indoor work.

Flexible conductors are next dealt with, and Rule 71 reminds us that fitting flexibles must only be joined to the ordinary wiring by screw terminals,

and not by soldering. In the installations which have lasted for nearly a quarter of a century without trouble, we soldered such connections, and, in addition, soldered the flexible at the lampholder ends, and thus obviated the risks of sparky hot contacts in inaccessible places.

We now pass to the section dealing with "Protection in Special Positions." Here there is no hint of how to proceed in corrosive, high temperature, wet or other difficult places, but the section refers us back to four preceding rules, and goes on merely to specify the use of casings and tubes for partitions, &c.

Bare conductor conditions are then well described in Rule No. 75, with nine sub-divisions. There is, perhaps, one section too many, as the matter of double insulation with straining gear is the subject of sub-division (b), and again appears fully in (e).

Rules 87 to 95 are devoted to switch and distribution boards, and deal with the subject well. It should be noted that teak-cased fuseboards must now be lined with fire-resisting material, and a minimum clearance of $1\frac{1}{2}$ in. must be provided. One hopes that the makers will act at once in this direction and save contractors the worry of making special big cases.

Switches and circuit-breakers are described in Nos. 96 and 97. The chief item of interest is the condemnation of that type of ironclad switch which has a slot for the handle. It has always been a wonder to the writer how such a futile type persisted. The sizes of switches are governed by load tests. This is quite proper, and one hopes that makers will now classify their switches accordingly, and not call a switch 50-amp. size when under prolonged working conditions it will only break and carry 10 amp. safely. Some indication of approved contact areas might with advantage have been appended to the rules.

The sections devoted to fuses and wall plugs and sockets have been considerably improved. It is evident that the Committee attach great importance to their recommendation to use cord-grips on portable appliances. It is repeated three times (Rule 104, 109, and 114). Does it apply to portable standards?

Rule No. 110 says that switch lampholders must be controlled by a wall switch. Lately there has been an extended use of ceiling rose switches. Are they to be classed as lampholder or as wall switches?

Rule 111 states that a lampholder must not be in metallic connection with the metalwork of a portable hand lamp. Must we fit insulated holders as well as cord-grips on all portable standards now? There is much to be said for the general adoption of insulated holders except on cord pendants, where they are not necessary.

There are several important provisions anent heaters in Rule No. 117. Those taking over 1,000 watts are to have D.P. switches. It is to be hoped that the ironmongers and stores—so beloved by the Tungsten Lamp Association—who are now selling 2, 3, and 4-kw. heaters, will tell their customers of this necessity. Those of us who are only electricians will note with malicious glee that the Institution anticipates heaters being used with pressures up to 650 volts. The smart ironmongery salesman may expect to hear something from madam then! Nothing is said about the earthing of heaters.

Manufacturers must note (Rule No. 118) that at least one section of the heating elements is to be controlled by the wall switch only.

Rule No. 120 states that heating circuits must be protected by a wall switch in each room. Thus in a dining-room with sockets for radiator, hot-plate, &c., a big master-switch must be provided at much expense, and probably never used.

Resistances, choking coils, and transformers are next dealt with, then motors and dynamos. Nothing is said about the earthing of any of these,

neither is any suggestion given as to approved methods of wiring to them. This is a point on which much guidance is necessary.

In dealing with accumulators, Rule No. 126 states that "each regulating cell should be protected by a fuse." This is astonishing. If such fuses are to be of any use they should be placed near the junction with cells. The atmosphere of a cell room will soon cause the fuses to blow, and in blowing they may even cause the cell room to blow up. In any situation the blowing of a fuse on a regulating cable would cause serious flashing at the switch regulators on the board.

Again, Rule No. 127 implies that a battery must have a D.P. switch and fuse control. This is often difficult to arrange in practice, and protective control can be otherwise secured.

Some differences are made in the tests for wiring. It is not now necessary to test the wiring proper before the fittings are erected. The old method was useful when the work was divided; now in such a case, when the tests are low, there may be difference of opinion as to where the faults lie.

We know that branch switches and their treatment are the chief factors in an insulation test. Yet these are not counted, and the insulation must not be less in megohms than 25 divided by the number of lamps.

An appendix is given which shows the number and sizes of 250-volt cables which can be drawn into the various conduits made to the Engineering Standards Specification. The table differs here and there from that prepared by the various conduit makers for the same sizes of cables and conduits. No indication is given of length of conduit through which the stated number of wires can be drawn, nor of the reduction in yards of length per normal bend. Neither is note given of the sizes of conduit for single main conductors. If the table is worth giving at all it should be complete for convenient reference.

A table prepared for the 650-volt cable would have been even more interesting, for then we should be learning about cable thicknesses which have hitherto been beyond our experience.

A great amount of space is occupied throughout the pamphlet by general specifications of items like copper conductors, ceiling roses, and constructional details of switches, sockets, fuseboards, and other accessories. This in spite of the fact that some of these particulars are already published fully in the British Standard Specifications. Some advantage in clarity and easy reference would be gained if such manufacturers' items were printed separately in a section by themselves, and not interposed with matter referring to methods of use and erection.

In the few months which have elapsed since the rules were issued, several critics have directed attention to the more important alterations required in current practice, and it has been suggested that this issue should have been delayed until after the war, when the wiring world would be less harassed with urgent work and more ready to consider changes.

The rules are not yet final or perfect, however, and now that peace is distant in sight, and stocks of old standard articles are unprecedentedly low, it is the best time to be preparing and changing patterns and methods. So the next set of regulations may be on more model and permanent lines and be a real charter to good average wiring practice.

THE BRITISH ASSOCIATION. IV.

The Utilisation of Coal as Fuel.

DURING the visit of the British Association to Newcastle-on-Tyne a joint meeting of the Geology and Chemistry Sections was held, on September 7th, on the investigation of the chemical and geological characters of different varieties of coal with a view to their most effective utilisation as fuel and to the extraction of by-products.

Prof. G. A. LEBOUR, in opening the discussion, said that the attitude or relation of geologists and chemists to the matter of coal was rather a peculiar one. Geologists had to find the coal, but in order to ascertain that the mineral found was coal they had to turn to the chemists, and the chemists could not always tell. Some authoritative classification of coal should be arrived at which should be to the satisfaction of both the geologists and the chemists. Coals were very different, and their chemical properties were not uniform; there were known cases in which two coals had practically the same composition according to the analysts, but differed in their physical properties. It was the physical properties that were of interest to the industrial world, and therefore they would like, if possible, to have a definition of coal which might comprise all sorts of schedules, such as coking, &c., and its physical and chemical properties. Geologists regarded coal as a rock, usually found in layers, with a roof and a floor. Floor and roof both varied, and according to the variety and difference in the roof there should be a corresponding difference in the nature of the coal. Chemists had very often to investigate coal without the slightest knowledge as to the conditions under which it was secured. If those particulars were given to the chemists, they might be able to explain the phenomena that had presented great difficulties.

Prof. W. A. BONE said the great difficulty with the chemists was that there was not much to say of a definite character. They usually applied certain tests to coals to secure information regarding their specific use for commercial purposes, and used tests which had been found to be more or less satisfactory. They could determine the carbon, hydrogen, and organic nature with a certain amount of precision, but too frequently these results came out differently according to the amount of air. More recently they had been studying the action of pyridine, which removed and dissolved certain constituents in the coal, and a good deal of work had been done by other individuals with other methods of testing coal, but little had been done in the way of correlating, or bringing the different undertakings to a focus, so that they might be seen in their proper perspective. Until that was carried out he did not think the chemists would be in a position to say very much about the exact chemical nature of the constituents of coal.

Prof. KENDALL, regarding the matter as a geologist, was of opinion that much research work was needed in co-operation with the chemists. There should be a general investigation of the coal and of coal seams, because a chemical analysis was not enough. The ash present in coal was one of the factors controlling its economic use, and so they would like to know what the ash was, and what was its relation to the original plant substance.

Dr. J. T. DUNN said they should know what each section was doing. Until chemists knew something about the chemical nature of coal they could not hope to present any scientific classification to the geologists, and they would not get far until they knew whence the coal came. Chemists, geologists, and botanists should join in their researches.

Prof. BONE thought there was every prospect that shortly the State would take up the question and grant subsidies for the investigation of coal. It was practically the result of the movement begun at the British Association meetings at Manchester last year and in various scientific quarters as to the value of the properties of coal. They had had an assurance given that the question would be dealt with in the very early future.

Prof. BEDSON said his study of coal over many years impressed him with the fact that the difficulty involved in the problem was the question of the chemical nature of coal. Pyridine dissolved up to 30 per cent. of the coal, but of the composition of the remainder they were ignorant.

Dr. MARIE C. STOPES spoke of the little progress that had been made in the study of the constituents of coal, and said that the chemists, in estimating the nature of coal unaltered by heat or chemical action, had done no more than to separate them into two main classes of constituents, which had been termed cellulosic and resinic. If the different by-products from coal were traceable to specific parts of plant life, and those plant remains were recognisable in the plant itself, a considerable step might be made in the knowledge of coal and its potentialities, for the individual plant portions might be isolated by suitable methods, and the substances for which they were responsible when coal was heated, determined. It was on such work that they were engaged. This study was obviously a case for co-operation. The ultimate aim of the research was a complete scientific knowledge of the chemical composition and mode of formation of coal.

Dr. D. P. JONES and Dr. G. HICKLING also took part in the discussion.

Board of Trade Inquiries.—The Commercial Intelligence Branch of the Board of Trade has received applications from firms at home for the names of manufacturers or producers of:
Bulbs for electric lamps; electric smoothing irons for boot uppers; and steatite insulators.

The Problem of Industrial Unrest.

THE Economics and Statistics Section of the British Association on September 6th turned its attention to the question of industrial unrest, the basis of the discussion being the report of a committee on means for the promotion of industrial harmony.

The report, which was very long, considered the subject in three sections: The causes of industrial unrest, attempts at diminishing industrial unrest, and the Committee's recommendations. The causes were stated to be: (1) desire for a higher standard of living, (2) desire of the working people to exercise a greater control over their lives and to have some determining will as to the conditions of work, (3) the uncertainty of regular employment, (4) the monotony in employment, (5) suspicion and want of knowledge of economic conditions, (6) the complaint that some labour is irregular and less satisfactory, (7) the effects of war measures. Attempts at diminishing industrial unrest included conciliation and arbitration boards, arbitration (a) voluntary, (b) compulsory, profit-sharing and co-partnership, and co-operation. The summary of the report stated that the aim of the investigation was to discover certain general principles which must underlie a harmonious economic organisation. Before the problems of industrial unrest could be solved those principles must be applied to particular industries. With their special application the Committee did not deal, and the suggestions put forward included only broad principles possible of wide application. The recommendations might be divided into groups, as they concerned: The general attitude and outlook of employers and workmen; machinery for dealing with disputes; the organisation of industry; and post-war arrangements. The recommendations were thus summarised:—

1. (i) That there should be greater frankness between employers and workpeople, and that they should discuss industrial matters together or through duly accredited representatives.

(ii) That employers should consider the cost of labour, and not the wages earned by individual workmen.

(iii) That the fundamental facts and principles of industrial and economic life should be known by both.

2. (i) That employers and workpeople should improve their organisations with a view to determining jointly the conditions under which industries should be carried on.

(ii) That in each industry permanent boards or committees be set up to consider all matters of common interest.

(iii) That there be a joint national board to which local boards could refer unsettled disputes.

3. (i) That the necessity for co-operation between employers and employed be recognised by both.

(ii) That employers establish: (a) Associations of one trade in a given district, (b) national associations of one trade, (c) local federations of trades, (d) national federations of trades, (b and d being organised under a system of representation.)

That workpeople establish unions and federations corresponding to the above.

(iii) From the two national federations there be elected an industrial council.

(iv) That the State give recognition to approved associations, unions, and federations under carefully devised regulations, the State being the representative of the consumer and of the community.

4. (i) On demobilisation, that district boards of really practical men be established to consider and adjust difficulties, especially as to the replacement in industry of men who have joined the Forces.

(ii) As to agreements and regulations in abeyance for the period of the war. The industrial community will have an opportunity for considerable reconstruction. The new organisation suggested should take this in hand.

Archdeacon CUNNINGHAM expressed a feeling of disappointment at the report, the recommendations of which had no relation to many of the causes of industrial unrest. There was no suggestion in it as to getting a higher code of morals both on the part of Capital and Labour. He referred to the housing question, and said employers of labour should be responsible for the proper housing of their employees.

Prof. W. R. SCOTT referred to the suggestion that had been made of an industrial war after the present military war, and said its prevention, while not in the power of any individual, was, he thought, within the power of the nation. If they could only prevent industrial war they could not only pay the interest on the war loans, but provide a material sinking fund for the reduction of the debt. He advocated co-opera-

tion between interests, and for that object the most practical method he could see was that associations representing capital and labour should act in conjunction.

Sir HUGH BELL said he did not accept the report in its entirety, although he was a party to it. No very definite conclusions could be suggested, for the question was in an obvious state of flux. The war had brought home these questions in a much more urgent form. It was clear that as soon as the war had come to an end problems that might have found a solution gradually would become urgently in need of an immediate solution. It seemed desirable in the present circumstances to present not so much definite conclusions as indications of the directions in which improvements could be sought. It was impossible, as they understood matters at present, to devise any scheme of compulsory arbitration. What they wanted to bring home to Capital and Labour alike was the fact that the centre of gravity was very much changed. He was convinced that they must dismiss proposals of profit-sharing as a solution of the problem before them. That they were going to have a troublous time, he thought, was beyond doubt, but the disposition to wait until circumstances had developed, rather than make preparations for eventualities that might never happen, would, he thought, stand them in good stead, as it had before.

Address to the Economic Science and Statistics Section.

By PROF. A. W. KIRKALDY, M.A., PRESIDENT OF THE SECTION.

(Abstract.)

In every sphere this great war has worked, and will yet work, great changes, but in the economic sphere the effects that can already be noted far exceed those in any other. Up to the present the war has cost us over £2,000,000,000. We have consumed that amount of commodities and services, we have diverted capital and labour into new channels of production, but these channels, unlike those connected with a good scheme of irrigation which may make the wilderness to blossom like the rose, have emptied themselves in the desert and the runnels are now dry and worthless. The warring Powers have turned their attention from profitable production, the output of wealth, the exchange or use of which will produce new wealth, to the production of instruments of destruction, which not only consume themselves, but carry out a work of destruction which entails the loss of other accumulations or possibilities of wealth. There is absolutely nothing tangible to show for this expenditure. Thus the position is that for two years we have been consuming our wealth, and to that extent must remain the poorer and be short of many of the goods and services we used to consider necessities of life, until we have, by renewed efforts and a return to the industries of commerce and peace, taken measures to restore those useful things which have been consumed.

When the war ends, it will be incumbent on us all to redouble our activities, increase the productivity of the mill, factory, and field; for, so long as there is a deficiency in excess of what we were accustomed to, so long must some of us, and especially the poorer members of the community, feel the pinch occasioned by this devastating war.

The war, in spite of the suffering and loss occasioned, has not been all loss. As a nation—nay, as an Empire—we have found ourselves. We shall emerge from this war a better disciplined, a more serious people, better equipped mentally and physically to cope with new conditions. We have learned what hitherto had only been suspected, or at most known to a few, that we have not produced anything like our industrial maximum.

An insidious element of friction threatening to develop into class war has been sapping our energies. There have been faults on both sides, but daylight is being thrown over the situation, and the waste and loss of this friction has been laid bare. If we do not take to heart this great experience and alter our ways for the better, then we deserve to go down as a nation.

Not only was there loss through friction between employers and employed, but in many industries we were continuing to use out-of-date tools and methods long after they should have been discarded. A long era of prosperity had not, indeed, caused decadence, but was threatening to do so. The war has shaken us up and shown us the realities of life, making the mistakes of the material side with which we have to do here plain and unmistakable.

To beat the national enemy we had to re-equip our workshops, and the new equipment will be available to a great extent for future work. Moreover, we have been taught by a bitter lesson that up-to-date equipment is as necessary if we are to maintain our position as an industrial and commercial nation as it was to enable us to maintain our international position.

I want to attempt now to make a forecast of what may be expected in the commercial and industrial spheres when we sheathe the sword. Germany has over-run some important manufacturing districts. Belgium, North-Western France, and Poland have not only been occupied by the enemy, but machinery and industrial equipment have in many cases been removed to Germany. The busy industrial areas mentioned have undoubtedly suffered very considerably, and will require to reconstruct and re-equip towns and factories, and

to reorganise the labour force. To set commerce and industry at work again on anything like the previous scale must be a work of some time. On the other hand, in spite of every effort, Germany has found it impossible to interfere with the industries of the United Kingdom either by force or intrigue; nor have the Entente Powers as yet invaded Germany. Indeed, for the purpose of this forecast it is wise to assume that German industrial equipment will not be affected detrimentally by the war. When once again the world begins to get into its normal stride, so far as one can foresee, England and Germany will for some time be the only two European nations prepared to take any considerable part in international trade.

Meantime, during the period of the war, two countries—the United States of America and Japan—have enjoyed new and unlooked-for trading advantages. So far as competition from the United States is concerned, it is probable that we need not feel unnecessarily pessimistic. The South American States are at the beginning of a period of development which may well prove to be rapid. The possibilities opened up by the Panama Canal route, even though the present canal should prove a failure, will not be resigned before another attempt is made to pierce the isthmus; that a cutting will eventually be made is, in my opinion, beyond question. American developments, then, may be expected to take place principally on the American continent, in the Pacific, and in the Far East. In these regions there is ample room for both British and American enterprise.

Nor will Japan, for some time to come at any rate, compete with our staple manufactures. The development made by Japan during the war would seem to indicate that it is Germany, and not Great Britain, that will have to bear the brunt of Japanese competition. Small goods and fancy articles which came freely into our markets from Germany and Austria before the war are now being made in Japan. Our merchants, being unable to get supplies of these goods, sent samples to Japan, with the most satisfactory results as to price, finish, and quality. Thus we have been able to extend our business relations with our ally at the expense of our enemy. Moreover, although there is no certain information on the subject, it is more than possible that when normal trading is resumed it will be found that Japan has been extending her business in these and other classes of goods into other markets hitherto the preserve of the Central Powers.

Hence it is of special interest to attempt to forecast to what extent and with what prospects England and Germany will be in competition in international trade after the war. This will depend for the most part on two sets of factors: (1) the internal industrial condition of each country, and (2) commercial factors. So far as the former are concerned, there is much that this country should realise and take to heart.

The United Kingdom, in spite of the war and its heavy drain on our resources, has been enjoying an exceptional time of seeming prosperity. A large section of the workpeople have been earning high wages, whilst some employers have been earning handsome profits. High prices, high wages, high profits have been the order of the day. The return of peace will very considerably modify the last two of these, and how will those affected face the change?

To understand how the parties will answer this question, certain agreements must be remembered. Foremost among these is the State guarantee that certain trade union restrictions and Government regulations which have been in abeyance for the period of the war shall be reimposed when peace is restored. If we were reverting to pre-war conditions there would be much to be said for this, but one hopes that both parties realise fully that conditions have radically changed, and that in consequence both employers and workpeople must be prepared to meet the new situation in a new spirit. Why were these agreements and regulations set aside? Because it was known that they hampered output, and our military success depended upon our producing the greatest possible amount of munitions of war. Our commercial success will now equally depend on getting the utmost possible production out of our industrial equipment. Are we, then, going to restore these obstacles just at the most critical moment?

With the return to more normal times the national necessity for war stores and munitions will cease, and our industrial forces will have to rely on the home and foreign markets for employment. Foreign competition will almost certainly be greatly intensified. There may be at first a great demand for manufactured goods of all kinds, as a consequence of decreased supplies during the war, but all the principal trading nations will strain every nerve to get the greatest possible share of orders. If, under such circumstances, we indulge in an internal struggle between Capital and Labour, instead of bending our whole energies to retain and extend our hold on markets, we shall lose an opportunity which is not likely to return. And yet there is a widespread expectation among employers and workpeople that the European war will be succeeded by serious industrial strife.

So far as the commercial factors are concerned, we have almost everything in our favour. We have not outraged the sentiments of humanity by employing inhuman methods in waging war. We have retained our position as the headquarters of the money market. We have our shipping resources and equipment practically intact. Our merchants and exporters are keen and ready to carry on their business

with even greater energy than before the war. We have arrears to make up, but have the will, and, with harmony at home, the ability to carry on a more extended trade. Our capital has not been seriously affected, and there are no signs that it will be—our financial establishments and banks are prepared to do their share.

Turning to Germany, there is a most interesting condition of affairs to study. If beaten in the war Germany will be a poor country; the economic position will be deplorable, but hardly irreparable. Every section of the community has already felt to some degree the effects of the war. When peace comes there will be a determined attempt to regain the old position. A disciplined people, acting under a Government that will be compelled by circumstances to foster every possible means for repairing the broken machine of trade and for restoring the national wealth, will without any doubt be prepared to make heavy sacrifices to regain what has been lost. The Government will offer advantages in the shape of low railway rates and canal facilities, and, as far as possible, bounties on export business and on shipping to encourage and extend foreign trade. Manufacturers and merchants will cut down profits, and workpeople will be carefully taught that only by increased productivity and by a period of low wages can that which has been lost be regained. One foresees a remarkable attempt by a united and determined nation to make good in as short a period as possible the waste and loss occasioned by the war and the blockade. German goods for export will be cheap, and the low price will be still further emphasised by the depreciation of the mark. For so long as the mark is at a discount there will be a *pro tanto* advantage to export trade, and although the mark may eventually regain its par value, a few months or even weeks will have an appreciable influence on re-opening foreign business.

Thus a comparison of English and German possibilities in foreign trade on the resumption of peace shows that there are certain advantages on both sides. The German advantages are solid and appreciable, but if England is seething with industrial friction the advantages she possesses will be neutralised and her failure a certainty.

This leads us to consider whether a policy can be devised which will remove causes of friction and assure to our industries a new era of prosperity.

As the war developed there has been a growing tendency to demand organisation in every sphere of national life. The striking successes scored by Germany have been universally, and probably rightly, ascribed to thoroughness of organisation and complete preparedness before provoking the conflict. It has been forgotten that Germany has for many decades prided herself on her Army, even as England has relied on her Navy. The test of war has proved that Germany was a very difficult country to oppose by land, but that in naval matters England is supreme. The economist, however, has to investigate into those matters which are connected with his science—namely, the production, the distribution, and the consumption of wealth. Can it be said that the want of organisation and other faults of our military system are typical of what has been going on in the industrial and commercial sphere? I, for one, cannot bring myself to accept the truth of this. For upwards of a century our industries have been gradually developing, and the progress has, on the whole, been along healthy lines—each decade has seen some advance more or less great.

German attention to industry and commerce is much more recent. She was able to benefit by our experience, nor was she slow in doing so. To take a simple illustration: A manufacturing firm of 50 years' standing has developed a system and has equipped factory and workshop as occasion demanded. A rival, seeing the possibility of competing successfully in the same business, organises a new company, raises the necessary capital, and is able to commence operations with plant, machinery, and equipment of all kinds absolutely up-to-date, and even with some new improvements. In these circumstances, provided that the management be good, and that there is a demand for the goods produced, the new firm has on the manufacturing side considerable advantages. The older firm, however, is not devoid of advantages. It has a certain connection, a goodwill, and with able management these will enable it to compete with the newcomer, whilst the managers will have time to consider how to put the manufacturing side of their business on a par with that of the rival firm. The position in a simple instance like this is fairly easy to understand. In the case of a nation, with its many and varied interests, it takes a very much longer time for the situation to develop. The agitation for Tariff Reform and Colonial Preferences is a proof that several years before the war broke out some Englishmen were awake to the fact that a new condition had come into existence, and that, if we were to preserve our advantageous position, we must take careful stock of newly-arisen factors in world-trade. For Germany was not the only one, nor perhaps the most serious, of these factors. The United States of America, from the time of the Civil War, had bent her energies to the work of internal development. Having concentrated on this for nearly 40 years, she began to expand a world-policy both political and commercial. Japan, too, emerged with unexpected suddenness into the arena. Thus, as the nineteenth century drew to a close, the economic interests of England required careful and earnest attention. The fiscal controversy undoubtedly had the great and important effect of waking English traders out of the lotus-eating condition into which they were in

(To be concluded.)

Several important exceptional phenomena have been reported which will, after discussion, be published. These include reports of aurora, strays, and signals in Alaska and Hudson Bay; severe atmospheric disturbances in Malta; simultaneous strays on both sides of the Atlantic; effect of tropical storm in the Gulf of Mexico, September 30th, 1915.

12,808 "Tele. app. for internal combustion engines." T. BICK-
STEDT. 11th. (U.S.A., September 10th, 1915.)

12,824 "Improving instruments." BRITISH WESTINGHOUSE. Five
U.S.A. Patents. (U.S.A., September 14th, 1915, September 16th, 1915)

12,842 "Improving relays." I. I. GOSSETT. September 14th.

12,849 "Improving relays for electric railways." K. W. H. DYER.
September 14th.

12,874 "Apparatus for electrically operating a relay." R. L.
WILKINSON. September 15th.

12,887 "Manufacture of electrically welded link chains at-
tachables." A. I. ALKESBERG. Kullerö, Rönneby, Göteborg, Sweden.
12th.

12,904 "Improving relays." G. G. HILL. September 15th.

12,950, "Manufacture of electrically-welded and hand-made link chains at-
tachables." R. GREEN. September 15th.

12,971 "Apparatus for electrically operating relays." H. J. HERRICK.
12th. RAY. M. J. HERRICK. September 15th.

12,985, "Art of electrical tuning." M. I. PETER. September 15th. (U.S.A.
September 17th, 1915.)

12,986 "Improved wave transmission." I. H. ARMSTRONG & M. I. PETER.
September 15th. (U.S.A., September 17th, 1915.)

12,987 "Wireless systems." E. F. H. ARMSTRONG & M. I. PETER. Sep-
tember 15th. (U.S.A., October 1st, 1915.)

12,988, "Transmission of electric signals." I. H. ARMSTRONG & M. I.
PETER. September 15th. (U.S.A., October 1st, 1915.)

12,989 "Sparkling plugs." D. A. B. HILL. September 15th.

12,994 "Distinct control of electric circuits for operating motors." A.
L. G. W. GUEST & H. O. MERRIMAN. September 15th.

12,997 "Sparkling plugs." V. PERRETT. September 15th.

12,999 "Telephone apparatus." W. C. CROOKER & F. MAYER. September
15th.

13,005, "Magneto for telephonic, &c., calls." I. B. NARRICK. Sep-
tember 15th. (France, September 16th, 1915.)

13,080, "Telegraphy." J. S. WITHERS (Cos). September 14th.

13,089, "Selenium cells." E. E. FOURNIER d'ALBE. September 15th.

13,097, "Sparkling plugs for internal-combustion engines." T. CROSBIE &
Sons and H. R. WILKS. September 15th.

13,121 "Charging systems for storage batteries." BRITISH THOMSON
HOUSTON Co. (General Electric Co., U.S.A.). September 15th.

13,142, "Electric battery cells." C. K. BAMBER. September 15th.

13,150, "Electric cable terminals." W. L. HUNTER & DEERHART WORKS
Co., Ltd., & W. H. NICHOLS. September 15th.

13,173, "Magneto ignition apparatus." G. F. COOKE. September 16th.

13,181, "Selenium relay." M. MURPHY. September 16th.

13,001, "Telephone hand set." R. B. GRAY, G. H. NASH & WESTERS.
Co. September 15th.

13,074, "Devices for closing contacts by radio-telegraphy." T. H. NARRICK.
September 14th. (Belgium, September 15th, 1915.)

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- 7.757. ELECTRICAL SYSTEMS FOR USE WITH INTERNAL-COMBUSTION ENGINES.
C. F. Kettering & W. C. Chryst. May 25th. (June 24th, 1914)
- 8.012. TELEPHONE TRANSMITTERS. H. J. C. Forrester (Powers Telegraph Transmitter Co.). May 31st.
- 12.309. STEP-BY-STEP RHEOSTAT SWITCHES. F. A. Ross. August 26th.
- 12.318. ELECTRICAL HEATING AND COOKING APPARATUS. C. G. Nobbs & W. W. Nobbs. August 26th
- 12.648. SYSTEMS OF ELECTRIC SHIP PROPULSION. British Thomson-Houston Co. (General Electric Co., U.S.A.). August 30th.
- 12.661. TELEGRAPH SYSTEMS. British Insulated & Helsby Cables, Ltd., and H. H. Harrison. September 1st.
- 12.664. WIRELESS SIGNALLING SYSTEMS. British Thomson-Houston Co. (General Electric Co., U.S.A.). September 1st.
- 12.673. AUTOMATIC TELEPHONE SYSTEMS. Relay Automatic Telephone Co., Ltd. September 3rd. (November 17th, 1914)
- 13.062. FITTINGS FOR ELECTRIC LAMPS. S. Quincy. September 13th.
- 13.083. MEANS FOR DISTRIBUTION OF ELECTRICITY FOR ELECTRICALLY-OPERATED RAILWAY TRAINS. P. S. Turner. October 29th.
- 17.034. MEANS FOR LAYING AND COLLECTING FIELD TELEPHONE WIRES. A. C. G. Smith. December 3rd.

1916.

- The numbers in brackets are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.
- 1.309. MEANS FOR SUPPORTING AND INSULATING ELECTRIC LINES. Bullers, Ltd., & G. V. Twiss. January 27th, 1916. [100.233].
- 1.635. ELECTRIC JOINT. G. H. Scholes. February 3rd, 1916. (Addition to 9,655.) [100.239].
- 3.359. ELECTRIC CAR-LIGHTING EQUIPMENTS. Albion Motor Car Co. & T. B. Murray. March 10th, 1916. [100.243].
- 4.575. HOLDERS FOR INCANDESCENT ELECTRIC LAMPS. J. Salt. March 28th, 1916. [100.250].
- 6.629. MEANS FOR TELEPHONIC COMMUNICATION TO AND FROM MOVING RAILWAY TRAINS AND THE LIKE. V. G. Werner & K. H. Warfvinge. May 11th, 1915. [100.453].
- 9.193. TELEGRAPH TRANSMITTING APPARATUS. W. J. Mellersh-Jackson (Western Union Telegraph Co.). November 4th, 1915. (Divided application on 15,579/15.) [100.278].
- 11.397. MEANS FOR TELEPHONIC COMMUNICATION TO AND FROM MOVING RAILWAY TRAINS AND THE LIKE. V. G. Werner & K. H. Warfvinge. August 21st, 1915. [100.281].

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NATIONAL ADAPTABILITY IN WAR TIME.

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AGAIN and again during the war, as the Allies' policy has been developed by the course of events, we have found it necessary to alter our manner of dealing with many matters. What seemed to be a proper decision and policy at one particular stage was not suited to another, and we have had to adapt our methods, and our arguments relating to them, in accordance with the changes. Looking backward after two and a quarter years of warfare such as the world has never witnessed before, we have to recognise changes that might under some circumstances be regarded as strange inconsistencies of conduct, but which considering all things have not been inconsistencies at all, and for which no excuse is needed bearing in mind all the exigencies—that could not possibly be foreseen—that have arisen.

It may be interesting to review some of the points that we have in mind; we are led to do so by the issuing of a notice by the Board of Trade, which appeared in our last issue, expressing its willingness now to entertain applications for provisional orders in the ensuing Parliamentary session if it can be shown that the establishment of works under the schemes proposed will be proceeded with as soon as practicable after the war. Last year the Board intimated that such applications would only be considered where extreme urgency could be shown to exist. As our readers are aware, some electrical undertakings, by virtue of war demands, have received special facilities, but others have had to defer all extension work involving the expenditure of new capital, and among these there have been cases of extreme difficulty leading to the stoppage of electrical progress. Indeed, there are places where new connections, not only will not be handled during the war, but the restrictive conditions are expected to obtain for some time after the war, until new plant is available. When the first shock of war shook the nation, actual experience, as well as apprehensions, led to an appeal being made to authorities at home and in the colonies asking them not only to refrain from cancelling contracts already placed, but to assist British works over a period of industrial emergency by giving them all the business possible. The late Lord Kitchener in those days issued his appeal for men, and our class of workers from all ranks, high and low, hastened to the Colours, manufacturers in many cases giving inducements of all kinds to assist the movement. But the kaleidoscope of war soon made the first of its so frequent changes, and munitions, unlimited munitions, became the clamorous demand. Then in place of the appeal for contracts to keep the factory

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wheels turning, came the discounting of private work and the imperative demand for the whole available suitable manufacturing capacity to be reorganised and readjusted, and much more to be added, for the purposes of war requirements. It was becoming apparent that it was an engineers' war, and nothing that hindered the provision of the necessary material could be permitted. Private manufacturing and contracting operations had to a large extent to be set aside. Buyers abroad who had only a little while before been urged to buy were now being disappointed in deliveries, and found that the Mother Country was so busy with her war work that she could not meet their needs, at any rate with the promptitude they desired. Some of them could not, or would not, wait—they turned to neutral countries; and these are now still supplying them, perhaps to a greater extent than the present situation requires, but others patriotically deferred their orders, preferring to suffer inconvenience for a season, until circumstances perforce compelled them to defer action no longer. To-day, as the organisation of our industries has been highly developed, and as vast new factories and equipments have been put down and large accessions of new labour of both sexes have been trained; the pressure of Government demands upon private factories is relieved somewhat, and they are freer to undertake certain classes of manufacturing. In the early months of war, when it was unknown how essential skilled engineering workers would be, because it was overlooked that we were to fight the entire and enormous industrial system of Germany organised for war, engineering and allied workers flocked to the Colours. But, later, when the demand for engineering munitions was beginning to be understood, the pressing need for skilled workers occupied our serious attention, and factories, from which by inducement and encouragement sometimes of a liberal kind, the exodus was facilitated, urgently needed their workers back again. In some cases they were selected and returned from the fighting line, or when home on sickness, on leave, or slightly disabled, were returned to their then very essential service at home, other fighting men being available to take their places. Then the demand was for more munitions, and those were anxious days for the Allied cause, such as we trust, and are assured, will never return. To-day there is another kaleidoscopic turn in process, and the cry once again is for more men. Thanks to the new factories and to the new and diluted labour, and the co-operation of the workers, the munition-making facilities are all that are required, and when the Minister of Munitions becomes Minister of War, with all his experience of the munitions problem, the unbudging of the unessential is found to be the most important need of the moment. The appeal is for the younger men, whether skilled or not, after having served their country well in her hour of need, to take their rightful place with the fighting forces and allow others to take their place, if need be, at the bench. Whether munitions work has been turned to as an accommodating shelter by those who should have been more ready for the other call is not our concern here; munitions were urgently needed, and the need was well met, and those who worked at them had, in most cases, their full reward. We had to feel our way gradually, doing what seemed to be the best thing at the time. Many of the badged, we believe, were anxious to fight, and will welcome the withdrawal of the badge; others were not so, and they are being led aright. What is now the unquestionably strong feeling of the country is that no young man shall be badged to-day who is not really absolutely indispensable, and upon the interpretation of this word will probably rest the revision of

the lists of certified occupations. Industry, not slow to recognise the necessity for loyalty to the greatest cause ever fought for, will not withhold its co-operation in this difficult matter.

The latest change in the scene, to which we have referred in our opening remarks, is as hopeful as it is interesting to industry. It is not a change either in engineering works policy or in the department of labour. It amounts to the removal of an embargo on enterprise, and it is a further illustration of the fact that if we "leave after the war to look after itself" we shall be neglecting certain very serious responsibilities. If we are going to find work for all our factories, so as to give "work for all" who need it, we must look ahead, and the Board of Trade is to be congratulated upon its timely announcement, though it may be it is rather late for the coming Session if notices have to be lodged by the usual date. Under stress of war demands it was necessary to put obstacles in the way of expenditure upon certain kinds of works, as we have stated. Further, there was neither the time nor the disposition to discuss the details of works that could reasonably wait. To-day most people see the need for preparing for another state of things than that prevailing just now, and they remember that preliminaries in connection with certain classes of public work do not generally suffer from too much expedition. The Board, in intimating to the Society of Parliamentary Agents its willingness to entertain proposals, recognises that the position has altered since last year's notice, and it is now ready to consider applications for provisional orders which will make work soon after the war ends, and will afford an outlet for labour or for the utilisation of plant and machinery which have been provided for the purposes of war.

It is, of course, necessary to include a reservation to the effect that the policy of the Board in dealing with these applications may be subject to further modification "in the event of a change in the general situation due to the war." This is as it should be—optimism is good, but cocksure miscalculations we prefer to leave to the Prussian mind. The announcement is a reminder to us that, though there will be changes, strange, pathetic, and remarkable in almost every walk of life after the war, there will be some things going on much the same as before—we shall be applying for provisional orders for gas and water works, docks, electricity works, tramways and light railways, and providing a certain amount of work by these means. The Board of Trade and Parliament will probably do their utmost under the altered circumstances to expedite approvals, and will not so often obstruct enterprise as in the past, because work for all will be the aim of all. The announcement may, we think, be considered to be one small item in the whole programme of preparation for Demobilisation, and all who are interested in electrical and other public concerns should have their plans prepared in good time. The matter should be attended to now as far as that is practicable without in any way interfering with the progress of the vital operations connected with the war.

Copper. THERE has been a phenomenal demand for copper again in the last few weeks, chiefly in connection

with the constant requirements of belligerent countries of the Allies' side, and this has obviously done much to accelerate a further upward movement in prices for all kinds of material, whether of copper itself or allied products. The big trans-Atlantic producers have made huge sales of refined metal to domestic consumers and for export combined, and there is not now much doubt that the market is bare of supplies for anything like near deliveries,

so that the tendency remains entirely in favour of holders. The cost of electrolytic now ranges from about £138 upward, according to position, but the high prices under present abnormal conditions do not seem to have much effect on the attitude of consumers, whose anxiety at this juncture is to have their needs well provided for in anticipation of further tightness over the winter months. War needs admittedly have been covered well ahead, but the fact remains that with but little to be had, American views, having regard to the future course of the market, are more optimistic than ever. American manufacturers are conducting operations on an unprecedentedly heavy scale, which is likely to continue for an indefinite period, so that the current refineries' output must be expected to be fully taken up in view of the heavy contracts awaiting execution for export. It is probable that the unsold stocks on the other side have, in the last few months, practically disappeared, for the exports were not only abnormally heavy, but the deliveries from the refineries were rather short of actual needs, due to the setback in refinery operations during the hot months. The refinery output, as a matter of fact, is still considerably short of the huge tonnage reached towards the middle of the year.

Operations are now steadily improving, but it is doubted whether the output will be restored to high-water mark until the early months of the coming year, when new refinery capacity becomes available. Supplies from other sources than America are for the present limited, since producers in that direction too are very well sold ahead. Shipping arrangements for Russia have been for the present about completed, but it is probable that gaps will have to be filled elsewhere this side of Christmas, which is likely to keep the tendency on the firm side. The total shipped by America during June, July, and August represents some 107,000 tons, which compares with about 52,000 tons for the same period in the previous year, an increase of 55,000 tons. The fact is worth noting that America is now also shipping much larger quantities of manufactured copper to this side. The apparent growing scarcity of metal, as indicated to some extent by the absurdly small quantities left in official warehouses, has dominated the market for standard copper, which has again risen steadily up to about £118, for near delivery, which commands a big premium over the price for forward delivery. Dealings in warrant copper, however, remain in exceedingly narrow compass, as speculation is prohibited. The demand from sulphate makers has abated somewhat, but rough Bessemer copper is held for full prices. At the extravagant level of values ruling, there is naturally more inducement to push production, and there should eventually be more than sufficient metal to go round, but for the present buyers are largely in the hands of the sellers.

The Reorganisation of Industry.

We recently drew attention to the excellent address delivered by Mr. Gerald Stoney at the meeting of the British Association, in which the President of the Engineering Section dealt with the internal reorganisation of factories with a view to the attainment of a higher degree of efficiency of production. In his presidential address to the Economic Science Section, of which we conclude an abstract in this issue, Prof. A. W. Kirkaldy discussed, with equal insight and understanding the broader problems of external reorganisation which will arise in the near future, and which demand the most earnest consideration of employers and workers. Referring to the immense economic waste entailed by the war, he pointed out that, after all, there was a brighter side to the question—it was not all dead loss. Both morally and physically the nation had benefited from the bitter

lesson it had learnt, and its faults and weaknesses had been remorselessly laid bare, the first essential to their amendment. So far as our industrial future is concerned, Prof. Kirkaldy is distinctly optimistic; he holds that American and Japanese competition will not materially affect our foreign trade, and that our chief opponents in the industrial field will be the Germans, who possess appreciable advantages and will exert every effort to regain their old position in the trade of the world, no matter what the cost. This is indeed their only hope; and if we return to the condition of industrial strife and friction that prevailed in this country before the war, we cannot hope to be successful in the conflict—nay, rather, our failure is a certainty. Above all, our rate of production must be maintained at the highest possible value.

Yet our Government has undertaken to restore all the trade union agreements and restrictions that have been waived during the war—and that guarantee must certainly be fulfilled, if the workers demand it; but will they? Surely the lessons of the war will not have fallen on deaf ears; a nation that could rise to the height already attained in this great crisis is not a decadent or stupid race, and we confidently look forward to the manifestation of enlightened views on the part of the workers when the time arrives for the resumption of their normal occupations. But it is not only the workers who have lessons to lay to heart, and Prof. Kirkaldy insists on the necessity of fundamental reorganisation of what he calls the "Industrial Army of Labour"—including under this head the captain of industry equally with the unskilled labourer. Our business men, he says, have hitherto worked as independent units; in future they must combine their forces, and work as members of associations—not with the lack of sympathy and co-operation that has been so deplorably manifest in the past, but with sincerity and zeal. How often have we complained of the inveterate prejudice against hearty and complete co-operation that has betrayed itself whenever attempts have been made to bring British manufacturers together for a common object! Unfortunately, as the professor states, not only has half-hearted adhesion been given to such movements, but also there has been a lamentable want of loyalty to agreements entered into by associations on behalf of their members. This want of loyalty and tendency to isolated and independent action has been still more strongly in evidence, because more publicly displayed, in connection with the workers' trade unions, and Prof. Kirkaldy truly declares that in both cases success depends on *absolute loyalty to the pledged word*—without which industrial harmony cannot be achieved.

For the details of the system of organisation which he proposes we refer our readers to the abstract of the address. His remarks on the subject of the return of the Army to industrial pursuits are also worthy of attention, and in this connection the report of the committee on the replacement of men by women in industry, abstracted on a later page, is of interest. It is held that, apart from the sad roll of those who have given, and will give, their lives and limbs for their country, many men will not return to indoor life, and at least one million will remain under arms; it should not be forgotten, too, that a large proportion of our citizen soldiers are drawn from other than industrial ranks. Moreover, our financial position is sound, and there is every prospect of a period of good trade after the war. There may even be a marked shortage of labour, in spite of the greatly increased adoption of automatic machinery and improved methods of production consequent upon war conditions. We look forward to the future without any qualms, confident that if employers and employed will work together for the common good, our future prosperity is assured.

MUNICIPAL TRAMWAYS ASSOCIATION CONFERENCE.—II.

Goods Traffic on Tramways.

At the recent meeting of the Municipal Tramways Association, Messrs. G. W. Holford, of Salford, and W. Clough, of Bury, read a paper on the "Utilisation of Tramways for Goods Traffic," in which they gave a short history of the subject so far as South Lancashire is concerned, briefly described the operation of goods traffic on several Yorkshire and Lancashire tramway systems, and roughly examined the question of the powers of tramway authorities to undertake such work.

It may be recalled that years ago the Douglas and Laxey line in the Isle of Man and the Bessbrook and Newry line in Ireland both catered for goods traffic.

In the South Lancashire area the object in view has generally been to provide speedier transit than under existing conditions between the manufacturing centres and the Liverpool and Manchester docks.

Mr. Gibbins dealt with the subject before the Institution of Electrical Engineers at Manchester in 1903; Mr. Bellamy touched on it at the Municipal Tramways Conference at Liverpool in 1904, and subsequently the tramway managers in this area have discussed the problem, without, however, finding a solution of the question of loading and unloading facilities.

In 1913, at the Tramways and Light Railways Association Conference, Mr. Edwardes referred to the subject again, and, more recently, Mr. Mallins has considered the conveyance of goods from the Liverpool docks over the Corporation system, but we gather that the Dock Board has not favoured the idea so far. The authors point out that Southern Lancashire is an ideal area for such a scheme: the continuous tramway network of the Corporations of Ashton-under-Lyne, Bolton, Bury, Liverpool, Manchester, Oldham, Rochdale, Salford, Stalybridge, Stockport, and Wigan, together with the Lancashire United and Oldham, Ashton and Hyde Co.'s systems cover 403 miles of 4 ft. 8½ in. route; it has also been pointed out by Mr. Mozley that there is a considerable mileage of 4-ft. gauge interconnected tramways in North Lancashire, and similar interconnected tramway systems exist in West Yorkshire, although we believe there is a considerable variation in gauge in the latter case, which would complicate the use of the track by purely tramway vehicles for through traffic, though, of course, it would not prevent the development of a local goods carrying service such as was recently suggested by Mr. J. B. Hamilton, the manager of the Leeds tramways for his city. The authors point out that under municipal management traffic can be dealt with on well organised lines with fares and services fixed on an equated basis, but if half-a-dozen or more private individuals were catering for passenger traffic then disorganisation would follow; they think that similar organisation would also benefit the transport of merchandise over certain areas, and urge that it is a matter for consideration of the whole of the parties interested.

Amongst the various instances of goods carriage on tramways, the authors cite Burnley, where a goods wagon was propelled in front of an ordinary car for the conveyance of heavy parcels weighing between 56 lb. and 5 cwt. The charges were based on 3d. per cwt. per package with a minimum charge of 3d. The financial results were not satisfactory, and the daily running of the wagon has been abandoned, but it is now run for a guaranteed load of not less than 4s. carriage.

At Glasgow the Corporation track is used for the conveyance of material from a railway station to one of the shipbuilding yards, a distance of half-a-mile, for which the Corporation charges 2d. a mile; the company uses an electric locomotive for hauling and 1d. per unit is also charged for electricity; as much as 160,000 tons per annum has been dealt with.

Since 1904 the Huddersfield tramways have carried coal from the railway to three different mills, two of which are three miles distant, and the other five miles. The Corporation siding to the railway cost £1,243, and the other sidings were built by the mill owners. Two self-propelled

tramway trucks were built, each equipped with two 45-H.P. motors. During the year to March, 1916, 12,121 tons of coal were carried.

In 1910 the Leeds Corporation tramways carried some 30,000 tons of sand for the waterworks department, a distance of 3½ miles, suitable wagons with hoppers being provided. The revenue was, roughly, £1,900, and a satisfactory net profit resulted. More recently an agreement has been entered into for carrying fireclay and coal for a local firm, a distance of five miles, across the city, and Mr. Hamilton, the tramway manager, is preparing a scheme for general mineral and goods carriage over the city tramway system (as already mentioned in our columns).

Many tramway undertakings convey their own permanent-way materials, and some special parcel-carrying vans have been provided.

The authors quote the judgment of Mr. Justice Farwell, in the High Court, in 1906, in the action by Messrs. Sutton and Co. for an injunction to restrain the Manchester Corporation from acting as carriers or delivery agents except on their tramways, and from expending any of the Corporation moneys for that purpose. They then inquire briefly into the powers of tramway authorities in the matter of goods conveyance, and come to the conclusion that (1) tramways have powers to convey goods on tramways; (2) that no difficulty need be anticipated in obtaining consent to run attached vehicles; (3) that there is no power granted to construct lines into railway or mill yards which are not owned by the Corporation, and that such lines would have to be privately constructed—although this view was contradicted in the discussion.

The authors point out that although the original 1870 Tramways Act apparently intended that, if necessary, the same vehicle should be used on tramways and railways, later Acts (such as the Salford and Bury Corporation Acts) contain a clause expressly prohibiting the use of railway vehicles on tramways; on referring to the Standing Orders relating to Bills deposited in Parliament, it is found that provision is still made for the running on tramways of "carriages or trucks adapted for use upon railways," and the authors conclude that the prohibition clause has been inserted into Municipal Acts which only provide 9 ft. 6 in. between rail and kerb, to comply with the Standing Order covering that matter, which, no doubt, is to provide for the greater overhang of railway vehicles.

Railway wagons cannot run along tramways as at present constructed, because the overhang is much more than the tramway allowance of 11 in.; also, the railway wheels are 5 in. wide, with a 1-in. flange. Tramway wagons cannot be used on railways, because the wheels are too narrow to pass over the gap of 4 in. in railway crossings and the flanges too small to safely negotiate curves.

The authors consider that for transit between towns some distance apart, with loads of a moderate character, tramway charges would be cheaper than present railway charges; taking 25 miles, and making no allowance for return load, the tramway rate would be 41s. 8d., or 4s. 2d. per ton, whereas an actual railway rate is 13s. 2d. per ton, and this leaves a large margin out of which to provide warehousing or loading facilities.

Sidings might facilitate the collection of goods, but would involve more points and crossings, which are undesirable on passenger routes, and in narrow streets sidings are impossible.

Mr. Edwardes, in his paper, said he found that the small amount of tonnage handled in the average mill would not pay interest and sinking fund on the cost of a siding.

Traffic between adjacent towns, the authors think, can only be done by the use of a vehicle which could use the tramways and yet be on equal terms with independent vehicles in the handling of goods: the same consideration applies to traffic between dock and railway yards and mills and warehouses.

A vehicle of the type indicated has been introduced by Mr. C. J. Spencer, manager of the Bradford tramways, and was illustrated and described in our issue of May 19th last.

Between May 15th and June 17th this vehicle (which consists of a railless trolley vehicle adapted for use over the tramway route and fitted with a battery to enable it to operate independently when necessary) ran 741 miles.

carrying 247 tons and earning £71; and making allowance for periods when it was withdrawn for private reasons, the earnings would have been £91. The estimated first cost is £800 or £900.

Mr. Spencer considers that it would cost £10 per week of 6 days, running 240 miles, to operate, as against £12 5s. for a petrol vehicle.

MR. C. J. SPENCER (Bradford), in opening the discussion, congratulated the authors on their paper; the subject was most opportune. They had to consider how they might assist in the transport problems of the future, and it was necessary to ascertain whether tramways could be used for goods traffic on a financially successful basis. On the basis of the cost of operating their cars at present, it might cost, say, 2d. per ton-mile to handle goods traffic, and although the latter cost might be increased under goods transit conditions, there would be savings in capital cost, tickets, conductors, &c. Goods traffic would improve the tramway load factor. Electric power was considerably cheaper than petrol power, but other conditions had to be studied; from the public point of view, the cost of road provision and maintenance should be charged to petrol costs. Would the proposal reduce street congestion? He thought the public control of goods transit would result in as much improvement as in the case of passenger transport. It was a question of substituting an organised for a disorganised system.

MR. H. MOZLEY (Burnley) said the railways did not care to be troubled with the short local traffic round towns. There had been difficulties in carrying goods on tramways on account of statutory charges; now these difficulties were to some extent overcome. Night traffic would, however, be intolerable, and goods traffic could be worked in with the passenger traffic during the day. At Burnley they were endeavouring to cater for the "carrier" traffic to the outskirts, and this required a combined "road and rail" vehicle, which, he believed, was the solution of the problem. If they were to adopt the Bradford system, they would have to go to Parliament for fresh powers to use heavy motor vehicles. He pointed out that, contrary to the authors' statement, his Council had powers to build sidings into works, and he thought others had also.

MR. J. B. HAMILTON (Leeds) said there were two points of view; one was the relief of traffic congestion, and the other point of view was the financial one. In Leeds they had superseded cumbrous steam tractors, and he believed that they could deal with mineral at less cost than was possible with steam or petrol. They were satisfied that they could not touch the business with the statutory charges, and so an arrangement had been come to, and they charged 3d. per ton-mile for the distance of five miles, and were just making it pay.

MR. WILKINSON (Huddersfield) pointed out that the authors' costs for 10 tons at 10d. per mile, would be much reduced if the weight were doubled. Some years ago he had to consider the question of handling 100,000 tons per annum, and he was confident that he could have conveyed the goods on a 3d. per ton-mile rate. The idea was to carry the whole railway truck on a bogie running on the tramways. Similar work had been done in Germany, and in one case he had found a rate of 6d. per truck-mile, using a 10-ton truck.

MR. McLEROY (Manchester) said tramways were originally constructed because it was recognised that a metal wheel on a metal rail gave cheap traction. Passengers collected and delivered themselves; but immediately they considered the carriage of goods, the question of terminal facilities arose. Tramways would be quite suitable for this if sidings into works could be made. He felt that in view of the great progress made in petrol, steam, and other vehicles, they must hesitate before they agreed to tackle the general problem of goods carriage.

MR. CLOUGH (Bury), in replying, assured them that 3d. per ton-mile was a paying rate. They had not suggested night traffic, as there was plenty of opportunity to deal with it in the day. He agreed that powers would have to be obtained to make use of vehicles such as those employed at Bradford, for regular goods traffic.

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1,693 X. Workmen (other than those engaged in the manufacture of porcelain parts) engaged in the manufacture (including assembling) of small electrical switches, fuses and lampholders.

1,694 X. Workmen engaged in the manufacture of electrical batteries and accumulators.

1,760 X. Workmen employed by switchgear manufacturers, and engaged in drilling slate bases for electrical machinery which is intended for use in war, or in the manufacture of munitions of war.

1,793 X. Workmen engaged in making wooden crates for packing purposes.

1,814 X. Workmen engaged in making small ebonite or vulcanite parts of electrical appliances such as magnetos, sparking plugs, &c. (and not covered by decision A 1,230, see *Board of Trade Journal*, January 2nd, 1913).

1,818 X. Workmen engaged in the manufacture of metal filaments for electric glow lamps.

1,853 X. Workmen described as machine or hand nailers, hoopers, dovellers, conveyor attendants, or truckers engaged in connection with the manufacture of wooden cases.

1,914 X. Workmen employed wholly or mainly in the manufacture or repair of telephone and telegraph instruments and signalling apparatus.

Cables, Overhead Lines and Street Lighting.—1,711 X. Workmen employed by electric cable manufacturers and engaged in (1) stranding wire, (2) insulating with rubber or gutta-percha, and (3) lead sheathing and armouring.

1,713 X. Workmen engaged in the manufacture of rubber solution.

1,805 X. Workmen engaged in proofing flax, jute, cotton, asbestos or other fabrics with rubber.

1,806 X. Workmen engaged wholly or mainly in the manufacture of carbon electrodes for use in the production of munitions of war.

Generation and Supply of Electrical Energy.—1,763 X. Workmen employed by coke manufacturers and engaged wholly or mainly in connection with the operation of by-product plant for the recovery of light oils or other chemicals from the waste gas or tar.

1,764 X. Workmen employed at gas works or at gas by-products and engaged wholly or mainly in the distillation of tar or in the extraction of light oils from tar or oil.

1,807 X. Workmen engaged wholly or mainly in the manufacture of carbide of calcium.

CONTRIBUTIONS ARE NOT PAYABLE FOR

Electrical Engineering.—1,695. Workmen (other than metal filament and metal cap makers) engaged in the manufacture of electric glow lamps, unless these are intended for use in war.

1,714. Persons described as calibrators or test-room assistants and engaged mainly in calibrating or testing electrical instruments.

1,785. Workmen engaged in the manufacture of metal conduit fittings for electrical conduit tubes, including assemblers, enamellers, finishers, packers, and general labour employed on the premises in connection with such manufacture (excluding workmen engaged in ironfounding in respect of whom contributions are payable under Part II of the National Insurance Act, 1911).

Cables, Overhead Lines, and Street Lighting.—1,665. Workmen employed by a rubber merchant, and not employed in connection with the manufacture of rubber or rubber goods.

1,710. Workmen employed by electric cable manufacturers and engaged in insulating cables with paper, fibre or similar material other than rubber or gutta-percha not intended for use in war.

1,789. Workmen (other than those engaged in the manufacture of rubber thread) engaged wholly or mainly in the manufacture of elastic, or rigid brads or webbing.

Generation and Supply of Electrical Energy.—1,848. Workmen employed by coke manufacturers, and engaged wholly or mainly in connection with the working of the coke ovens, and not covered by decision 1,763 X (see above amongst "payable" decisions).

1,905. Workmen engaged in the outdoor repair and maintenance of overhead, third rail, conduit, surface contact or cable equipment of railways, tramways, light railways or electric power supply undertakings.

1,906. Workmen employed by electricity supply companies as meter fixers or readers, fuse hands, crane men, boiler cleaners, or in any of the occupations set out in decision B 264 (*Board of Trade Journal* of July 4th, 1912) (also see p. 277 *ELECTRICAL REVIEW*, August 16th, 1912).

THE NATIONAL INSURANCE ACT, 1911.

UMPIRE'S DECISIONS ON UNEMPLOYMENT INSURANCE.

By JOS. J. H. STANSFIELD, F.C.I.S.

FOLLOWING the passing of the National Insurance (Part II) (Munition Workers) Act, 1916, and the order of the Board of Trade dated September 1st excluding certain classes of munition works from unemployment insurance, a large number of applications have been made to the Umpire for his decision as to whether contributions are or are not payable.

As some of these decisions affect the electrical industry, they are given below as advertised in the *Board of Trade Journals* issued up to September 28th, 1916. Decisions in which the Umpire has decided that contributions are

In 1912 the Board of Trade made an order exempting drivers and attendants of any vehicles, and stablemen or other workmen employed in attending horses or cleaning any vehicle. This has been slightly modified by decision 1,866 X, which states that "drivers or attendants of vehicles employed in connection with insured trades, and employed mainly on the premises on which such trades are carried out," must be insured for unemployment insurance.

GAS AUTHORITIES AS SUPPLIERS OF ELECTRICITY.

By J. W. NAPIER.

At the annual meeting of the North British Association of Gas Managers at Edinburgh, on September 1st, Mr. J. W. Napier, of the Alloa Gas and Electricity Works, read a paper, of which the following is an abstract.

The object of the author in presenting this paper is to create an interest in the supply of electricity as an agent in providing light, power, and heat for public needs, and to show that the dual supply can most profitably be given by the existing authority for gas supply—company or municipality—having regard to the economics of the question from the point of view of both the supplier and the consumer. The author does not wish to discuss the merits of the illuminants as such, or, indeed, to consider gas and electricity as rivals—this is a fast disappearing conception, and happily so—and disclaims any idea of opposition to purely gas interests. It is not intended that this review of the subject should have reference to the larger towns or to areas already supplied by electricity authorities having Parliamentary powers.

In these times of change and overthrow it becomes us to take a fresh perspective of events and conditions of things so that the horizon of our outlook may be widened and the scope of our responsibilities broadened and strengthened. In this regard the trend of things has undoubtedly been towards centralisation of supply, no matter what the commodity may be. Competition as a factor in serving the public interests most economically has been of great value, but it may be carried beyond the limit of sound judgment, and it is to be remembered that the supply of gas and electricity as a monopoly in the hands of one party has the safeguarding and watchful control of Parliament. The author is aware that in Scotland several gas supply companies have for some time past been seriously considering the supply of electricity. There are several instances where Parliamentary power has been granted to gas companies for electricity supply, notably the Tottenham District Light, Heat, & Power Co.

The Alloa Electric Lighting Order was obtained in 1899, and the Town Council immediately concluded an agreement with a company for a bulk supply to be continued during a minimum period of 14 years. The arrangement was that the Corporation took delivery of the current at a sub-station in the town, and thereafter themselves undertook the distribution, having provided and laid down at their own expense the street cables. The arrangement for supply from the company was doomed to failure, and this was entirely due to the excessive rates of charge imposed upon the Town Council. In order to end the unfortunate position of affairs, after ten years the arrangement with the bulk supply company was terminated by mutual agreement, the Corporation to pay an indemnity of £3,000, spread over a period of six years. The full sum has now been paid.

It was now possible to decide upon the erection of a station. The gas works site was utilised, and has proved most satisfactory.

Suction producer gas plant with gas engines was decided upon as the most economical type of plant, best suited to the local circumstances.

In 1910 the plant first put down consisted of one 85-B.H.P. and one 140-B.H.P. gas engines with dynamos direct coupled, with one producer gas plant for use with gas coke, and a storage battery (Tudor) of 221 cells and capacity to meet the demand after 11 p.m. and on Sundays. In 1911 a twin-cylinder horizontal type engine of 250 B.H.P., with generator, was installed, with two separate sets of producer gas plant for use with coke. In 1914 the demand for electricity had increased to an extent that required more generating plant. A much larger unit of plant was now installed—a vertical engine of 600 B.H.P. with eight cylinders, together with two sets of producer plant of ample capacity. A cooling tower was erected with duplicate centrifugal pumps, motor-driven. With an arrangement underground and overhead water tanks and pumps the water required for the producers is circulated through the scrubbers over and over again, it being only necessary that the water be cooled sufficiently. The scrubbers while fed with a constant supply of water do duty chiefly in cooling the gas, there being no impurities to absorb except sulphur gases. When some qualities of anthracite are used in the producers, or gas coke from horizontal retorts, very great

care must be taken to clean the gas thoroughly from traces of tar. With the use of vertical-retort coke, however, all tar troubles immediately cease, the volatile matter in this coke being practically nil.

The supply is on the three-wire system, 220 volts for lighting and 440 volts for power. Since 1914 the output of current has rapidly increased, and at the present time a 700-B.H.P. vertical engine and generator are in process of erection, on the same lines as that already described.

The increase in the output of energy is shown in the following statement:—

Year.	CONSUMPTION OF ELECTRICITY.				Max. load on feeders, kW.
	Private Lighting.	Power.	Public Lighting.	Total.	
1911	55,460	13,922	28,938	98,320	85.0
1912	59,145	92,015	27,397	78,557	105.6
1914	88,037	247,060	24,845	360,942	229.0
1916	135,821	642,347	11,794	780,963	440.0

It will be observed that the greatest increase has been for power purposes, and this has had a very important influence on the working results and success of the station.

Regarding cost of production, the following statement gives the working results for the past year:—

	Amount.	Pence per unit sold.
Fuel	£4,767 0 2	0.23
Oil, waste, water, &c.	863 11 10	0.11
Wages of workmen	951 10 5	0.29
Repairs and maintenance	432 4 9	0.13
Rents, rates, taxes	114 8 9	0.04
Management, office, and legal expenses	150 6 8	0.05
Insurance of plant	187 11 1	0.05
Total	£2,975 13 8	0.90

The price charged for coke was 13s. per ton.

For stations of the size of Alloa, gas-engine driven generators and producer gas plant undoubtedly provide low works costs, and our experience has amply proved the wisdom of the choice of plant.

The prices charged to consumers are for lighting, 4d. per unit; for power, from 2d. to 0.8d. per unit. An extra 15 per cent. on power and 5 per cent. on lighting will be charged until further notice.

FINANCIAL RESULTS.

Revenue—		
From private lighting	...	£1,988
From power and heating	...	2,832
From public lighting	...	123
Rents, royalties, &c.	...	13
Total	...	£4,956
Working costs	...	2,976
Gross profit	...	£1,980
Gross profits—		
Before providing for interest, &c.	...	£1,949
Per cent. to capital outlay	...	5.96
Interest	...	949
Sinking fund	...	987
Surplus	...	44

In using coke as the fuel for the production of electricity a product of the distillation of coal is being utilised, the raw coal having been consumed in the vertical retorts in a scientific manner, yielding a satisfactory heating gas for industrial and domestic needs, as well as a smokeless solid fuel, and the other valuable by-products, tar and ammonia. This aspect of the generation of electricity from gas engines with producer gas made from gas-works coke as the fuel is of extraordinary importance from a national standpoint, having regard to the wasteful use of coal direct for electricity generation. The combination of gas and electricity production in the manner outlined is a singularly good example of realising in a highly economical way the value of coal.

The producer plant in use at Alloa is of the suction type, and therefore the nitrogen value of the coke has not been recovered as ammonia. The installation has been too small to warrant the capital expenditure for recovery plant, but with the horse-power of engines now installed a scheme for producer gas plant on the Mond type with recovery plant has been determined upon. Conditions of war have prevented the expenditure of money on new plant, and the installation has therefore been delayed in erection. The conception of the scheme is as follows:—Coke contains about 1 per cent. of nitrogen, and the results of experiment on the large scale have shown a yield of 30-40 lb. sulphate per ton. The Mond plant will be erected on the gas works site, and a supply of producer gas will be afforded to the gas works for heating the retorts, and to the electricity station for driving the gas engines. The gas works are already equipped with plant for the manufacture of sulphate, and this plant will in part be available.

The strongest evidence I can bring to prove that electricity has a permanent place in public demand coincident with a large consumption of gas, and that competition does not enter in to destroy the interests of either department, is an example

of the gas and electricity supply of Alloa. For many years Alloa has enjoyed a low rate for gas for lighting and cooking, in pre-war times 2s. 1d. to 2s. 4d., and a specially low rate of 1s. 4d. to 1s. 10d. for power. Every facility has been given to consumers to take advantage of the use of gas, with the result that for a population in the area of supply of 17,200, the gas manufactured per annum is equal to £40,000,000 c.f., considerably higher per consumer than most towns in Scotland.

As regards the consumption of electricity, it will be noted that the annual output has increased from about 100,000 units in 1910 to about 600,000 units in 1916. The author is not conscious of any collision of interests in the supply of the two forms of energy—new consumers are not lost, as they are bound to come to us for supply—and is only concerned with the joint success of the two works forming one department of business. Consumers demand whatever form of energy is most convenient and best suited to their requirements, and they are supplied accordingly. A showroom was recently opened in which there is exhibited lighting, heating, and cooking apparatus for both gas and electricity.

The directors of a gas company in considering a scheme for electricity supply may reasonably conceive that by embarking upon an electricity scheme the consumption of gas will be lessened, and electricity take its place. Such a view is dangerously wrong. Of no area of gas supply can it be said at the present time that the use of gas has reached the utmost limit, and an increase in consumption for domestic use, as well as for industrial needs, should yield an increasing output from year to year. To embark on an electricity supply scheme would simply be pursuing the same line of business, but by a different avenue. Where electricity is available for lighting it will command a fair share of domestic use, while for public buildings and shops, preference is given to electricity. Further, considering the adaptability of the electric motor, there will be a certain displacement of gas engines thereby, and for larger units of power electricity will be installed.

It will be perceived that with this view of things the advantages and gain will be with the company supplying the two kinds of energy. Provided the area concerned is a suitable one, industrial to be preferred in order to obtain the highly valuable day load, the electricity side of the business can, in my opinion, be made remunerative if diligence is shown (1) in keeping down the capital account, (2) in selecting a type of plant the working of which will be conjoint with the interests of the gas works, (3) that the gas works be selected as the site for the generating station, (4) to dissociate in practice any spirit of competition, and to push the sale of electricity as a legitimate and remunerative business. From the point of view of the interests of the public, it is not desirable that there should be a duplication of works supplying the one kind of commodity, though in two different forms, as the increased cost of production must fall on the consumer.

From the evidence now adduced it may be fairly claimed that the co-existence of gas and electricity supply under one control is at once a practical and commercial proposition. The fresh field of business will appeal chiefly in the case of towns where there is at present no electricity supply. It is my settled conviction that what is required of the gas industry of to-day is a broadening of the basis of its function as suppliers of the public need for energy—gas and electricity. There is small doubt but that gas companies, if they do not prepare the way, will be met in the near future with competition where there is no electricity supply at present. It is a true indication of strength and vitality when an industrial business can comprehend the issues that lie in front of it and, having done so, prepare accordingly.

DISCUSSION.

The President, Mr. ALEXANDER MASTERTON (Edinburgh), said he thought the author had made, out quite a good case for gas authorities taking over the supply of electricity. The strongest argument, to his mind, was the economy which would be effected in regard to the use of coal as a result of the combination. The author's experience and the data he had given ought to be of considerable service and assistance to municipal authorities who were considering the problem of the supply of heat, light, and power. Placed under the jurisdiction of a capable engineer and manager—one without bias either towards gas or electricity—the joint management ought all to be in favour of economical working and the production of these two agents for supply to the public at cheap rates. There was no reason why the two competitors should not work side by side, promoting the interests of each other in the best possible way.

Mr. DAVID ROBERTSON (Dunoon) considered that there need be no rivalry between gas and electricity provided they were under the one control. He thought the author was proceeding on right lines when he suggested that gas companies or corporations ought to have the control of the electricity supply in any one district. If the electricity station was placed in the gas works there was absolutely no doubt but that economy would follow.

Mr. CLARKE (Chesterfield) said he happened to be in the unique position of being chairman of a gas company manufacturing 220 million cu. ft. of gas, and vice-chairman of an electrical company with plant up to 2,500 kw. These two interests were antagonistic and conflicting, and as chairman of the gas company he was suspected of having leanings towards electricity and vice versa. The great point he desired

to make as the outcome of his experience was that the two undertakings were quite separate and distinct, and a particular set of conditions appertained to each. He could see that the combination might be successful in small residential towns, but only there.

Mr. J. W. NAPIER said he had been most careful to point out in his paper that his conception of a joint scheme did not apply to towns of considerable size. In large centres, he frankly admitted that separate management was not only desirable but necessary. Taking a broad view of things, he was satisfied that for towns of a population up to about 20,000 an amalgamation of interests would prove beneficial.

MANCHESTER ELECTRIC VEHICLE TRIAL.

A MOST interesting report is that recently made by Mr. S. L. PEARCE, chief engineer of the Manchester electricity department, to the Electricity Committee of that city, on the trial use of an electric vehicle in place of horse haulage in connection with the work of the department. The vehicle, a one-ton standard G.V. lorry, supplied by Messrs. Drake & Gorham, was fitted with an Edison battery and a 3-h.p. motor capable of 200 per cent. overload for short periods.

The trials were carried out by the testing department, under the direction of the superintendent, Mr. H. A. Ratcliff; the lorry has been employed in the service of the department since the end of March, 1916.

Mr. Pearce mentions that the report deals with the subject on the basis of the actual results obtained, and no attempt has been made to work up a case for the electric vehicle, and that, so far as personal considerations were concerned, he had been somewhat sceptical as to the possibility of an electric lorry being able to compete with existing contract carting arrangements, and also as to the claims made on behalf of the former.

1. *Horse Carting Conditions.*—Light luries were ordered from the contractors as required by the several departments concerned, payment being on a flat rate on a time basis. As an equitable rate a figure of 1s. 4d. per hour has been taken for the purpose of comparison.

2. *Test Conditions.*—It was obvious that if the electric lorry was merely to replace and do the equivalent work of a horse lorry it would certainly not compare favourably, owing to the higher standing charges and the additional running costs. Consequently, it was necessary to reorganise the carting arrangements to a very considerable extent so as to give as nearly as possible continuous employment for the electric vehicle, and also whenever possible reduce the number of separate journeys by combining two or more departmental carting jobs in one round journey.

3. *Driving Arrangements.*—The employment of a special driver appeared to be undesirable; two fitter's labourers were therefore trained for the work. The driver's attendance is not always necessary, and he can therefore be employed on other work, thus reducing the standing charges considerably.

4. *Working Cost of Electric Lorry.*—The figures arrived at (on a liberal scale) are:—Standing charges, 1s. per hour; running costs, 2d. per mile; driver, 7d. per hour during the time he is actually employed with the lorry.

(a) *Standing Costs.*—The standing charges have been calculated on a basis of 2,500 working hours per annum, i.e., 50 hours per week for 50 weeks in the year.

The "life" of the chassis and body has been taken at 10 years, and written down accordingly at 8½ per cent. per annum.

The makers state that the battery will last for at least 10 years, or alternatively for 100,000 miles. The guarantee, however, is only for four years, and five years has been taken as a reasonably safe estimate of the working "life" of the battery, and it has been written down accordingly at 18½ per cent. per annum.

The possible scrap value of the battery after five years' "life" has been ignored.

Interest on the full capital outlay has been allowed at 4½ per cent. The actual capital charges are therefore as follows:—

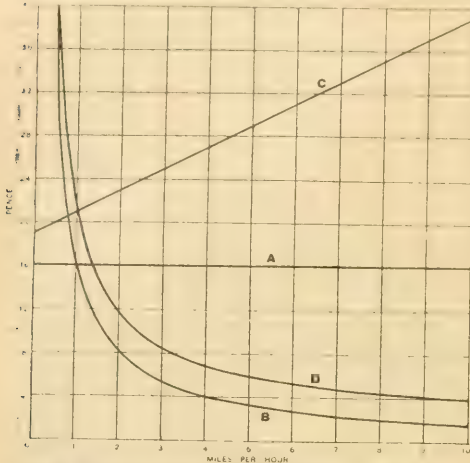
Outlay on chassis, £355, less 5 per cent.	£337	5	0
Outlay on battery, £280, less 5 per cent.	266	0	0
Outlay on body, £100, less 5 per cent.	95	0	0
Outlay on tyres, £25, less 5 per cent.	23	7	5
Outlay on tiller, £20, less 5 per cent.	19	0	0
	675	15	0
4½ per cent. on £675 15s.	30	8	2
8½ per cent. on £384 15s.	33	13	4
1½ per cent. on £266	49	17	6
	113	19	0
Insurance, £100, at 10 per cent.	10	0	0
Two drivers' licences at 5s. each	10	0	0
	£124	9	0

£124 9s./2,500 = 11.95d., or, say 1s., per hour on a basis of 2,500 hours per annum

If the interest rate be taken at 5 per cent, the figure becomes 12.25d. In other words, there is the wages of the driver at 7d. per hour, but this is hardly a true standing charge for the battery at that rate.

Electric lorry costs.—The load is an "off peak" one, and does not cost more than one third of a penny per unit, but in order to cover small incidental expenses the cost of current is taken at one halfpenny per unit.

The vehicle normally requires about 6.5 ampere-hours per mile, which corresponds to about 0.7 kw.-hour per mile; but



CURVES SHOWING VEHICLE COSTS: HORSE, A PER HOUR, B PER MILE; ELECTRIC, C PER HOUR, D PER MILE.

as the efficiency of the motor-generator used for charging the vehicle is only about 70 per cent., the actual consumption per mile is approximately one kw.-hour.

The cost of tires has been based on a "life" of 12,000 miles, and repairs and upkeep of vehicle and battery have been taken at 1d. per mile, which is well in excess of the makers' allowance of 0.6d. per mile.

Tires: 12,000 miles at £25 the set = $25 \times 240/12,000 = 0.5d.$ per mile.

Total running costs per mile:—Current at 3d. per unit, 0.5d.; tires, 0.5d.; repairs and upkeep, 1.0d.; total 2.0d.

5. Comparison of Costs.—From the above results the accompanying curves have been drawn, and they enable the relative costs for any condition of speed to be seen at a glance. The curves show:—

A. The cost per hour for horse lorry and driver.

B. The cost per mile for horse lorry and driver.

C. The cost per hour for electric lorry and driver.

D. The cost per mile for electric lorry and driver.

All the curves have been drawn to a common base of "miles per hour."

The two most noticeable features are:—(a) The cost of the horse lorry per hour is naturally independent of the mileage; (b) the standing cost of the electric is only 3d. more than for the horse lorry, and is actually 4d. less if the driver is not in attendance.

Obviously comparable results can only be obtained by getting more work out of the electric in the same time, i.e., by increasing the average miles per hour.

It has been found that two miles per hour is an average figure for an ordinary horse lorry. For the ordinary carting day of nine hours this gives an average daily mileage of 18, which is a very reasonable estimate.

Before these trials were conducted Mr. Pearce was of the opinion that an electric lorry would only be worth consideration if it could be shown to be capable of doing the work of one and a half horse luries; actual operating data covering a period of four weeks ending May 6th, 1916, plainly shows that the electric lorry is the equivalent of at least one and a half horse luries, work for work, both on the total average daily mileage and also on the average miles per hour.

Referring to the curves, it is seen that at two miles per hour the horse lorry costs 8d. per mile, and a horizontal line drawn through this point cuts the electric curve at 3.16 miles per hour; a condition which the tests have proved to be practically fulfilled.

Owing to the organising of the carting rendered possible by the use of a mechanical vehicle, each journey undertaken has represented the carting of 1.6 departments, and therefore the total work done by the electric is the equivalent of that done by $1.5 \times 1.6 = 2.4$, or, say, two horse luries.

The average cost works out at 7.55d. per mile (instead of 8d.), or $188.1 \times 7.55d. = £6$ per week.

Calculating on a basis of two miles per hour for the horse luries, data shows that the electric is the equivalent of $3.37/2 \times 1.61 = 2.71$, or, say, 2½ horse luries.

The electric lorry is variously estimated as the equivalent of from two to three horse luries, with a preponderance of opinion in support of the higher value.

For 58 hours during the four weeks ending June 3rd, 1916, or an average of 14.5 per week, the driver was actually working as a motor fixer's labourer. This represents a saving on the driving item of $14.5 \times 7d. = 8s. 5d.$

The net cost of the carting is therefore $£6 - 8s. 5d. = £5 11s. 7d.$ for 188.1 miles, or 7.12d. per mile.

Assuming the electric to be the equivalent of 2½ horse luries, the amount saved per week is $2.5 \times £3 6s. 8d. = £6 = £2 6s. 8d.$ (The figure of £3 6s. 8d. represents 50 working hours at 1s. 4d. per hour.)

This calculation makes no allowance for possible reduction in actual driving time. The amount saved in a year of 50 working weeks will therefore be £116 13s. 4d., or nearly sufficient to cover the capital charges on the electric lorry.

6. Total Cost of all Carting (1916).—January £150 4s. 8d., February £131 1s., March £158 8s. 2d., April £109 4s. 3d., May £110 16s. 11d.

Owing to the weather conditions there was a marked reduction in all the carting during the month of February. It is therefore permissible to regard the mean of the January and March costs as a reasonable average value.

The Easter holidays would reduce to some extent the total carting for the month of April, and to allow for this the actual cost is increased by £6.

Average cost per month for January and March	£154 6 5
Average cost per month for April and May	£113 0 7

Actual reduction due to the operation of the electric lorry	41 5 10
Average cost per month of electric lorry	26 0 0

Amount saved by electric lorry per month	15 5 10
--	---------

Taking the weekly cost of a horse lorry as 75s., i.e., 50 hours at 1s. 6d. per hour, or, say, £16 6s. per month, and the electric lorry as the equivalent of 2½ horse luries, then the reduction of the carting account should be: $£16 6s. \times 2.5 = £40 15s.$

This estimated figure agrees very closely with the actual reduction obtained as above.

Were it not for the unduly inflated price of electric vehicles, and more particularly those fitted with Edison batteries, very



STANDARD G.V. LORRY, MANCHESTER ELECTRICITY DEPARTMENT.

much better working costs than those given above could be obtained.

7. Speed.—The first impression of the speed is that it is very low, and it is undoubtedly lower on the average than the makers claim. As the bulk of our carting is in the city area, however, it is at least questionable whether a higher average speed would be much of an advantage. On hills there is certainly room for improvement, but this could only be obtained at the expense of a larger battery and an unnecessarily high and undesirable speed on the level.

The very low speed on hills is the natural result of the characteristic speed torque curve of the series motor, and is further accentuated by the comparatively high internal resist-

ance of the Edison battery. Probably this is one reason why lead batteries are frequently preferred for vehicle work, although personally Mr. Pearce considers that any gain in this respect is more than counter-balanced by the objections attaching to the use of sulphuric acid on vehicles.

The average speed is higher than can be maintained by a horse, and on the level is probably as good as that obtained with a steam lorry; but although better than a horse it cannot equal a petrol vehicle on hills.

On average roads and with average loads the average speed is about 9 to 11 miles per hour, and may under exceptional conditions reach 12 miles per hour. On hilly roads the average speed is 7 to 9 miles per hour, but less if the hills are exceptionally steep.

On a recent trial run 16 miles per hour was obtained on a down grade in Middleton Road, but the road was clear and there were no side roads.

The apparently low speed has not prevented the obtaining of an average of 30 miles per day, and a maximum on one occasion of 50 miles in the day.

It is questionable whether the railway companies' petrol-driven parcels vans average more than 35 miles per day.

As a result of these extended trials, Mr. Pearce recommended the Committee to retain the electric vehicle, stating that he had little doubt, in the light of the experience gained, that electric lorries could be advantageously used for other branches of the department's carting work in preference to horse-drawn vehicles.

filament. apertures at the top of the chamber permit the gas to escape into the outer space and equalise the pressure on the mer-



FIG. 3.—GAS-FILLED CARBON-FILAMENT LAMP.

cury, while the outer wall of the bulb remains cool and can therefore withstand the comparatively high pressure. One form of the lamp is illustrated herewith.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Large Impulse Turbines.

MESSES. FRASER & CHALMERS, LTD., of Erith, who, since 1905, have been developing the horizontal multi-stage impulse turbine, recently supplied to the South Metropolitan Electric Light and Power Co., Ltd., the turbine illustrated in fig. 1, driving a 6,300-kw. alternator at 3,000 R.P.M. The large clearances permissible in this type of turbine, and the diminished axial thrust, rendering a balancing piston unnecessary, are amongst the chief reasons for preferring the impulse to the reaction principle; the small number of stages and consequent short length of the machine are additional advantages, the latest type of Fraser & Chalmers turbine having

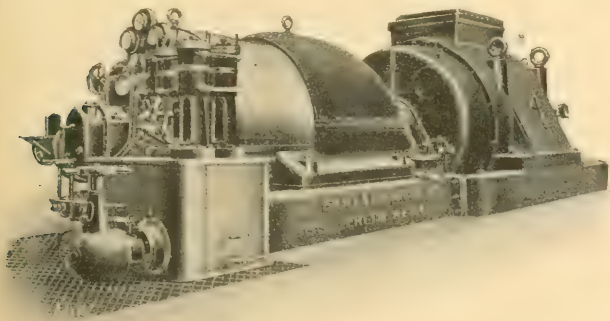


FIG. 1.—FRASER & CHALMERS TURBINE DRIVING 6,300-KW. ALTERNATOR.

one velocity wheel with two rows of moving blades at the first high-pressure stage, and a number of single impulse stages for the rest of the expansion. The turbine interior is also subject to lower temperatures and pressures and possesses close governing characteristics. Nickel steel is used for the blades, which are milled out of square bars together with the fork by which they are fixed to the moving wheel; the method of securing the blades is shown in fig. 2, the velocity wheel being provided with similar blades to those of the single wheels. The design of the turbines has been standardised, and special machinery has been installed for their exclusive production. A small-power impulse turbine of the multi-velocity stage impulse type is also made.

A High-Efficiency Carbon Lamp.

The *Electrical World* describes a new patent gas-filled carbon-filament lamp of German origin, which is said to have an efficiency even higher than that of metal-filament lamps. The bulb is filled at the start with an indifferent gas at a pressure slightly below that of the atmosphere. The filament is of the concentrated helical type, and is supported just above a pool of mercury, which is evaporated by the heat when the circuit is closed. A glass tube surrounding the filament and its supporting conductors and dipping into the mercury forms an inner chamber in which the mercury vapour rises, pushing the inert gas upwards and away from the

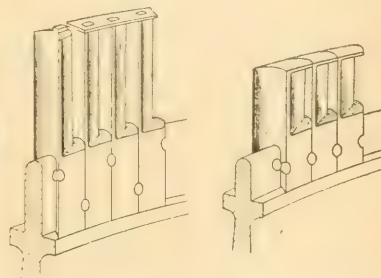
NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

FOR the second time the great Quebec bridge has met with disaster.

A few generations ago it would have been said that the Spirit of the great river was determined that the waters should not be spanned by man, and probably the attempt would have been abandoned. To-day we are more prosaic, and doubtless work on a new centre span will be proceeded with almost immediately. One sympathises with the engineers, whose labours of several years were about to be brought to a successful conclusion, and who must now be so bitterly disappointed.

It is just a few weeks over nine years since the first attempt at



LONG BLADES.

SHORT BLADES.

FIG. 2.—BLADING OF FRASER & CHALMERS TURBINE.

building the bridge failed; at that time 63 men lost their lives. On this second occasion, fortunately, only 13 men were killed, though this is bad enough.

So far, the two bridges have cost about £5,000,000, and yet the river is not spanned.

It is observed that the Council of the I.E.E. advocate the adoption of British standards throughout the British Empire. This would be a great and worthy object to work for, but the Council may be assured that whatever might be accomplished in other of the Dominions, such as South Africa and Australia, it would be no easy task to deal with Canada in this respect, as the influence of the U.S. (already very strongly established so far as standards are concerned) would be almost impossible to counteract.

As has been pointed out in these notes before, too many Canadian engineers get their engineering education and training in the U.S. for British standards and methods to obtain much of a footing here. What is needed is the training of Canadian engineer students in the British Isles, so that they will come back home with a knowledge of British methods and British firms instead of, as is often the case at present, a knowledge of U.S. methods, &c., and a supreme contempt for "old country" ideas.

It is not enough, either, that large numbers of engineers should come from England; the young men born in this country must be given an opportunity to receive their engineering training in

British and American engineers, and the appliances of the latter are being used in the former, and before much can be done to improve the situation.

Some of the most serious defects in the construction of the power lines in the Province are the use of water pipes for the main supply lines, and the use of iron pipes for the distribution lines. The use of water pipes is a very serious defect, as they are liable to rust and breakage, and the use of iron pipes is a very serious defect, as they are liable to rust and breakage. To what extent these prevail may be judged by the Trade Returns of the Province for the year 1915, which show that the ratio of British to American goods was in normal times, about 7 to 1; at present the ratio is about 1 to 1.

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The Dominion Government is reported to have appointed a Commission to investigate the subject of generating some 2,000,000 H.P. at the Niagara Falls. The Commission is to consider the possibility of developing the water power of the rivers in the north of the Province for the benefit of the towns and villages there. It is argued in some quarters, however, that utilisation of the great lignite fields, and even of the immense quantities of the coal of the Province, would be a better and cheaper method of obtaining power than using the available water power, owing to the cost of development and the long transmission lines necessary in this last case.

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The Canadian Niagara Power Co. is installing three more 12,500-H.P. units at Niagara Falls, making the total capacity of the plant 1,000,000 H.P.

In the City of Montreal the Board of Control has before it a report of the Commission of Enquiry into the question of the proposed aqueduct. A number of prominent engineers consider the proposed aqueduct to be unwise, and have requested that the Board have an expert report made on the subject. The Board have in the past recently refused this.

The Hydro-Electric Power Commission of Ontario had a rather serious shut-down on its system not long ago. One of the large oil switches at the Dundas inter-switching station (where the main supply of power comes in from Niagara Falls, and is distributed at Dundas to the various main transmission lines) caught fire and caused serious damage, interrupting the supply over the whole of the Niagara system, covering an area not much smaller than England, for several hours. A somewhat similar, but less serious, accident occurred shortly afterwards at the generating station at Niagara Falls.

The Germans are reported to have been trying to obtain a substitute for switch and transformer oil, presumably because oil is growing scarce in that country. The accidents referred to above, furnish a very good reason why in Canada and other parts of the world a less inflammable insulating liquid should be found as soon as possible. Carbon tetrachloride does not yet appear to be a satisfactory substitute for a good switch oil.

As rates for current steadily come down, as they are doing in Ontario, there will be an ever-widening field for electric heating and cooking appliances. English manufacturers might look into the possibilities of supplying electric water-heaters to fit into the warm-water tanks which are a feature of so many of the houses in the larger towns and cities where a public water supply is available. Heaters for this purpose are already on the market.

WAR ITEMS.

War Saving Certificates.—The "Times" states that one of the largest telegraph and cable companies in London has issued 10,000 War Saving Certificates for its employees all over the world.

Enemy Goods Prohibited in New Zealand.—By Order in Council, the importation of goods manufactured in the enemy's country is prohibited in New Zealand.

The A.L.G. and Shipbuilding.—A further development of the work of the Admiralty in the construction of ships, is the formation of the Admiralty Longitudinal Group, which is to be in charge of the construction of the hulls of ships. The group is to be in charge of the construction of the hulls of ships, and is to be in charge of the construction of the hulls of ships.

Sub-station Lighting.—Prosecution.—The Hull Police Court has heard the case of a man charged with the offence of lighting a sub-station. The man was charged with lighting a sub-station, and was found guilty. The man was charged with lighting a sub-station, and was found guilty. The man was charged with lighting a sub-station, and was found guilty.

Controlled Establishments.—The number of establishments now controlled by the Ministry of Munitions is 4,319, 1,07 having been added since the last announcement.

Trading with the Enemy.—The "London Gazette" for September 29th contains a further list of persons and bodies in the Netherlands, Sweden, and other countries with whom trading is prohibited.

To be Wound Up.—The following companies have been ordered by the Board of Trade to be wound up.

Selas Co., Ltd., Manchester, manufacturers of installations for lighting and heating. Controller: J. P. Garnett, 61, Brown Street, Manchester.

Feld Bros & Co., Ltd., London, E.C., manufacturers of electric wires. Controller: J. E. Percival, 6, Old Jewry, E.C.

Wages in Railway Shops.—Men employed in railway shops are asking for an advance of 10s. a week, and representatives of the craft workers were to meet in London on Wednesday to discuss the position. The application is to be considered at a conference of the railway companies. There are about 1,000 skilled and unskilled men affected. *Daily Telegraph.*

Munitions First.—The Minister of Munitions has issued a notice requiring all persons, firms, and companies engaged in the manufacture of cranes, aerial ropeways, capstans, conveyors, grabs, elevators, hoists, lifts, runways, shear legs, transporters, travellers, or winches, whether operated by steam, electric, hydraulic, pneumatic, or hand power, not to carry out, without a permit issued under his authority, in any factory, workshop, or other premises, any work consisting of the manufacture, assembling, or erection of any of the above-mentioned articles except under:—

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Liquidation of Enemy Firms in East Africa.—The Colonial Office notify that the undermentioned firms are in process of liquidation:—

Hansing & Co., Mombasa, Zanzibar, &c.
Kempson & Co., Mombasa, Zanzibar, &c.
African Handels-Gesellschaft m.b.H., Mombasa and Zanzibar.
Westdeutsche Handels- & Plantagen-Gesellschaft, Mombasa.
W. H. & Co., Mombasa, Zanzibar, &c.
W. H. & Co., Mombasa, Zanzibar, &c.
Alois Schaefer & Co., Ltd., Mombasa.
G. Denhardt & Co., Lamu.

Claims should be submitted by December 1st to the Liquidator of Enemy Aliens, Mombasa, accompanied by: (a) A declaration of the nationality of the claimant; (b) an affidavit supporting the debt and affirming that no satisfaction has been received; (c) a receipt of all documents showing marks of packages and port to which goods were shipped.

Exemption Applications.—At the Shrewsbury Tribunal, the first of a batch of applications applied for by a man aged 25, single, who was employed in making tools and setting lathes for a month. He was the only one they had to do that sort of work. Asked how many women he had working, applicant said two, but some had left. However, he should have more if this man remained. Exemption final for a month was granted.

At Accrington Tribunal, on September 29th, the electrical engineer applied for five employees at the electricity works. Their ages were 25, 39, 25, 41, and 27. Captain Harwood told the Tribunal that the cases came before the Advisory Committee, but on account of there being three young men under 30 years of age among them they declined to have anything to do with them. They felt strongly that the management of the electricity works ought to get older men. The engineer said there were good grounds for making all the applications. The first one, aged 25, had been in the Territorials, was sent out to Egypt, and was there until last April, when he became time-expired. Older men had been tried, but it was found they were physically unfit. Captain Harwood: What will happen if, as an M.P. is proposing, all young men up to 25 or 30, whatever they are doing, shall be called up? The Town Clerk: They will have to do without light and power in Accrington, that's all. Captain Harwood said perhaps they had no option but to give conditional exemption now, but the engineer would have to face the music when it began to play later on. Conditional exemption was granted to all the men.

The Huddersfield Tribunal gave three months' further exemption, conditional on remaining at his present work, to an electrical wireman, aged 31, single, who, on the recommendation of the Tribunal to get work of national importance, was now a munition volunteer worker at Immingham Locks.

Sheffield Tribunal has given conditional exemption to B. C. Smith (33), electrical engineer, appealed for by Messrs. Makin and Co., Ltd.; and until October 31st to E. G. Bradman (37), electrician, appealed for by Messrs. Stuart & Moore.

Epsom Rural Tribunal has granted two months' exemption to Ernest E. Johnson, electrician, of The Lodge, Ordall.

At Aldershot, Mr. Burch, The Arcade, appealed for George Hubbert, electrical wireman and fitter. Captain Croxford asked if Mr. Burch had got any men back from the camp

shops and he replied: "No, they are a kind of for men." Two months' exemption.

Shedfield Tribunal has granted exemption until the end of the year to Mr. W. Johnston (35), electrical engineer.

At Bath, Mr. Geo. Hitchens appealed for the retention of F. J. Hitchens (38), electrical fitter. The appeal was respite for a medical examination.

At Kingston-on-Thames, Mr. H. H. Biden (35), electrician, applying for renewed exemption, stated that he had lost his foreman and all his men, and could not replace them. As all his capital was in the business, he wished to hold it together until the close of the year. He was admitted to exemption until December 31st.

An electrician who appealed at Broadstairs stated that, although unfit for Army duties, he was passed by the Medical Board for service. The Tribunal decided that he should go before the Appeal Medical Board.

An electrical engineer who appealed at Kingston-on-Thames, stated that he had thrice been rejected on account of chronic acute deafness, but was not passed for service in Class C2. The Mayor asked if applicant was of any use to the Army, and Colonel Chapman replied in the affirmative, adding: "The qualifications for C2 are that a man should be able to walk to and from work a distance of five miles, and should be able to see and hear sufficient for ordinary purposes. The Tribunal allowed final exemption to October 1st only."

Mr. A. C. Edwards (37), electrical engineer, of Wedmore, appealed at Bromley (Kent) on personal and business grounds, and was allowed a delay of two months.

The Military appealed to the Bucks Tribunal against exemption allowed to Wilfrid Parmenter (28), electrician at the High Wycombe Electroscope Theatre. It appeared that the local tribunal granted the concession because respondent, passed by the Army Medical Board for home service, was very deaf. The appeal was allowed, and the exemption cancelled.

At Melton Mowbray, renewed exemption was sought by Mr. C. W. Wright for Jesse Atkin, electrician at Saxilby Park. Mr. Wright explained that he was under an obligation to supply an electrician to the mansion, and Atkin could not be replaced. As he was passed for home service, and was acting as a special constable, Atkin was given conditional exemption.

At Newton Abbot, the Urban Electric Supply Co. appealed for W. H. Carpenter, clerk and electrician, and P. G. Stephens and A. W. Prudence, electricians and wiremen. The manager, Mr. Smith, said that owing to the military requirements, they had to work day and night, and Carpenter was indispensable. Exemption was allowed to Stephens (reserved occupation) and Prudence (medically rejected), but the appeal for Carpenter was dismissed, he being 21 years of age and single. Mr. Smith said he should appeal.

At Aldershot, the Traction Co. appealed for Mr. A. E. Webster (31), secretary, regarded as indispensable to the carrying on of the concern. It was stated that Mr. Webster was the only one who had full knowledge of all the details relating to the financial interests of the company; he had control of the books, and had under him a clerical staff of 14, of whom 11 were females. Three previous exemptions had been given, and a further three months were allowed. The company also applied for an inspector, claimed as being in a certified occupation, but the Military and Tribunal dissented, and dismissed the appeal; and for three drivers, two of whom were given a final month, and the other a month for him to be badged or replaced.

Before the Chichester Tribunal, a junior wireman and a shift engineer and assistant fitter were appealed for by the Electric Light & Power Co. The engineer stated that the staff had been reduced to a minimum consistent with safety, and the wireman was the only skilled man left for the work he was doing, except the mains superintendent. If the Military could find substitutes they did not wish to retain any single men. The wireman was refused exemption, and the shift engineer was allowed three months.

A Chichester electrical engineer, appealing for his brother, stated that he was the only man left to carry on the business. The Chairman said that they could not exempt single men of 21, and 14 days' exemption would be granted, with no further appeal without leave.

At West Ham, H. E. Wright (36), a Corporation tramway conductor, who appealed, said that he was the patentee and maker of a tram and bus ticket holder. It was agreed that the holder was a very handy thing, but the appeal was refused, and the calling-up delayed for three weeks.

At the Aberdeen Tribunal, H. W. Munro, electrician and overhead line-man, was claimed by the Aberdeen Corporation Tramways. Mr. R. S. Pilcher, tramway manager, stated that Munro, who had been passed for general service, was a skilled worker in a public utility service. There were three overhead line-men. There were only seven exemptions in the department out of a staff of 302. Seventy-five per cent. of the staff were serving. Temporary exemption of two months was allowed.

Kidderminster Tribunal has granted three months each to Mr. W. H. Hughes, electrical engineer, and to E. Turner, tramway car shed foreman; and has respite for a medical examination an appeal by Thomas Barth, wireman and electrical fitter.

Llanelli Tribunal have granted two months' exemption to the electrician employed at Hazzard's Theatre.

At Shrewsbury, Mr. Smallwood, electrical engineer, applied for exemption until the end of the year. The appeal was granted until December 1st.

At Stroud (Glos.), the Electric Light Co. sought exemption for several men, and the Military Representative agreed.

The military authorities. He thought that matters would be met by releasing the married men and taking the single ones. The company had suggested that the men claimed might be replaced by incapacitated soldiers; four such men had been provided, and they had useful careers before them. Several of the men were put back until the end of the year, and others until March 31st.

Contraband of War.—[1.] Insulating materials, raw and manufactured.

Insulating materials, raw and manufactured. Cadmium, cadmium alloys, and cadmium ore.

Books for Prisoners of War.—[1.] Prisoners of War Book Scheme (Educational) for the ensuing week are:—Works on transformers (Still), alternating currents (Still), alternating currents (Siemens), "Text-book of Electrical Engineering" (Thomson), "Electrical Handbook" (Trautwine), "Steam Electrical Hand-book" (I.E.E.), "Modern Electrical Practice" (Gresham Publishing Co.), "Hand-book of Electricity," "Electrical Engineering" (Slingo & Brooker). Will readers please address offers of new or second-hand copies of books to Mr. A. T. Davies at the Board of Education, Whitehall, London, S.W., from whom further information respecting the working of the scheme can be obtained.

Disabled Sailors and Soldiers and Electrical Work.—The classes organised at the Northampton Polytechnic Institute by the Institution of Electrical Engineers, in co-operation with the London County Council, for the purpose of giving a preliminary training to disabled sailors and soldiers as electricity sub-station attendants are about to be resumed. Up to the present some 40 men have been admitted to the courses, of whom 25 have been placed in electricity supply undertakings, the remainder having either found other situations or been unable to complete their course. The courses are free to the men, and the work consists of demonstrations and exercises in the first principles of electrical engineering and of physics, practical work in the electrical and physical laboratories, and demonstrations in the power-house of the Northampton Institute. By the courtesy of some of the London supply companies visits are also paid in the last week of the course to sub-stations and generating stations in the London district, and instruction is given by the men in actual charge of the stations. A third batch of 20 men will begin their course in November.

Employment as probationers about the middle of November. Engineers having vacancies which could be offered to these men are requested to communicate with Dr. Walmley, Principal of the Northampton Polytechnic Institute, Clerkenwell, London, E.C., who will also be pleased to send application forms for admission to the courses, with full particulars, to disabled sailors or soldiers wishing to join.

Exports to China and Siam.—The "London Gazette" for October 3rd contains further names of persons and bodies to whom or which exports to China and Siam may be consigned.

BUSINESS NOTES.

Greece.—According to the U.S. Consul at Athens, commercial and industrial conditions in Western Greece, as upon the whole satisfactory during 1915. He says that it is now generally believed that the war has not seriously affected both volume and variety having greatly increased. Prior to the war the imports from the States were not more than £2,000,000 per annum, but during 1915 the value for articles in which the Consulate has direct assistance was £1,100,000, and the total value exceeded that figure. The goods which consisted of wheat and other food supplies. The Consul says it is practically certain that when peace is restored a large part of the trade now done by American exporters will revert to the original sources of supply. Metal manufactures are mentioned as one of the fields in which there will probably be sharpest competition and in which the American exporter will have the best prospect of making his ground. A suggestion is made in regard to the question of credits.

It is possible, the American exporter should make some arrangements as to terms. This market was formerly accustomed to credits of from two to six months. It is probable a similar arrangement is necessary, as was maintained by many importers. The fact that importers have, during the war, been able to do an abnormally large business in certain lines particularly in the case of those against documents port of shipment' seems to indicate that local importers can do a cash business if necessary. It is hardly probable that this market could be persuaded to continue to do business against documents port of shipment, but except an amount of credits that will doubtless be offered again by European markets upon the termination of the war. Several lines have expressed a desire to continue their business with American markets after the

that provided the American exporter is willing to deal on a basis of cash against documents sent at destination, which would be equal to the seller's advantage to something like 30 days cash. The local importers have begun to discover that the American method of doing business on a practically cash basis has certain decided advantages to the buyer and that the long-credit terms offered in the past by other markets have generally been balanced off by higher prices.

The U.S. Consul at Salonika also refers to the same subject in the following terms: "The great difficulties which affected American trade during the past year were insufficiency of transportation facilities, excessive freight rates, the non-delivery of cables, and disorganised banking facilities. Under normal conditions, European terms of sale are generally more favourable as regards credit than those of American firms. However, price and quality are more important factors than credit. It is reasonable to believe that long credit is not given without making provision for interest and a percentage for possible loss. It is difficult for American firms who have no representatives in the Balkans, to ascertain the financial standing of local firms, as no commercial rating agencies have branches in Salonika. It is believed, however, that local banks would answer credit inquiries from American banks more readily and completely than inquiries coming directly from American manufacturers or exporters. As of possible interest in this direction, the names of the following local banks are submitted:—Banque d'Orient, Banque Nationale de Grèce, Banque Impériale Ottomane, Banque de Salonique, Banque d'Athènes, and Banque de Commerce et Dépôts."

China.—The U.S. Consul at Harbin refers to the foundation of the decided success of Japan in Northern Manchuria that was laid by the Russian Government and by the Russian Chambers of Commerce. "Every encouragement to trade between the two countries has been given by the two Governments. The Russian Government placed enormous orders with Japan, and the Chambers of Commerce of various cities of Russia sent to the municipal administrations and to the banks lists of the various kinds of goods that Japan could profitably export to Russia as well as those that Russia could supply in return."

In the list of goods offered to Russia by Japan are the following: Aluminium and manufactures thereof; electric bulbs; electrical machinery and fixtures; enamelled ware; earthenware; machinery and equipment for technical purposes; wire. Plans were worked out by the Japanese railways and by the Russian Imperial Ministry of Communications for the organisation of special exhibition trains to tour in Manchuria and Mongolia, but this scheme has not yet been put into effect. There was a great influx of Japanese merchants and small shopkeepers into Harbin during the last half of 1915, and it is said that every firm of any standing in Japan now has its agents there, and they have opened branches for the accommodation of the buyers from Russia. It has thus been the firm policy of the Japanese to make Harbin and not Dairen or Vladivostok or Moscow the distributing centre for all trade between the two countries. The Consul tells American manufacturers that under present conditions at least they must meet with very great obstacles in the competition for the trade of Northern Manchuria. Yet never before has so much American interest been shown in this trade, nor have such serious and intelligent efforts been made to secure a part of it. At least three large organisations of capital had decided by the end of 1915, or early in 1916, to station agents of American nationality, or to open branches, in Harbin. "These plans look beyond the present trade to the promise of the future." It is believed that a certain American banking house will open a branch in Harbin.

The Consul at Mukden says that previous to the war there was keen competition between German and Japanese importers of cheap articles for sale to Chinese. Since German goods have ceased to be obtainable in the market this line of trade has fallen entirely into the hands of the Japanese. He adds that the most hopeful direction in which American manufacturers may look to overtake their European competitors would seem to be in the supply of electrical railway and mining materials, and iron and steel manufactures, and perhaps, at the end of the war, in that of arms and munitions.

Copper Prices.—THE WEEK'S CHANGES.

Messrs. F. Smith & Co. report: Wednesday, October 4th:—Electrolytic bars rose from £138 to £140; ditto sheets from £156 to £160; ditto rods from £146 to £148; ditto H.C. wire from 1s. 5½d. to 1s. 5½d.; silicon bronze wire from 1s. 8½d. to 1s. 9d.

Messrs. James & Shakespeare report: Wednesday, October 4th:—Copper bars, sheets and rods (best selected) rose from £157 to £164.

Dissolution.—GILBERT, FIELD & CO., cycle and electrical engineers, Station Street, Burton-on-Trent.—Messrs. W. C. Gilbert, F. Rogers, and E. J. Field have dissolved partnership, Mr. W. C. Field retiring. The remaining partners will attend to debts, &c.

Trade with our Allies.—Sir Algernon Firth, President of the Association of Chambers of Commerce, addressing commercial men at Wolverhampton, last week, said aliens should not be allowed membership of the British Chambers of Commerce, and the British Consular Service should be served by British. Dealing specially with trade after the war, he urged merchants and manufacturers to recognise the importance of the Russian and Italian markets. Two immense opportunities were waiting to be grasped. In 1913, of Russian imports 47 per cent. was done by Germany and Austria. It was our duty and interest to enable Russia to wipe these clean off the slate. In Italy the Germans had exploited the markets, unscrupulously, and now that the connection with Germany was cut

off, we ought to establish cordial business relations with Italy, even if the efforts did not secure an immediate return.—*Daily Telegraph*.

Book Notices.—*Applied Mechanics*, Vol. I. By Andrew Jamieson. Revised by E. S. Andrews. London: Chas. Griffin & Co., Ltd. Price 6s. net. In spite of the depletion of our technical colleges by the war, the demand for the text-books of the late Prof. Jamieson has necessitated the issue of this, the tenth, edition of his well-known work. It has been revised by Mr. Andrews with a tender hand, avoiding any departure from the methods of the author, and the latest papers set in the A.M.Inst.C.E. examinations have been added. So successful a manual needs no commendation other than its own record.

The Fan. By C. H. Innes. Revised by W. M. Wallace and F. R. Jolley. London: Technical Publishing Co., Ltd. Price 8s. 6d. net.—This is the second edition of a work first issued 12 years ago; it has been thoroughly revised and checked, most of the figures have been redrawn, and a new chapter has been added on recent practice in the construction of fans and centrifugal compressors. The connection between the fan and the electric motor is growing ever closer and more intimate; the load is ideal in many respects, and consequently the fan may reasonably be annexed as rightly belonging to the electrical field. There is probably no department of study in which greater progress has been made in recent years than in that which concerns the behaviour of air when solid bodies are moved through it at high velocities, and remarkable results have been obtained, which should be of use to the designer of fans on scientific lines. In this work the author applies to the subject the theory of the centrifugal pump, on the basis that in practice the compression of the air is so slight that it may be regarded as, like water, an incompressible fluid, and the examples of actual tests which he adduces certainly support this contention. Fans of many types are dealt with in detail, and the book can hardly be dispensed with by engineers engaged in designing or selecting fans and centrifugal air compressors.

Lektrik Fumblers Switch Controls for Glow-lamp Circuits. Messrs. A. P. Lundberg and Sons have issued a booklet describing, with elegant diagrams, the advantages and modes of application of some of the many controls detailed in their "Lektrik Lighting Connections," and showing the types of switches used, the purpose and effect of each device, and the number of wires required. The diagrams are of a novel kind, intended to assist contractors and others concerned in explaining the controls to their clients, and are therefore reduced to their simplest terms. The booklet, which is distributed gratis, should be very useful.

Catalogues and Lists.—MESSRS. I. FRANKENBURG AND SONS, LTD., of Greengate Rubber and Cable Works, Salford, Manchester, have sent us a copy of a small ring-flange pocket memo. book with celluloid covers, such as they will forward to anybody in the electrical trade on application.

IGRANIC ELECTRIC CO., LTD., 147, Queen Victoria Street, London, E.C.—Leaflet No. 520, giving a full and illustrated description of their push-button control system for motor-driven planners and vertical slotters.

MESSRS. WATKINS DOVE BITUMASTIC, LTD., 5, St. Nicholas Buildings, Newcastle-on-Tyne.—32-page pamphlet, containing particulars of their "Bitumastic" (brand) solution, testimonials concerning its protective qualities, and photographs of water tanks, pipe lines, gasholders, and other engineering works and structures coated with it.

MESSRS. LANDIS & GYR, LTD., 72, Windmill Road, Hampton Hill, Middlesex.—32-page illustrated catalogue of portable and switchboard patterns of their induction-type wattmeters.

British-Made.—According to the *Financier*, a member of the Southwark Borough Council last week gave notice of the following resolution:—"That, in order to promote and encourage in this country the development of industry and the manufacture of most classes of goods hitherto produced in enemy countries, it is necessary, in the opinion of this Council, that there shall be created an adequate demand, and that this demand can be assured by its being made obligatory on all Government departments and public and local authorities throughout the country to use, as far as possible, only British-made goods, and so create at once an open market sufficiently large to secure the economic interests of the various industries affected, and to urge forward the interests of technical education."

Mr. Stephen Walsh, M.P., a well-known Labour man, speaking at Wigan, said that given the horrible facts which the last two years' had given us surely it was the lesson of common sense to develop our own resources in our own land. "Why should we always make ourselves the dustheap and dunghill of the whole world? There were a thousand and one things which we could just as well produce in our own land, or in the Dominions affiliated with us, instead of being dependent upon the foreigner."

Bankruptcy Proceedings.—A. F. HAWDON, electrical engineer, Eytholm, Emfield Gardens, Gosforth, Northumberland.—October 14th is the last day for the receipt of proofs for dividend by Mr. C. Woollett, the trustee, 30, Mosley Street, Newcastle-on-Tyne.

Trade Announcement.—ROCHDALE ELECTRIC CO., LTD., have taken new showroom premises at 30A, Hare Hill Road, Littleborough.

South Africa.—The *Cape Times* stated in August:—"Electrical goods are arriving from the United Kingdom more freely now, but contracting work has not improved."

To Home Firms Trading with the Russian Far East.—H.M. Consul at Vladivostok (Mr. R. M. Hodgson) writes that his attention has been called to the fact that home firms, when telegraphing to firms at that port, not infrequently fail to give an adequate address to which replies should be sent. It should be noted that telegraphic or abbreviated addresses are not accepted by the Russian postal authorities, and that, consequently, it is impossible for the persons who receive such telegrams to answer them. Mr. Hodgson adds that local firms do not have telegraphic address lists, and it is therefore advisable that full addresses should be given to firms to whom senders of telegrams are unknown. *Record of Trade Journal.*

LIGHTING AND POWER NOTES.

Abertillery.—**PRICE INCREASE.**—The Council has decided to increase the price of electricity by 1d. per unit.

Australia.—The Brunswick Council (Victoria) has decided to float a loan of £5,000 for the purpose of extending the electric lighting scheme.

The Narrabri (N.S.W.) Municipal Council will shortly take a plebiscite of the ratepayers on the question of borrowing £7,500 to finance an electric supply scheme for the town.

The South Australian Government proposes submitting to Parliament an amendment of the Adelaide Municipal Tramway Bill, so as to enable the Tramways Trust to supply power for electric lighting to its constituent Corporations and District Councils, and to private consumers.—*Tenders.*

Aylesbury.—The electrical engineer has reported that the Diesel engines have been successfully run on tar oil, and 5,200 gallons of the oil had been stored.

Bahia.—An American Consul reports that practically nothing was done throughout the past year in connection with the large hydro-electric plant under construction near Bahia.

Barnes.—At the meeting of the U.D.C., last week, the electrical engineer reported an application from the Barnes Mechanical Works for a further supply of 100 H.P.; it was necessary to lay a special cable to the premises at an estimated cost of £1,000. The Council decided to accede to the application, subject to the firm providing the capital for the necessary cable.

Bradford.—The local Press, in referring to the extension of the boiler house at the electricity works, mentions that the demand for electricity for the past half-year shows a bigger increase than in the previous 12 months, and that the supply to the spinning and weaving industries is rapidly growing.

Chester.—**HYDRO-ELECTRIC PLANT.**—When the Electricity Committee's proceedings came up for confirmation at the last meeting of the City Council it was stated that, at the request of the Ministry of Munitions, the work of adding a 12-in. curb to the weir, negotiations for which had been in progress several months, was now to be carried out. It is expected that this will result in a saving of 1,200 tons of coal a year.

Christchurch.—**ELECTRICITY PRICES.**—With reference to the proposed increase of 10 per cent. on the contract price for electricity supplied by the Bournemouth and Poole Electric Supply Co., the B. of G. has offered to pay during the duration of the war an additional 5 per cent. on the electricity consumed, such additional payment to be the maximum, and to run from January 1st, 1916, to the end of the war, or for such lesser time as the company shall impose, the offer to be without prejudice to the terms of the contract.

Continental.—**SPAIN.**—Application has been made for a concession to utilise the water power of the River Inola at Salardu (Province of Lerida) in the generation of electrical energy for lighting and power purposes in the district.

Dewsbury.—**REVISED CHARGES.**—The Electricity and Tramways Committee proposes the adoption of a new tariff for electricity supply to the Ravenshorpe district, under which the charges are to be 4d. per unit, plus 10 per cent. for lighting; for power, 2½d. per unit for one hour per day of the consumer's maximum demand, and a ¼d. per unit for all energy used above that quantity, plus 15 per cent.; ¼d. per cent. discount is allowed for prompt payment.

Doncaster.—**YEAR'S WORKING.**—For the year ended March 31st, there was a deficiency of £263 on the electricity undertaking compared with a surplus in the previous year of £1,295.

Eastbourne.—**SLOT METERS.**—The Electricity Committee has adopted a suggestion by the engineer with regard to the supply through slot meters (which before the increase in charges was at the rate of 6d. per unit, as compared with the ordinary flat rate of 5d., no meter rent being charged), that as it would be an expensive matter to alter the mechanism to adapt the meters for the increased price, a meter rent of 6s. per annum, or 1s. 6d. per quarter, be charged those consumers obtaining their supply through slot meters. During the past year, the engineer reported, the consumption by 79 slot meters was 5,032 units, an average of 63.7 units per meter, which, at a 1d. per unit, represented 5s. 4d. per annum.

Ebbw Vale.—Owing to the large number of new consumers there has been practically no decrease in the revenue of the U.D.C. electricity undertaking, and at present there is no necessity to increase the tariff rates.

Erith.—**PROPOSED LOANS.**—The U.D.C. has decided to negotiate for loans of £1,300 and £4,000 for electricity purposes, these sums being unspent balances of sanctions by the L.G.B. in July, 1912.

Edinburgh.—Figures furnished by the Corporation Electric Lighting Department indicate a substantial reduction in the electric lighting as a result of the Summer Time Act. The decrease from May 21st last is 13 per cent. as compared with the corresponding period of last year. On the other hand, there has been a large increase in the amount of electricity required for power purposes, resulting in a total net increase of 8 per cent. in the amount of electricity supplied by the Corporation.

Falkirk.—Treasurer Gilchrist, moving the adoption of the Finance Committee's report on the estimates of income and expenditure for the year 1916-1917, stated that last year there was a loss in the electricity department of £156, and unless the price of electricity were raised there would be a loss again this year. It was therefore recommended that the cost of electricity for lighting be increased by 5 per cent. and for power by 10 per cent. This would mean an estimated additional income of £546, which would be sufficient to meet the expenditure of the department and leave a balance of £172.

Gravesend.—**SALE OF PLANT.**—The T.C. has accepted an offer from the Piggott Electrical Co. of £825 for the purchase of the No. 1 generating set, used as a stand-by, and not run for the past two or three years. It will be replaced after the war by a larger set.

Haslingden.—The Corporation has agreed to supply electricity to Messrs. J. Perritt & Sons' premises at Helmshore.

The Tramways and Electricity Committee has deferred consideration of the question of the department supplying electrical apparatus to consumers, pending inquiries from neighbouring authorities.

Hornsey.—The T.C. has made an arrangement with the Great Northern Railway Co. for the disposal of clinker and ashes from the electricity works, necessitating the construction of a gangway from the works to the siding, at an estimated cost of £15, and the Council is to make an annual payment of £1 to the company for the use of it.

Ilford.—**PLANT EXTENSION.**—A Special Committee of the U.D.C. reports that the electrical engineer has submitted preliminary tenders for the provision of main and sub-station plant, cable and conduits required in connection with the utilisation of the steam at the refuse destructor, for directly augmenting the supply of current to the eastern side of the district, instead of transmitting it in the first instance to the Ley Street works. Application is to be made to the L.G.B. for sanction of the borrowing of £10,000 for the necessary plant and building.

Kingston-on-Thames.—**YEAR'S WORKING.**—The annual report on the Council's electricity undertaking to March 31st last shows a deficit of \$629 on the year, as compared with a loss of £1,295 in 1915. The total receipts from the commencement of supply in 1893 have been £209,716; the total expenditure on works cost, excluding capital repayments, amounted to £129,492; and after repayment of principal and interest, there was a deficit on the full period of working of £18,745. The electrical engineer reports that the two horizontal Diesel engines had worked satisfactorily throughout the year, the fuel costs per unit generated being only 14½d., against 3'286d. per unit for coal for the steam plant. The chairman of the Electricity Committee stated that although the report was more favourable than the previous one, he was bound to draw the attention of the Council to what might be in store for it in the future. Daylight saving had made a great deal of difference to the revenue; in consequence of an accident to one of the Diesel engines, they would not be able to use it again until February or March, and the expenditure on coal, through having to use more steam, had gone up seriously. In addition, there was the cost of the new crankshaft, about £1,000, which he anticipated would have to be paid out of revenue.

London.—**HAMMERSMITH.**—The L.C.C. has sanctioned the borrowing of £650 for the purchase of a site for a sub-station. It is proposed that Messrs. Callenders carry out the cable work, at the cost of £628 in connection with the bulk supply to the Chiswick Electric Supply Corporation. In connection with the pumping of coal from the Council's wharf to the electricity works, arrangements have been made with the Port of London Authority for the use of the Thames water for this purpose.

Northampton.—**PRICE INCREASE.**—The local Electric Light and Power Co. has temporarily further advanced the price of current for lighting and heating by 10 per cent., and for power by 12½ per cent., as from the Michaelmas meter readings.

Preston.—**WORKHOUSE LIGHTING.**—A new 55-kw. generating set, installed at Fulwood Workhouse, was formally started on Friday, last week, by the senior Lady Guardian.

Salford.—The Electricity Committee proposes to enter into an agreement with Messrs. F. Smith & Co. for the supply of current on certain conditions, including a minimum payment of £600 per annum.

Sunderland.—**PLANT EXTENSION.**—A scheme is under consideration at the Corporation for an important extension of the plant at Hydon Road. In his report to the Electricity and Lighting Committee, Mr. Blackman, the city electrical engineer, points out that the main turbine broke down last year the works costs ran up to consequence by £3,500, and they were for the time without any stand-by. The demand upon the undertaking has grown during the last 12 months by about 330 kw., and new consumers would in the near future further increase the load. The extensions are estimated to cost £15,246.

Torquay.—**PRICE INCREASE.**—The T.C. has decided to increase the charge for electricity for private lighting by 3d. per unit from the Michaelmas reading of the meters. The Electricity Committee recommends that the question of the supply of electricity to the Tramway Co. consequent on the rise in the price of coal be reopened.

Twickenham.—The Council has declined to meet the proposed increased charges of the Twickenham and Teddington E.S. Co. on the ground that the price of energy for public lighting (which the Council interprets as lighting on its property) is limited by agreement to 2½d. per unit.

The Council has been recommended by its Committee to give the company six months' notice of termination of a licence for an overhead line, the company to remove the latter at the end of that period. This action apparently follows on a report by the surveyor that the overhead line had been renewed and added to without the consent of the Council.

Walthamstow.—The Lighting Committee has considered the report of the electrical engineer as to the result of the official tests carried out on the Ljungstrom turbine plant, and has instructed him to report further before finally taking over the plant at the expiration of the maintenance period.

Wednesbury.—**PROPOSED LOAN.**—The T.C., on Monday, decided to apply to the L.G.B. for sanction to borrow £5,000 for electricity developments.

Wimbledon.—**PRICE INCREASE.**—The Electric Lighting Committee has resolved that, on and after the date of the next reading of the meters, the charges for supply to ordinary consumers of Wimbledon and Merton, and for the hire of meters be increased by a further 15 per cent., making a total increase of 25 per cent., and that the prices to be charged to ordinary consumers in Maldens and Coombe be increased to 6d. per unit for lighting purposes, and to 1½d. per unit for power, heating and cooking purposes, and that the charge for meter rents in the last-mentioned area be increased by 25 per cent. To secure more efficient working of the Curtis turbo-alternator, a new governor is to be fitted at a cost of £80.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Corporation tramway men have applied for an increase of wages.

Australia.—In the report of the Chief Commissioner of the New South Wales Government tramways for the year ended June 30th, 1916, it is stated that the total output of electrical energy for the year was 94,352,417 kw.-hours, of which the alternating current gave 93,662,028 and the direct current 690,389 kw.-hours. On comparison with the previous year, the total output shows an increase of 797,858 kw.-hours, or 0.85 per cent. With regard to the new power house at White Bay, it is stated that six additional Babcock & Wilcox boilers, making eight in all, complete with economisers, fans, and chimneys, have been erected and put into service as required. Twenty miles of trolley wire on the City lines and 1½ miles on the North Sydney lines have been renewed. Five miles of high-tension transmission cable have been erected between White Bay power house and Burwood sub-station. Nine miles of low-tension feeder cable have been erected overhead and 10½ miles laid underground on the City lines.

Barnsley.—The Barnsley and District Electric Traction Co. has reopened its motor-coach service between Barnsley, Goldthorpe, and Doncaster on Sundays, Mondays, Wednesdays and Saturdays only; the service includes parcel delivery.

Blackpool.—The lease of the tramway between the Grand Hotel and Squire's Gate, at present held by Lytham and St. Anne's Tramway Co., expires in July next, and as the Corporation proposes adding this to the routes under its own control, negotiations are in progress with a view to the Lytham and St. Anne's Co. having running powers over this section, as well as over that portion from the Central Station to the Grand Hotel.

Bradford.—**WAGES.**—The Tramways Committee, on Monday night, gave further consideration to the application of the employees for another advance in wages, involving a revision of the entire scale of pay, and an extra cost to the city estimated at £21,000 per year, and decided to refer the question for settlement to the Committee on Production. The application affects over 1,000 employees, who want permanent advances varying from 5 to

15 per cent. in addition to the present war bonuses, which range from 3s. to 4s. per week. The increased cost of living is the ground of their demand.

Brighton.—**ACCIDENT.**—On Saturday last, a passenger accidentally struck a tramway gong during the temporary absence of the driver, and the conductress, thinking this was the signal to start, released the brakes, with the result that the car ran away down Queen's Road, eventually leaving the rails and colliding with a building. The passengers kept their seats and escaped injury.

Chester.—**TRACK RENEWAL.**—The city surveyor is to prepare a report and estimate of cost of relaying the tramway track where necessary, and the electrical engineer is to submit afterwards a detailed report and estimate of the cost of buying the tramway undertaking up to date, and of alternative methods of traction.

Doncaster.—**YEAR'S WORKING.**—The surplus on the tramway undertaking for the year ended March 31st has fallen to £756 from £2,855.

Edinburgh.—**ARBITRATION PROCEEDINGS.**—Certain matters which are in dispute between the Tramway Committee and the Tramway Co. are to be submitted to Sir Alex. Kennedy, the arbitrator under the lease, which expires in three years. The points of reference relate to the condition of the lines, and particularly to a very large section which the Committee had called upon the company to put in good order, a request which the company had refused. The proposed reference will, it is expected, clear the way for more rapid progress in the negotiations with the company on the whole question.

Glasgow.—A Corporation car, in charge of a woman driver, jumped the points in Dumbarton Road, shortly before midnight on Saturday last, and before it could be stopped, ran into a shop, one or two people being injured.

Hanwell.—At the meeting of the U.D.C., last week, it was reported that the London United Tramway Co. proposed taking up the rails in Lower Boston Road for repairing purposes elsewhere, and had asked that this action should not be considered as an abandonment of the, at present, unused line. It was decided to assent to the proposal.

Ilford.—**VEHICLE LIGHTS.**—The tramway manager reports that the police authorities have now definitely decided to press tramways to carry out the new Lights on Vehicles Order to the fullest extent, and two white lights in front of the car, at the extreme corners, and one red light at the extreme off-side corner at the rear, have now to be shown. To carry this out he is fixing a considerable number of carriage lanterns purchased some time ago. In addition, he has found it necessary to buy twin-wire and special lamps and lampholders. The work will cost at least £50, and considerable alteration will have to be made to the wiring of the cars.

Leeds.—**ACCIDENT.**—Twenty-two persons were more or less injured in a collision between two cars on Wednesday night, last week, owing to one of them, which, having got out of control near the Wortley terminus, ran down an incline and crashed into a car coming up a single line. The cars became interlocked and together ran down the hill, by good chance keeping the metals, until they ran off the line at the terminus, but fortunately did not overturn. Several passengers jumped off unhurt, and the driver of the runaway car was thrown off his platform without injury; only five persons had to be taken to the infirmary.

Leyton.—**VEHICLE LIGHTS, &c.**—The tramway manager has been authorised to alter the lights on cars to conform to the new lighting regulations. The cost is estimated at £55. The Great Eastern Railway Co. proposes to strengthen the approaches to the bridge carrying Lea Bridge Road over the railway, and as it is considered that the proposed work was rendered necessary owing to the cars on the tramway over the bridge, the Council has been asked if it will admit liability for payment of the expense to which the company will be put. The Legal and Parliamentary Committee of the Council is to report on this matter.

London.—**NORTH LONDON ELECTRIFICATION.**—The Broad Street to Richmond electric train service was brought into use on Sunday last; a saving of 10 minutes has been made on the old journey time.

SOUTH-WESTERN ELECTRIFICATION.—The opening of the Waterloo to Claygate electric train service, which was to have taken place on Sunday, has been postponed.

Newport.—**COLLISION.**—Two cars came into collision on Saturday night, owing to a driver leaving a car, which started off uncontrolled. No passengers were hurt.

New Zealand.—In the railway statement for the year ended March 31st, 1916, presented by the Hon. W. H. Herries, Minister of Railways, it is shown that the particulars of expenditure on electric block working, telegraph and telephone facilities, and electric lighting for the year totalled £14,762 for new work; whilst maintenance was responsible for £15,857. During the year electric lighting has been installed at five additional stations, 10 railway dwellings, and in numerous buildings and goods yards. An electric engine-traverser was installed at Linwood, and the electrification of a 20-ton overhead crane in the boiler shop at Petone was also carried out. The installation of electric motors and transformers for Newmarket workshops is, it is added, in hand.

The Invercargill Municipal Tramway Department is increasing its power generating plant, which at times is fully loaded, and tenders are shortly to be invited for two additional boilers of 2,000 sq. ft. heating surface, and a 2,300-volt, 750-KW. turbo-alternator.

Northampton.—The B. of T. has extended to August, 1917, the period for the construction of the tramways authorised by the Northampton Corporation Act, 1911. The Tramways Committee has decided to inform the L.G.B. that it has no works which are likely to be carried out immediately on the termination of the war.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—**SYDNEY.**—January 22nd, 1917. Electrical plant (converter, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.*

October 17th. For the Deputy P.M.G. (1) Sleeves and tapes (Schedule No. 1,355), and (2) 3,100 stay-roads, with low tapers (Schedule No. 1,359).*

MELBOURNE.—October 18th. Victorian Government Railways. Electric time releasing mechanisms for automatic signalling (Cont. No. 30,343).—November 1st. 50,000 yellow flame arc carbons.*

October 31st and November 8th. Deputy P.M.G. Telephone parts : switchboard ; instruments, &c. Schedules Nos. 1,363, 1,364, and 1,365.*

December 11th. City Council. Supply and erection of coal transporter plant. See "Official Notices" September 15th.

PERTH.—November 8th. P.M.G. Accumulator parts (Schedule 327 W.A.).*

SOUTH AUSTRALIA.—November 15th. P.M.G.'s Department. Automatic switchboards and all associated apparatus, for telephone exchanges, Brighton and Glenelg.

Johannesburg.—Municipal Council. Twelve gross of carbon brushes for electric motors. (Contract No. 178).*

New Zealand.—**WELLINGTON.** October 11th. Public Service Stores Tender Board. 1,000 magneto extension bells, 1,000 ohms.*

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Aylesbury.—U.D.C. Maintenance of battery, Chloride Co.

Bradford.—B. of G. Messrs. T. Broadbent & Sons, a 48-in. electrically-driven hydro extractor (£197) for the workhouse laundry.

Derby.—T.C. Accepted tenders :—

R. Wade & Sons, Poles, £134.

B.I. & Helsby Cables, Ltd.—Armoured cable, £2,990 ; copper cable, £500 ;

under materials, £50.

British Thomson-Houston Co., Ltd.—switchgear, £253, extension of main

station switchboard, £262.

Brush Electric Transformer Co., Ltd.—550-kva. transformer, £256, 150-kva.

ditto, £160.

Hebden Bridge.—U.D.C. Messrs. Connolly Bros., Ltd., 400 yards of cable ; Mr. O. Watson, for laying the same.

Ilford.—In reference to the current contract with Messrs. A. Foster & Co. for 500 tons of Graigola large Welsh coal, at 28s. 5d. per ton, the Electricity Committee reports having been notified by the contractors that the price is to be increased by 2s. 6d. per ton, under the Price of Coal (Limitation) Act.

Kingston (Surrey).—The following tenders have been accepted for coal to the electricity works :—

Spencer Whitley, Ltd.—12 trucks (approximately 110 tons) South Leicester

13-in. main nutty slack, 20s. 7d. per ton ; and 12 trucks South Leicester

13-in. deep nutty slack, 21s. 7d.

E. Foster & Co.—1,200 tons Siston 13-in. slack, 22s. 1d. per ton (delivered

100 tons per month over 12 months) ; and 1,200 tons Bolsover nutty

slack, 22s. 9d. (ditto).

London.—**HAMMERSMITH.**—The Electricity Committee recommends the acceptance of the offer of Messrs. W. H. Bowater for 100 tons weekly for 12 months of Holly Bank slack coal, at 21s. 6d. per ton delivered at Shepherd's Bush, or at 23s. per ton at Chancellor's Wharf ; and of Messrs. Cory Bros. & Co. for 100 tons per week to end of December, 1916, of Aberclyd small coal, at 27s. per ton alongside wharf.

Maidenhead.—T.C. Crynant Colliery Co., Ltd., 600 tons of large Welsh steam coal. Messrs. George Hinchliffe & Co., 400 tons of large Llydcoad Welsh coal.

Salford.—Tramways Committee. Messrs. Isaac Bentley and Co., Ltd., for a six months' supply of oils and paints, £600.

The Electricity Committee is accepting the tender of the British Westinghouse Co., at £275, for equipping a blank cubicle with H.T. switchgear, together with the necessary control panel, in connection with a 1,000-KW. rotary converter recently supplied by them.

Walthamstow.—Lighting Committee. Accepted offers : Cleeves & Co. and Hinchliffe & Co., for a supply of Griff peas, and has decided to allow Messrs. Cleeves to substitute Griff peas at 24s. per ton in place of D.S. nuts at 26s. per ton under their contract.

Wednesbury.—T.C. British Westinghouse Co., rotary converter, £3,190, for the King's Hill district.

FORTHCOMING EVENTS.

Chief Technical Assistants' Association.—Saturday, October 7th. At the Tavistock Hotel, Covent Garden. Discussion on "Advantages and Disadvantages of Electrical and Steam-driven Auxiliaries," opened by Mr. Thompson.

Association of Mining and Electrical Engineers.—Saturday, October 7th. At the Midland Hotel, Manchester. General Council and annual meeting.

Salford Technical and Engineering Association.—Saturday, October 7th. At 7 p.m. At the Royal Technical Institute. Lecture on "Endurance of Metals under Varying Stresses," by Mr. J. H. Moelen.

Association of Engineers-in-Charge.—Wednesday, October 11th. At 8 p.m. At St. Bride's Institute, Bride Lane, E.C. Presidential address by Mr. F. Bailey.

Electro-Harmonic Society.—Friday, October 13th. At 8 p.m. At Holborn Restaurant (King's Hall). Smoking concert. (See "Notes" to-day.)

NOTES.

Electric Tipping-Wagon Costs.—The last issue of the *Electric Vehicle* contains, amongst other interesting matter, some data regarding the operation of the 3-ton G.V. electric vehicle, fitted with a tipping body and alternative 650-gallon tank for road sprinkling, which has been in use for some time by the Ipswich Corporation. For the year ended March 31st last, the vehicle covered 6,154 miles, and carried an estimated load of over 9,000 tons.

The actual expenses incurred were :—Garage, £18 4s. ; repairs, oil, £4 14s. ; electricity (7,961 units), £36 9s. 9d. ; wages, £75 16s. 8d. ; interest (on £958 10s.), £47 18s. 6d. ; depreciation (less battery and tires), 10 years' life, £71 17s. ; tire depreciation (8,000 miles' life), £38 10s. ; battery renewal (two years' guarantee), £94 10s. ; insurance and driver's licence, £8 14s. 8d. ; making a total of £396 16s. 7d.

It is expected that the battery (Ironclad Exide) will outlast the two years' guarantee, and the tires might have covered over 8,000 miles had they not run over unmade roads, &c. Experience shows that the vehicle is very reliable and economical, and so simple to drive that any intelligent labourer or horseman can be taught all there is to learn in a few hours. Its handiness in negotiating congested streets and in manoeuvring to loading and tipping places is a great advantage.

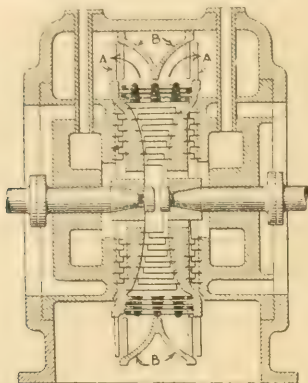
Resuscitation after Electrical Shock.—In the last number of the *N. E. L. A. Bulletin*, Mr. W. P. Strickland, general inspector of the New York and Queen's Electric Light and Power Co., of New York City, says :—

Recently one of our foremen, after climbing a pole, preparatory to stringing primary wires, received a shock that caused him to fall to the ground. It is inferred that in adjusting his belt and shifting his position, his spur cut out, and that, to save himself, he instinctively reached out and touched the wires carrying 2,300 volts. When the other linemen and ground hands reached him, to all appearances the man was dead. One of the linemen, following instructions, immediately took hold of the ankles of the limp body, lifting it until the whole weight rested on the neck, and then letting it fall. He then took a pair of connectors, and hammered the soles of the injured man's feet without removing his shoes. Another lineman opened the man's mouth, pulled forward the swallowed tongue (which occurs in electric shock), and was about to begin the Schaefer prone method of resuscitation, when the man returned to life. He was removed to the hospital, and is alive and well to-day, though suffering severely from his burns.

For the past year the writer has been teaching his men to strike the feet without removing the shoes in all cases of electric shock. Some years ago an accident occurred where a man came in contact with 6,600 volts, fell from the pole, and was restored to consciousness by this means, although he was terribly burned, and died three days later. Another accident that came to the writer's attention happened in New Jersey, when a man came in contact with a wire carrying 2,200 volts. This man was struck violently on the feet, his tongue was pulled forward, and he was restored to consciousness before the arrival of the doctor.—*Electrical Review and Western Electrician*.

Ozone in Military Surgery.—A novel method of treatment for wounds, involving the use of ozone, has recently given remarkable results. Wounds which have defied the ordinary methods have quickly yielded to the new treatment, which consists in dispensing with bandages, subjecting the wounds to repeated applications of a stream of ozonised oxygen, and covering them only with a loose layer of lint in the intervals. The painful process of removing and replacing bandages is thus obviated, and healing takes place rapidly without undue inconvenience to the patient. The ozone is generated by electrical means.

Axial Exhaust for Ljungstrom Turbine.—A recent patent describes the arrangement of radial blades to a Ljungstrom turbine, as shown at A in the accompanying sketch. The guide piece B splits the flow of steam issuing radially from the regular Ljungstrom turbine system and turns it to either side causing it to pass axially through the black system A. In the sketch only one row of stationary guide blades on either side, and one row of



SECTION SHOWING RADIAL BLADES.

moving blades attached to either rim of the revolving element, are shown, although more could be used if desirable. A full area is thus obtained for the final exit of the steam, permitting more complete expansion, or, in other words, reducing the "leaving loss." The greater velocity of the blade allows of a greater velocity of steam flow with the same efficiency, which conduces to the same end. The radial disposition of the blades reduces to a minimum the difficulties due to centrifugal force.—*Power.*

Electric Lighting in Motor Garages.—A radical change has recently been made in the rules of the American National Board of Fire Underwriters governing the installation and use of electric light and electrical devices in motor garages. The new rules are not enforced in garages which can only accommodate one or two cars. They provide that in any portion of a building in which self-propelled vehicles carrying volatile inflammable liquid are kept, and any portion of the building that is on or below the floor or floors on which such vehicles are kept, which is not separated therefrom by tight, unpierced fire-walls or fire-resisting walls, all wiring must be done in approved metal conduit or armoured cable, and because of the danger from inflammable vapour, which always seeks a low level, all cut-outs, switches, switchboards, outlet boxes, junction boxes, receptacles, cord connectors, and any contact points at which a spark may be produced by the connection or breaking of the current must be situated at least 4 ft. from the floor. All motors and dynamos (except those actually a part of the vehicle), unless they are of the fully-enclosed type, and all charging panels, unless they have all sparking points surrounded by a vapour-tight enclosure, shall also be at least 4 ft. above the floor.

All cords for portable lamps shall be of an approved type, designed for rough usage, and must carry the male end of a pin-plug connector, the female end being so hung that the connector will break apart readily in any position.

Lignite as Station Fuel.—A considerable share in connection with the maintenance of the economic life of Germany during the war has been taken by the lignite industry in different parts of the country. In Saxony, where the establishment of a Government monopoly of the supply of electricity is under consideration, active discussion has been aroused by the purchase of extensive lignite fields and the proposed acquisition of the Hirschfeld power station of the Electricity Supply Co., which belongs to the A.E.G. group, and which procures fuel from the Herkules Lignite Co. The most important undertaking, however, is in the district of Bitterfeld, where the Electro-Works Co. (late Golpa-Jessnitz Lignite Works) is under an obligation to deliver 500,000,000 kw.-hours per annum to the Imperial Government nitrate works and 250,000,000 kw.-hours to the Electro-Salpêtre Works. The development of the Bitterfeld district during the war is reported to have been so great that many industries have been established there, and the time is foreseen when the rich lignite deposits will no longer be partially converted into briquettes for domestic consumption, but will be used entirely in connection with the production of power for the electrochemical industry and for the recovery of by-products.

Canada Produces Electrolytic Copper.—The U.S. Consul at Fernie, British Columbia, states that the first pure copper known to the trade as electrolytic copper was turned out at the new copper refinery in Trail, British Columbia, on August 20th, 1916. "The electric current was switched on to some of the tanks containing the copper anodes, and the pure metal, the gold and silver values being left in the slimes, was the result. In the near future a daily production of 10 tons is expected. This is the only place in Canada where pure copper has been made."

New Zinc Industry in Norway.—According to a U.S. Consular report, new works are about to be started at Drammen for the extraction of zinc by an electric wet process, invented by a Belgian engineer. Raw materials for the first year, about 10,000 tons, have been secured, and special attention will be paid to ores containing from 8 to 30 per cent. zinc, which have hitherto been considered worthless.

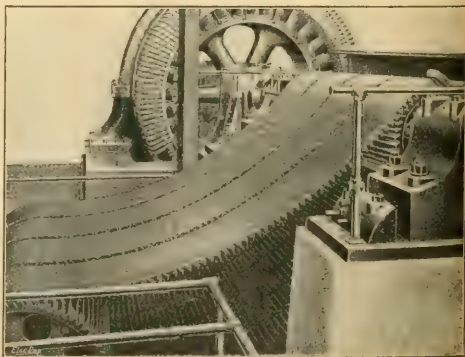
Sulphite Refuse as Fuel.—A factory is to be erected at Greker, in Sweden, for the utilisation of refuse from sulphite. A Swedish engineer has invented a method for extracting a substance from sulphite lye which, in powdered form, will be made into briquettes and used as fuel. It is claimed that the powder thus formed yields 6,000 calories per kg., while the best English coal gives 7,000.

The Mechanism of Light Production in Animals.—This subject has recently been further investigated by Prof. E. Newton Harvey, at Tokio, who gives a short account of his researches in *Science*. He finds that the dried and powdered luminous organs of the firefly behave like the compound lophin (triphenylglyoxaline) investigated by Radziszewski, which, if hydrolysed in the presence of oxygen by alcoholic potassium hydrate, emits light with the formation of benzoic acid and ammonia; in the absence of oxygen, no light is produced, and benzaldehyde is formed instead of benzoic acid; the alkali acts as a catalyst.

In the firefly it is natural to suppose that an organic catalyser, an enzyme, is concerned in light production, and Prof. Harvey states that the existence of such an enzyme has been definitely proved. He gives the credit of the discovery entirely to Prof. Raphael Dubois, of the University of Lyons, who experimented on the subject in 1884, but whose work has received little attention. He confirms Dubois's discovery that two substances are present in the luminous organs of *Pyrophorus noctilucus*, the West Indian cutwallow: a thermostable substance, luciferin, which oxidises with light production, and a thermolabile enzyme, luciferase. In 1887, Dubois showed that the same was true for the luminous mollusc, *Pholas dactylus*, and Prof. Harvey has isolated these substances derived from various sources. Luciferin of one form will act with luciferase of another, and *vice versa*, in producing luminescence, but whether the luciferin and luciferase of all forms are identical is still an open question. Mr. Harvey has recently discovered that pyrogallol will produce light with vegetable oxidases (potato or turnip juice) on the addition of hydrogen peroxide; as little as one part of pyrogallol in 254,000 parts of water gives perceptible light, and the behaviour of the substances is closely analogous to that of the animal products, the pyrogallol + H₂O₂ corresponding to luciferin and the vegetable oxidase to luciferase. He concludes that the problem of bioluminescence has been solved in its broad aspects, though it will take some time to fill in the details.

The subject has always been of interest to electrical engineers in its bearing upon the future of electric lighting.

A Large Chain Drive.—In the *American Machinist* a description is given of a hydroelectric plant in which a silent-chain drive is employed to transmit no less than 5,000 H.P. The installation is situated on the Snake River, Oregon, where a fall of 21 ft. is available: it was originally intended to increase the head to 42 ft., and the power plant had been purchased for that head, when funds ran short and the owners were unable to build the necessary dam. On the advice of Prof. J. R. Allen, it was decided to make the best of the circumstances by gearing two turbines, running at the speed corresponding to the reduced head, to one



CHAINS TRANSMITTING 2,500 H.P.

generator running at its designed speed. Gear wheels could not be used, owing to the space and cost required, and, with some misgivings, the use of chains was decided upon, as involving the least cost and space. A view of the four chains employed to transmit the power of one turbine is given herewith: each chain is 21 in. wide, of 2 in. pitch, and the distance between centres is 129 in. The chains, made by the Morse Chain Co., run at 1,765 ft. per minute, and are almost noiseless. The plant has been running for two years without giving any trouble.

"The Delineation of Internal Organs by an Electrical Method."—An article which appeared in the *British Medical Journal* under this title, on Saturday last, has been much quoted in the lay Press, and, coming from such a source, cannot be lightly regarded. The claims that are made for the method are, however, so extraordinary, and the means by which the results are obtained are so obscure and vaguely described, that we must express the gravest doubts as to the trustworthiness of the account.

A lengthy but unconvincing description of the apparatus employed is given by our contemporary, together with reproductions of diagrams or pictures reported to be obtained by the process, which are equally lacking in verisimilitude. Without following the original account in detail, we may briefly say that two batteries, A and B, are employed, of "equal strength, together with a means by which alternations in their currents can be produced and varied at will." Battery A is connected to a metal screen A, 18 in. by 12 in., which stands vertically on a pedestal near, but *not touching*, the patient's body. Battery B is connected to a screen B, which is supported horizontally 4 or 5 ft. above the centre of screen A. "The primary result of this arrangement is that any electrical field emanating from screen A is always at right-angles to that of screen B. The fields themselves are respectively charged by the currents derived from the batteries A and B with their alternating interrupters. Consequently, it is open to the operator to choose at will the section of the body which shall be brought within the influence of the combined electrical fields, as also the plane of the body which the lines of force in field A shall affect." Another curious statement is that "at given instants of time during the operation of the appliances, the current in electrode B is very unstable, consequently it has placed around it a wire coil, which insulates it from atmospheric electricity." The patient having been placed in the right position, quite close and head on to screen A, and with the affected organ directly under screen B, though at a considerable distance from it, a wax sheet is placed upon a recording cylinder and "the currents from batteries A and B are simultaneously released." The recording cylinder revolves under a stylus called "the hammer needle," which traverses the cylinder *twice* from end to end; the currents are then cut off. "What has happened in the meantime is that the current from battery A has reached electrode A, and has thence been projected horizontally from all parts of screen A as an electric field. The same thing is said of screen B, except that the direction of the field is 'vertically downwards.' "What has also happened is that the two fields have met at right angles, and as they are of precisely equal strength, and are synchronised in respect of alternations, it might be expected that they would have precisely neutralised one another, and that consequently no exhibition of dynamic force would be obtainable from them. But in practice this is not what occurs." We should think not. It would be interesting to see any kinds of fields at right angles neutralise one another. But these electric fields are new to our experience, and we learn that in practice "an effective current from below always manages to reach electrode B, and thence passes to the detector." The result is a diagram on the revolving wax sheet "which precisely resembles the outline of the living tissues lying vertically below screen B."

The writer remarks that "when the results are compared with the visible means by which they are reached, they seem at first quite incomprehensible, if not incredible." We agree. The inventor, we are informed, "believes that the results are primarily due to the fact that the process interposes between two alternating electric fields of equal strength—and at the precise point where they meet—a third electric field, whose facultative potential force is thus released, and can be converted into dynamic power. It is this released circuit which operates the recording needle, and the pattern tapped out on the revolving cylinder varies with the shape of the organ furnishing that circuit." The italics are ours.

The writer remarks that the foregoing is one legitimate way of summarising the inventor's view in simple language. It is, indeed, simple, with the exception of the word "facultative," the bearing of which upon the subject is obscure. But "another would be to say that the force operating the needle is the balance of current which remains after the horizontal current from electrode A, reinforced by the electricity contained in the organ through which it has passed, has met the descending current emanating from electrode B." Without tiring the reader with further quotations, we may point out that the author of these incantations obviously has no conception of the configuration of electric fields or of their properties; he has utterly mistaken and distorted ideas regarding electric circuits and currents, and, if he is not misquoted, confuses these two terms; no intelligible particulars of the recording mechanism are given, and the electrical connections are only vaguely suggested. That such an equipment could by any possibility produce a definite representation of any part of the body or of anything else in the world, is utterly unbelievable; the language is that of quackery from start to finish, and we fear our esteemed contemporary has fallen a victim to a stupid or malicious imposture.

Claim by the Victoria Falls Power Co.—In an action recently begun in the local division of the Supreme Court, the Victoria Falls Power Co. sued the Brakpan Mines, Ltd., and the Consolidated Mines Selection, Ltd., for £692, the balance unpaid of an amount of £2,321 for steam energy supplied by the plaintiffs during August, 1914, in terms of a contract dated March 9th, 1910, entered into between the plaintiffs, the Consolidated Mines Selection Co. and the Brakpan Mines, Ltd.

According to a report in a South African newspaper, plaintiffs further sought to recover £1,753, payments made to the defendants

between July, 1913, and February, 1914, under, it is alleged, a mistake of fact in the belief that the contract mentioned contained a clause entitling the defendants to a rebate on the prices for steam energy, whereas the contract contained no such clause.

Defendants in their plea said it had been agreed between the parties to the contract that the terms of the agreement to be drawn up should not be more favourable to the Brakpan Mines than those in the agreement then in existence between the Rand Mines Power Supply Co. and any of the Rand Mines groups, and that the defendants should have exactly the same favourable terms in regard to the air supply as those granted by the Rand Mines Supply Co., Ltd., to any of the companies comprising the Rand Mines groups. When the contract was finally completed and signed, the clause embodying the agreement referred to was omitted owing to a mutual mistake. Defendants pleaded that there was a clause in the Rand Mines contract referred to, to the effect that if there should be any increase or reduction in railway rates, siding charges, &c., on coal consumed by the Power Co. above or below those ruling on January 1st, 1908, the difference in cost of producing power occasioned thereby should be added to or deducted from the prices specified in the contract. The amounts of £692 and £1,753 represented rebates which, it was claimed, the plaintiffs were bound to allow defendants by reason of reductions made in railway charges on coal subsequent to January 1st, 1908, and which defendants were entitled to claim.

Alternatively defendants claimed that the plaintiff company was not entitled under the terms of the licence of the Victoria Falls Co. to charge higher prices than those which defendants would have had to pay after the reductions of the £692 and £1,753. The railway charges on coal consumed by the plaintiff company had so far been reduced below those rates on January 1st, 1908, and the defendants would be entitled to the reductions referred to.

Defendants in reconvention claimed the rectification of the contract.

Plaintiffs in their replication denied the allegation that the contract was not complete, and held that it was binding and final as it stood.

The hearing was adjourned.

A 15,000-H.P. Vertical Turbine.—The electrification plans of the Puget Sound lines of the St. Paul Railway include a great system of power houses to supply the current necessary for the operation of these lines: the transmission lines of the Montana Power Co., which has undertaken to supply the road with power, form a network that covers the greater part of Montana and a portion of Idaho, not only supplying electric power for the 440 miles of railway that are being electrified, a large portion of which is now in operation, but also furnishing power for many mining enterprises. For this work the power company has 12 power stations, either already developed or projected, and by a complete system of interconnections a constant supply of power is insured.

These stations, which will have an ultimate capacity of 243,890 kw., supply alternating current at 100,000 volts, which at the points where it is used is stepped down to the required pressure. In the case of the railway, the current is utilised at 2,300 volts by motor-generators, which furnish direct current at 3,000 volts to the trolley wires.

One of the smaller power stations is operated by steam turbines, but all the rest depend on water power, and to supply this a number of reservoirs have been established in different places. The largest reservoir, at Hebgen, has a storage capacity of 300,000 acre-ft., located at the headwaters of the Madison River, and this can supply in turn the several installations on the Madison and Missouri rivers, so that the same storage water is used a number of times, giving an available storage capacity considerably greater than the above figure would indicate. Besides this great reservoir there are several auxiliary reservoirs at various points that bring up the total available capacity to 418,000 acre-ft.

The largest of this great system of power plants is at Great Falls, Montana; there are six turbines at this station, each rated at 15,000 shaft H.P., that will give a combined output of 90,000 H.P. In addition to the main turbines, there are being installed two similar units of 850 H.P. each for driving the exciters.

The big turbine has a single runner working in a cast-iron scroll case, and operating under a head of 150 ft., and its size may be judged by the fact that the intake is 8 ft. in diameter. The shaft of this turbine is vertical, and the moving parts of both the turbine and the electric generator are suspended from a thrust bearing on the top of the generator.—*Scientific American*.

Fuel Economy in the U.S.A.—The recovery of the valuable by-products from American coke manufacture made big advances in 1915, and has now attained the proportions of an important industry. The value of these by-products last year was nearly \$30,000,000, a large increase over the previous high-water mark of \$17,500,000 in 1914. Under the spur of almost fabulous prices for benzol products, retort coke-oven plants throughout the country quickly installed elaborate benzol-recovery systems, and now save the valuable oils that not very long ago were being burned or wasted, or, if saved, were begging for a market. The benzol products obtained in 1915 amounted to 16,600,657 gallons. More than 138,000,000 gallons of tar were obtained from coke ovens, and sold for \$3,568,384, in 1915. The ammonia brought a total of \$9,867,475 to the producers. Surplus gas to the extent of 84,356,000,000 cu. ft., valued at \$8,625,000, was sold or used. The by-products, which had a total value of \$29,824,379, were obtained by the carbonisation of 15,500,000 tons of coal, from which was also obtained 14,000,000 tons of coke, valued at \$48,500,000. The total value of the coke and by-products was more than \$78,300,000.

—*Science*.

Appointments Vacant.—Works electrician (£12s. per day) for the Municipality of Port Elizabeth, South Africa. See our advertisement on page 380 today.

Electro-Harmonic Society.—The first smoking concert of the association will be held at the Holborn Restaurant (King's Hall), on Friday evening, October 13th, 1916, commencing at 8 p.m. The programme is as follows:—Tenor, Sapper Frank Webster, bass-baritone, Sapper Joseph Farrington; comedian, Mr. Ben Osborne, humorous entertainer, Mr. Walter Churcher, solo violin, Signor Francesco Virgilio, entertainer at the piano, Mr. Leslie Harris, solo pianoforte and accompanist, Mr. Bernard Flanders, V.R.M., Captain H. Radl Sankey, C.B., late R.E., has kindly consented to take the chair.

Electric Steel in France.—A new electric steel furnace has just been brought into operation at a power station of the Tramways Départementaux, where it is being used for the smelting and refining of the steel turnings arising from the shell factories in that region. The furnace, which is said to be of the Keller type, will be able to deal with 30 tons of turnings per day, yielding 25 tons of steel. Power is supplied from the Eymoutiers Works at a pressure of 30,000 volts, reductions to 10,000 volts and then to 100 volts being made at the tramway station.

German Wiring Rules.—Further modifications have been made in the wiring standards and practice laid down by the German Electrotechnical Union (V.D.E.), in order to effect yet further economies in cotton and reclaimed rubber. Cotton may no longer be used as covering material for rubber-insulated zinc and aluminium conductors of 16 sq. mm. (say, 7/16 s.w.g.) and larger cross-section. In rubber-insulated zinc and aluminium wires, and in armoured wires, a paper sheathing is now to be used over the rubber in place of the rubber or impregnated strip, formerly prescribed for the duration of the war. An earlier rule permitted the use of paper in this connection, but did not make it compulsory. Flexible conductors for use with counterweight fittings in low-pressure installations are temporarily removed from the rules, and will not be made until further notice. Probably this deletion is due to difficulty in making satisfactory conductors of this type from "substitutional" materials, though it may, of course, be in the nature of a war economy by suspending manufacture of a class of wire which cannot be said to be indispensable. The Commission recommend especially that, wherever possible, use be made of wiring composed of materials of which there is no shortage, e.g., paper-insulated sheathed wiring. Conduit should only be installed where absolutely essential. For the duration of the war, and for some time thereafter, copper for wiring purposes, may have a resistance of 20 ohms per km. per sq. mm. cross-section at 20° C.; the standard on which the I.E.E. wiring table is based is approximately 17.5 ohms per km. per sq. mm. at 20° C.

Wages of Electricity Works Employees.—A number of men employed by the Islington Borough Council in their electric light department applied for leaving certificates at the London Munitions Tribunal on Tuesday, on the ground that they were not being paid fair wages. They asked that the 7d. per hour paid to labourers should be increased by 2d., with a proportionate increase to gangers and handymen and Trade Union conditions for other employees except engineers and bricklayers, whose Unions were acting separately. It was stated that some 70 or 80 men were involved. After a long consultation in private, the Chairman said that the Court were of opinion that the Council ought to take into consideration the question of whether the fair wages clause had been observed. They were of opinion that the undertaking was now a certified munitions factory, and that it had been brought under a clause which called upon it to pay a rate of wages no less favourable than those recognised in the district by trade societies. The case would be adjourned, so that the Corporation might consider the matter, and to give them an opportunity of negotiating with the men. If at the end of the negotiations the men felt that they had a grievance, they could come back to that Court. *Morning Post.*

A Remedy for Slippery Iron Plate Floors.—Writing to the *American Machinist*, Mr. W. A. Lailer says:—

In one part of our shop we have installed a large area of sheet-iron floor-plates that were entirely satisfactory until the corrugations wore off, after which the smooth-worn plates gave considerable trouble owing to several nasty falls of the men that resulted—the trouble being enhanced because of the presence of oil and grease. Roughening the plates by means of chipping was tried, but this could not be done very satisfactorily nor without excessive wear on the plates.

It then occurred to us to try to corrode the plates slightly as often as necessary, to prevent them from becoming too slippery. Since a deep rusting effect was not desired, because of excessive eating-away of the plates, we arranged to take care of it in the following manner: We take a small amount of powdered salamoniac, which is used as a corroding agent in our work, and mix it up thoroughly with a large quantity of fine sand. This mixture is then sprinkled over the floor so that all parts are covered, and then the whole mass is watered, using an ordinary sprinkling can, and left to lie over night. In the morning the sand is swept up, a rust coating being produced by the action of the salamoniac that will last for several weeks, after which the process is repeated.

We found that this method involved less time and cost and was more effective in eliminating danger from slippery iron plate floors than any other of which we have heard.

Inquiries. Makers of the "Volco" battery, marked "S.P.S. & S. Ltd." and makers of the Flaman (Paris) speed recording instruments, are asked for.

A correspondent is anxious to get into touch with a firm able to supply windmills for driving dynamos.

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place, S.W.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, October 9th.—Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10, Signalling Class. Recruits' Drill, 6.25—8.

Tuesday, October 10th.—School of Arms, 6—7. Lecture, 7.15, "Organisation and Discipline," Company Commander A. Hynain, Range Practice.

Wednesday, October 11th.—Instruction Class, 5.15. Platoon Drill, Platoon No. 1. Range Practice.

Thursday, October 12th.—Platoon Drill, Platoon No. 7. Range Practice.

Friday, October 13th.—Technical for Platoon No. 10, Regency Street. Squad and Platoon Drill, No. 9. Signalling Class. Recruits' Drill, 6.25—8.25.

Saturday, October 14th.—General Parade, 2.15; Uniform, for Drill.

Sunday, October 15th.—Entrenching.—Parade Victoria Station (S.E. & C. Railway). Booking-office, 8.45 a.m.

(By order) MACLEOD YEARSLEY, Adjutant.

October 4th, 1916.

Electrochemistry in Norway.—The Fredriksstad Elektrokemiske Fabrikker A.B. has increased its share capital from 350,000 kroner to 700,000 kroner.

The Bremenger Power Co., whose head office is at Bergen, has decided to raise its share capital from 600,000 kroner to 5,000,000 kroner. The company also intends to utilise the Selvas stream, in Bremenger, to the extent of 21,000 turbine h.p., and to establish a carbide factory with an estimated annual output of 30,000 tons of carbide; also a cyanamide factory. The aggregate capital of the several concerns is put at 9,000,000 kroner.

Electric Farming in Canada.—According to telegraphic information received at the office of the High Commissioner in London for Canada from the Minister of the Interior at Ottawa, a large number of farmers within a radius of 50 miles of Lethbridge, Alberta, will shortly install electrical plants for various purposes on their farms. These plants are run by small petrol engines, and cost from \$300 to \$500 (about £62 to £103) each, according to the power generated. —*Board of Trade Journal.*

Fatalities.—On Saturday last an assistant electrician named Gerald J. MacErlan, aged 18, in the employment of Mr. Stanley Johnston, electrical engineer, Belfast, was killed in the Inver Bleaching Works, Larne. He was carrying out some electrical repairs in the bleach house, and while working at some wires near the roof his sleeve was caught in some gears. He was found hanging over the shafting, and was dead. There were lengths of electric wire coiled round the body. His head was almost severed from his body.

At Peak Dale, last week, an inquiry was held into the death of Tom Bennet, aged 35, a wagoner and weighman employed by the Buxton Lime Firms Colliery, who was found dead in a tunnel, lying on a pipe through which an electric wire ran. The inquiry was attended by Mr. G. Scott Ram, Electrical Inspector to the Home Office, Mr. J. D. Mottram, and Mr. W. J. Charlton, Inspectors of Mines, and Mr. A. C. Ainsworth, for the company. Mr. T. C. Griffiths, electrical engineer for the company, said that this particular line of wiring was there before his time. It was to provide light for the tunnel. Verdict: "Killed accidentally by an electrical discharge."

REVIEWS.

A Manual of the High-Speed Steam Engine. By H. KEAY PRATT, A.M.I.Mech.E. London: Constable & Co. Price 5s. net.

The high-speed steam engine may be said to be a direct outcome of the activities of the electrical engineer.

When electric lighting first came into vogue the dynamos were driven by ordinary steam engines coupled up by belt. It was soon seen that there were many objections to this arrangement and that much better results, to say nothing of space saving, should be obtained by using a direct-coupled engine, assuming that such an engine could be designed and made to run at dynamo speed. We all know the success that was achieved in the desired direction by Willans, Chandler, Brotherhood, Morcom, and other distinguished engineers.

Yet, in spite of the general adoption of the high-speed steam engine in recent years for electrical work, it is remarkable how little has been published about it in book form and dealing exclusively with the practical design and running of this type of engine. Mr. Pratt remedies the deficiency very effectively in the 270-page illustrated handbook under review.

No designer of these engines, however standardised his engines may have become, can fail to find in its suggestions likely to be helpful, whilst it will be of still more general assistance to the greater number of persons engaged in, or responsible for, the running of these fascinating machines.

Though the volume deals primarily with the design of the double-acting, forced lubrication type of engine, the single-acting type is also considered. The various details each have chapters to themselves, such as steam cylinders and adjuncts; valves; pistons; connecting rods, piston rods, crankshafts; baseplates and flywheels; and governors. Materials of construction, as well as foundations and erection, are well discussed. The chapters on testing and on practical working will be found specially helpful to those responsible for the good performance of these engines.

The concluding portion of the book is devoted to descriptions and illustrations—from photographs and working drawings—of a selection of well-known high-speed engines, including the Allen, Alley & MacLellan, Belliss & Morcom, Brotherhood, Brovett & Lindley, Burnsted & Chandler, Chandler, Sisson, and Willans. The distinctive features of the several designs are skillfully touched upon by the author, making this chapter of value also to the potential purchaser of a high-speed engine as well as to the designer and maker.—G. S. S.

Arithmetic for Engineers. By CHAS. B. CLAPHAM, B.Sc. London: Chapman & Hall. Price 5s. 6d. net.

The "directly useful" technical series of text-books issued by Messrs. Chapman & Hall already includes a number of valuable manuals for engineers, and this latest addition by Mr. Clapham is in no way inferior to its predecessors. The series is designed to occupy a midway position between the usual types of theoretical and practical text-books, and *Arithmetic for Engineers* deals with the subjects of algebra, mensuration, logarithms, graphs, and the slide rule with a distinct bias towards the practical, but without entirely neglecting the theoretical side of these subjects.

As the author rightly points out in his preface, the title of the book inadequately describes the contents, but the more apt title of "Mathematics for Engineers" had already been chosen by Mr. Rose for a more advanced treatise in the same series—hence this misnomer. The subjects dealt with in the present volume are the simpler portions of practical mathematics—vulgar fractions, decimal fractions, symbols and their uses, simple equations, logarithms, mensuration, graphs, and the slide rule. Every section is treated in a remarkably complete and painstaking manner, indicating that the author has had considerable experience as a teacher of mathematics. Diagrams to illustrate the examples and worked exercises of all kinds abound, and no detail has been thought too small to merit careful attention. In fact, the attention to detail is carried to such lengths as to render some parts of the book verbose, and the necessity for more than the mere passing mention of some of the matters to which whole paragraphs are devoted seems to us quite superfluous. It is just as fatal to labour a subject overmuch as to scamp it unduly, and a book written so laboriously as to ensure the understanding of the veriest duffer is liable to be tedious to the average student. Mr. Clapham certainly seems to be catering for a very block-headed type of student in some of his earlier pages; but it is also true that the majority of text-books on elementary mathematics seriously err in the other direction—by taking far too much for granted.

Chapters I and II deal with vulgar and decimal fractions, and contain a multitude of examples taken from every conceivable branch of engineering science. Important paragraphs in Chapter II deal with degree of accuracy and approximation for result—two points to which it is essential that the attention of all engineering students should be directed in the very early stages of their mathematical training.

The chapter on symbols deals fully with brackets, square roots, powers, and indices. A very useful section is devoted to clearing up the difficulties which the beginner invariably discovers in connection with the addition and subtraction of + and - quantities. The illustration of this by reference to changes of temperature on a thermometer is apt and well written.

At first sight, a chapter of 30 pages on simple equations would appear to be an untimely waste of space in a book which has already dealt in some detail with subjects which are usually taken at a much later stage, e.g., indices and square roots. But Mr. Clapham has found so many things to say about these "short statements that two things are equal" that it would be utterly impossible to spare even half a dozen of these pages without injuring the treatment. Included in this chapter are examples of simple equations involving fractions, brackets, indices, and surds.

Although regretting lack of space for the fuller treatment of the theory of logarithms, the author has not wholly neglected the theory, while he has given a very complete account of the use of logarithms with a large number of practical examples.

Chapter VII, on mensuration, is undoubtedly the most valuable portion of the book. In just over 100 pages the author has covered all the ground usually covered in mensuration books, and not only so, but he has provided a unique collection of illustrated examples which are worthy of unstinted praise. Starting with units and measurement, this chapter

deals in succession with perimeters, angles, and areas, and the following chapter completes the treatment by dealing with volumes and surface areas; useful tables of circumferences, areas, and volumes of all the principal figures are given at the ends of these chapters.

The last chapters on graphs and the slide rule are both clearly written accounts, with many examples worked out in full, and others left for practice by the student.

It is extremely difficult to estimate the true worth of this book taken as a whole, or to recommend it to any particular type of student. Some parts of the first three chapters, and the whole of the rest of the book, may be regarded as covering the average first and second-year courses in arithmetic given to engineering apprentices. But the greater portion of Chapter I, and much of Chapters II and III, is certainly work that should be done in the elementary school before a boy can call himself, by any stretch of the imagination, an engineer. In fact the early part of the book is more correctly "Arithmetic for Everybody" for the student who becomes an engineer before he knows the meaning of plus and minus, or can cancel a vulgar fraction down to its simplest form, is surely extinct in these days, and it is not now necessary to explain the multiplication of $\frac{3}{4}$ by 5 in five steps (page 22) to anyone above the age of 12. The latter part of the book can be heartily recommended to young engineering apprentices for its very thorough treatment of logarithms, mensuration, graphs, and the slide rule.

The book is well indexed and serviceably bound, and is fair value for the price asked.—P. H. S. K.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—Erith U.D.C. has decided to grant a payment of £50 to the electrical engineer and manager, Mr. J. C. WILLIAMS, in respect of services rendered.

Rugby U.D.C. has increased the salary of Mr. SHENTON, manager of the electric light works, by £25 a year to £250.

The Walthamstow Lighting Committee has decided to fix the wages of Messrs. G. F. BRIDGMAN and H. J. HALLIDAY, who have been trained by the electrical engineer as switchboard attendants, at 25s. per week each, rising by half-yearly increments of 2s. 6d. per week to 35s. Mr. R. E. MASON, switchboard attendant, is to be promoted to the position of junior charge-engineer, with an increase of 2s. 6d. per week, and his maximum salary is to be increased to 45s. a week.

The Kendal Electricity Committee has decided to increase the salary of its electrical engineer by £25 from October 1st, making £200 per annum.

On 2nd inst., Mr. J. S. D. MOFFETT, of West Ham, took up his duties as general manager of the Belfast Corporation tramways, in succession to Mr. Andrew Nance.

Mr. J. BUCHANAN, engineer-in-charge at the Hammersmith B.C. electricity works, has resigned his position.

General.—Mr. CHAS. MAYFIELD, electrical engineer, of London, was married last week, at Clifton, Bristol, to Miss Laura Coates, daughter of Colonel Coates, late Sheriff of Bristol.

Mr. W. E. WATERS, secretary and cashier at the Farnworth D.C.'s electricity works, who has accepted an appointment at Messrs. Cammell, Laird & Co.'s works, at Sheffield, has been presented by the members of the Farnworth staff with a smoker's cabinet and set of pipes.

Mr. JOHN ROTHMAN, manager for Messrs. Ferranti, Ltd., electrical engineers, Hollinwood, Manchester, is now in the hands of the Germans. He was one of the 66 passengers on the Dutch liner *Prins Hendrick*, which, whilst on a voyage to Gravesend, was captured by the Germans and taken to Zeebrugge. Mr. Rothman was returning from a visit to Amsterdam in connection with the firm's business.

London Gazette Notice.—Territorial Force. Royal Engineers. Type Electrical Engineers. Second-Lieutenant LIONEL HORTON (Royal Warwick Regiment) to be Second-Lieutenant.

The Manchester City Council, on Wednesday, approved the action of the Tramways Committee in granting the request of the Board of Trade for permission for Mr. J. M. McELROY, general manager of the Corporation tramways, to act as referee to determine the difference between the Bacup Corporation and the Rawtenstall Corporation re stages and fares.

Mr. H. BROWNE, Messrs. Falk, Stadelmann's representative for the South of England, has been appointed to the London Electrical Engineers, Territorials. Arrangements have been made for his colleague, Mr. C. H. BEAZLEY, to wait upon his clients during the remainder of the war.

Roll of Honour.—Captain R. S. WADIE, King's Own (Royal Lancaster Regiment), reported wounded, is the son of Mr. W. S. Wadie, electrical engineer, of Chiswick, W.

Gunner R. H. SAUNDERS, of the R.F.A., formerly on the staff of the Carlisle electricity works, has been granted a

Obituary.—MR. JOHN HENRY LEE.—Mr. John Henry Lee, who died at Derby on September 24th, at the age of 64 years, was associated with the old Electric Telegraph Co., and entered the Government service at the time of taking over the system in 1870. He was, until his retirement in 1908, telegraph superintendent at Derby.

Magnetic Waves, Ltd. (1,525,111) s.—Particulars filed September 2nd, 1916. Capital, £25,000 in 14 shares. Registered in Jersey. Incorporated in Jersey. 1916. The business of electro-magnetic wave treatment, &c. British address: 133 and 135, Oxford Street, W. Sir Ernest W. Robinson, Bart., Craigmore, Queen's Road, Jersey; H. G. Barrett, Mill Land, Clayton, Sussex; R. A. Pitcairn, 10, Hanover Square, W.; and T. W. Norman, Spring Hill, Wellingborough, are authorised to accept service. Directors: R. A. Pitcairn, W. Robinson, Bart., H. G. Barrett, T. W. Norman.

Lancashire Electrical Engineering Co., Ltd. (56,992).—
Capital £5,000 in £1 shares. Retained profits Jan. 26th, 1916, £878; share
taken up, £20 paid, £1,878; on profit £1,111. Dividends and charges. Nat.

Marconi International Marine Communication Co., Ltd.
 (inc. U.S.A.) Capital, £250,000 in 41 shares. Return dated June 28th, 1946
 306,984 shares taken up, £201,984 paid, £105,000 considered as paid. Mort-
 gages and charges £114,560.

The report was printed in the ELECTRICAL REVIEW for September 15th.] Mr W. HARRISON CRIPPS presided over a comparatively small attendance. In opening the proceedings, after a feeling reference to the loss the company had sustained since the last meeting in the death of Lord John Hay, one of the original directors, he said that the object of the meeting was to confirm a compromise. Compromises proverbially satisfied nobody, and it was useless to pretend that he was entirely satisfied with the arrangement come to between the committee and the board. He would have liked all the questions at issue between the board and these responsible for the appointment of the committee to have been thoroughly thrashed out, and in particular that every shareholder should have been placed in a position to form a judgment on their merits. The publicity necessarily incident to such a process was, however, considered to be adverse to the true interests of the company, and having satisfied himself that an arrangement was possible on the basis of his own resignation of the chairmanship of the board, he could not allow his own wishes or his own interests to stand in the way of what otherwise seemed to be to the advantage of the company as a whole. In resigning an office which he had now held for 17 years, and to the duties of which he had devoted the best years of his life, he would have liked to devolve the work which had been done and to give his reasons for believing in the existing and future prosperity of their undertaking. Under existing circumstances he could not do this. Were he to attempt it he would be reviving controversies which it was the chief object of the compromise to set at rest. To every word of what he said at the last meeting he still adhered. Much of it had been confirmed by reports made by Sir John Snell, late President of the Institution of Electrical Engineers, and Mr Picken, the well-known city accountant, and reports which had been submitted to the committee and would be invaluable to the directors for future reference and guidance. He regretted that the committee in their report did not further explain the statement as to the fall in dividend since 1905, implying that it was the result of bad management on the part of the board, and suggesting that it was the cause of the retirement of certain directors. It was that statement that so thoroughly alarmed the shareholders when asked for their proxies. The earnings of the company had not fallen; they had increased. The actual gross receipts in 1906, the year after the sale of nearly half of the property to Marylebone, were £175,000. Last July they had risen to £253,000, a rise of over 44 per cent.; and they had already received the report of the progress during the past half-year. They would remember that 1906 was the first year after the loss of Marylebone, and was therefore the

first year for ascertaining either increase or decrease of receipts. He explained in March that the initial fall in dividend in 1900 was fully and amply compensated for out of the excellent award of £1,212,000. Included in this sum was compensation for lost future dividends assessed by the arbitrator at no less than £750,000. At a special meeting, it was unanimously decided to return that sum, representing the lost future dividends, to the shareholders, who received approximately a bonus of £6 10s. for each £10 share held. He was sorry the shareholders could not have seen Mr. Pixley's report on this vital matter, which entirely supported the explanation given by him (the chairman) at the last meeting. He also said that the committee suggested that Mr. Highfield's services as engineer should be retained. He feared they could not have followed the facts. The board, fully confident of the value of Mr. Highfield as an engineer, had already retained his services for a period of five years from the commencement of this year. The arrangement came to by the board had been the subject of diverse criticisms. With criticisms made by those who did not share his own views he was in no way concerned. But there were two criticisms put forward by his own supporters on which he desired to say a few words. How he had been asked, had he brought himself to abandon this or that particular line of policy, or this or that commercial principle on which he had till now insisted as essential to the well-being of the company? His answer was that neither he nor they would have abandoned any line of policy or any commercial principle to which they had heretofore attached importance. The compromise which had been come to decided nothing as to policy or principle. It affected merely a change of personnel in the directorate. The reconstituted board would consider all those questions and determine them to the best of their ability, and in accordance with the best advice that could be obtained. He had no doubt that every member would act *bona-fide* in the interest of the company. As on all boards, there might be differences of opinion, a certain amount of give and take. But obviously questions of that sort were better decided by an authorised board of directors than by an *ad hoc* committee. He had also been asked why, with so many able business men already shareholders in the company, they had thought it necessary to find a new chairman and new directors from outside. In his opinion that criticism was well founded, and he was afraid that he was not altogether free from responsibility. The new chairman and new directors were selected by the committee, but he (the speaker) made it a condition of his resignation that they should be gentlemen not hitherto connected with the company. That might have been taken to exclude existing shareholders, though it was meant only to exclude those who had already taken part in the management of the company. The matter was hot, however, now of any great importance. The new chairman and directors, whether taken from inside or outside, might be assured of the cordial co-operation of their colleagues. Mr. George Verity was known to them all as having always taken an interest in the company, and his brother, the late Mr. John Verity, was long a valued member of the board. He had not the advantage of knowing the other two gentlemen nominated, who, however, seemed to have a wide experience of company matters. With close attention to detail, and goodwill on the part of all concerned, he saw no reason why the prospects of the company should not be assured, and for his own part he would in the future, as in the past, do everything in his power to advance the interests of the company, in whose future he had the utmost confidence.

Mr. ROGER GREGORY, chairman of the shareholders' committee, then moved the adoption of the report of that body. He said that, speaking for the committee, he wished to say how greatly they appreciated the generous terms in which Mr. Cripps had expressed himself in his speech, and for the way in which he had carried out a task which must have been a painful one to him personally. With regard to the report, as the chairman had said, it was entirely a compromise. The task of the committee had been an arduous and a difficult one. They had interviewed numerous witnesses and had had before them a great mass of reports, some of them of a highly technical and difficult nature, and they had formed their conclusions to the best of their ability. As they proceeded with their work it seemed to himself and his colleagues on the committee that a change in the board was desirable, and he believed they had succeeded in selecting three names which would commend themselves to the shareholders as desirable additions to the board. It might be asked why they had not suggested the three directors whose resignations had resulted in the appointment of the committee, but, as he had said, the report was the result of a compromise. He fully agreed that great credit was due to those who first realised the necessity for an inquiry. With regard to the future, he did not think there was any cause for anxiety about the company's prospects. The shareholders had a very valuable property indeed, and he believed that if it was carefully and properly managed they could look forward to considerable prosperity. The committee had amassed a large amount of very useful information in the course of their inquiries, which would be at the disposal of the new board. Regarding Mr. Highfield's services, he would like to say that he thought all the committee were agreed that they had been of the greatest possible value to the company.

Mr. J. CARR SAUNDERS seconded the motion.

Mr. TOY proposed an amendment to refer the report back to the committee with instructions that they should amplify it and report to an adjourned meeting on November 9th. In the course of a long speech Mr. Toy said he must confess to a feeling of disappointment at the result of the labours of the committee. The report did not give them a vestige of information, and the shareholders were asked to take its conclusions upon trust. They were not given access to any of the reports which had been brought before the committee, and they had not been taken into their confidence in any way. The suggested compromise was inconclusive and unsatisfactory, and if they were not very careful it would land the company in further difficulties.

Mr. PIERSELL formally seconded the amendment.

Mr. GREGORY said he admitted that the report might seem a bald and colourless document, but if it had gone into detail it would have had to deal with the intimate relations that existed between the company and its customers, and such publicity would not have been to the advantage of the company. All the information which the committee had would be placed before the new board, and it would be for that body to deal with it as they thought best in the interests of the shareholders.

Sir R. MELVILLE BEACHCROFT, a member of the committee, said they had employed four technical experts occupying probably the highest positions in London in their several professions. Those gentlemen had made their reports, and, as was usually the case, none of them agreed with the others. Under the circumstances he thought the compromise suggested was the best course to take, and he thought the shareholders were indebted to the chairman for having been willing to sacrifice himself in order to bring about an arrangement of the kind proposed. The future of the electrical industry in London was uncertain. Just before the war the London County Council proposed a Bill for amalgamating the companies and buying them out by agreement, which Bill, he was confident, would be reintroduced the moment the war was over. When that time came they would need not a divided board, but one that was united, and they would want the help of the most experienced men who were now dealing with this question.

Mr. PAXTON expressed disappointment that the committee had not made any reference in their report to the part taken by Mr. Tuckett in bringing about the inquiry. It was, he said, that gentleman's technical knowledge that showed him that something was wrong as soon as he was elected a director, and the shareholders had to thank him for the part he had taken in the matter.

Mr. FRANK BAILEY, as an original shareholder, and as one whose official connection with the company ceased five years ago, said he was disappointed with the compromise put forward by the committee, which did not seem to be accompanied by sufficient evidence as to its utility. If the committee thought that Mr. Tuckett, Lord Avebury, and Sir James Pender did right in resigning their seats on the board, they had a right to expect something more conclusive than the report which had been issued. The least the committee could have done was to have made some public recognition of the services of those gentlemen.

On a show of hands the amendment was negatived by a large majority, only nine voting for it, and the report of the committee was adopted.

Mr. A. W. TAIT, Mr. George Balfour, and Mr. George Verity were then elected as directors of the company in accordance with the recommendation of the committee, and a further resolution was agreed to directing the committee to place at the disposal of the board the reports of the experts employed by them.

On the motion of Mr. A. SAMUEL, a cordial vote of thanks was accorded to the chairman for the services he had rendered to the company in that position during the past 17 years, and a similar vote was accorded to the shareholders' committee.

The report for the year ended March 31st, 1916, of the A.G. der Maschinenfabriken Escher, Wyss & Co., of Zurich and Ravensburg, the majority of whose shares passed again into Swiss ownership some time ago, states that the effects of the war were felt considerably less than in the preceding financial year, as a more active demand set in gradually for the company's specialities. It was, however, only possible to take advantage to a moderate extent of this favourable state of affairs owing to the increasing difficulties which arose from the enormous rise in the prices of almost all raw materials and intermediate products, and in obtaining delivery of them. A further hindrance to business lay in the low level of the rate of exchange with individual countries, which in many cases caused contracts to be no longer remunerative. It had therefore been necessary to work other markets to a greater extent, and the hope was expressed that the new business connections thereby obtained would also be maintained after the conclusion of peace. The frequent changes in the workmen and staff in consequence of military requirements and the migration of skilled workmen had an unfavourable effect on the production. Notwithstanding these difficulties, it was possible to raise the degree of activity in most departments almost to the normal level of the last year of peace. During the year the hydraulic turbine

plant for the Electric Light & Power Co. was set in operation with very favourable results, and the financial settlement of this great transaction was now proceeding satisfactorily in every respect. The delivery of machinery to different countries, particularly Russia, suffered from great difficulties, especially in the steam turbine department, which consequently did not develop quite as had been expected. In the meantime the demand for steam turbines had increased, and was very active at the present time. After placing £32,000 to the depreciation fund, as compared with £21,000 in 1915-16, the accounts show net profits amounting to £17,000, as against £13,000 in the previous year. It is proposed to pay a dividend at the rate of 4 per cent. on the ordinary share capital of £260,000, being the same as in 1915-16.

Calcutta Electric Supply Corporation, Ltd.—Interim dividend on the ordinary shares at the rate of 7 per cent. per annum for the half year ended June 30th.

Cuba Submarine Telegraph Co., Ltd.—Interim dividend on the ordinary shares for the half-year ended June, 1916, at the rate of 5 per cent. per annum.

Montreal Light, Heat & Power Co.—Interim dividend at the rate of 8 per cent. per annum for the quarter ending October 31st.

STOCKS AND SHARES.

TUESDAY EVENING.

Stock Exchange markets have had an abrupt check to their previous vitality and strength. It was not supposed that the Government would issue any new form of borrowing to come into direct competition with existing securities, so that the offer of three-year 6 per cent. Exchequer Bonds has come as a surprise and a disappointment. Critics blame the Government for this new departure, and complain that holders of the existing 4½ per cent. War Stock have been badly treated, in that their option to exchange into a new loan is once more rendered nugatory by the fact that the latter is in the shape of Exchequer Bonds, into which the proprietors of the War Loan cannot make a direct exchange.

The defenders of the short-term policy point out that the 6 per cent. Exchequer Bonds are likely to prove very tempting to foreign investors, whose money will be useful at the present time in keeping steady the rates of exchange. But for this advantage, it may be wondered whether the Treasury is not paying an extravagant price, and whether a straight-out 5 per cent. longer-term loan would not have achieved an enormous popular success.

The immediate consequence is that all fixed-interest securities have become unstable, and their prices have dwindled. Indeed, for the moment it is difficult to say upon what basis stocks and shares can be valued. Obviously, the 6 per cent. Exchequer Bonds set up a new standard—at all events, for the time being. Severe falls in Consols, the War Loans, Colonials, and similar stocks have been the natural corollary to the Treasury's offer, and no doubt, in course of time, markets will settle down again, just as they did after the advent of the 4½ per cent. War Loan some 15 months ago. But until the investor becomes familiar with the new bonds, and with the standard of comparison which they set up, we are not likely to see any noticeable improvements in the purely investment descriptions.

Home Railway stocks have suffered acutely in that the depression caused by the 6 per cent. issue comes at a time when further Labour trouble among coal miners begins to manifest itself. It was only a fortnight ago that the railwaymen were given a substantial increase of wages, and everybody hoped that the Labour world would be content to carry on under present conditions, at all events through the winter. The coal miners, however, think otherwise, and, in the circumstances, it is not surprising that proprietors of railway stocks should feel somewhat despairing of their investments. The flatness has extended to electric railway varieties, and Districts, Metropolitan, and Underground Electric are all lower on the week. London & North-Western Consolidated dropped below par, in spite of the start which has been made with its electrified suburban system. Underground Electric Income Bonds gave way to 88.

The meeting of the Metropolitan Electric Supply Co. passed off with no more ruffling of the waters than might have been anticipated, having regard to all the circumstances of the case. The resolutions were duly carried; and, as we have said before, the thanks of the shareholders are due to the committee which spent so much time and energy upon the affairs of the company since spring. No change has occurred in the price of the shares, and the Electric Lighting list is steady throughout. The reversion to winter-time had no effect upon prices. It may be recalled that the dulness which occurred in this market upon the introduction of summer-time was recovered in less than a month, so that the success of the scheme was not tinged by so much as a shrinkage in the prices of the shares of the illumination companies.

Anglo-Argentine Tramways begin to show a better tendency. The first preference are up 1/16, this being the first advance which has occurred for many weeks. Brazil Trac-

tions, however, are a weak market, there appear to be several lines of shares about, which have a difficulty in finding permanent homes. British Columbia stocks continue to advance, the preferred and the deferred both showing gains of a point on the week. Mexicans are weaker, though the Tramway Co.'s 5 per cent. first mortgage bonds have recovered their recent small loss. The bonds of the Electric Light and Power Co. fell 2 points, this notwithstanding distinctly more encouraging reports from Mexico than we have been accustomed to of late. Bombay Electric preference are in demand.

The New York financial papers dwell upon the remarkable way in which some of the Mexican railroads are recovering from their misfortunes under the recent chaotic regime. Stocks and shares in the Canadian-American power companies are mostly firm, though the spirit of speculation, which has reached boiling point in New York during the past fortnight, has been concentrated upon railway and munition issues, to the exclusion of the more humdrum Utilities. Canadian General Electric has risen four points to 124.

Marconis reacted to 3, but recovered most of their loss. Americans are quiet at 18s. 3d., and Canadians at 10s. 6d.

Amongst the Industrials, something of a reaction has occurred in armament shares, as well as in the iron and steel department. British Westinghouse preference eased off to 2½, on the other hand, Telegraph Constructions are good at 3½, and Electric Constructions at 18s. 9d. are 1s. 3d. up. Activity in the rubber share market has been checked to no small extent, although prices on the whole keep firm, there having been little selling. The various impositions of excess profits tax in Colonial and Allied countries are exercising their natural effect upon prices of shares in companies connected therewith, and a slight dulness in some of the copper companies' issues is due to this cause.

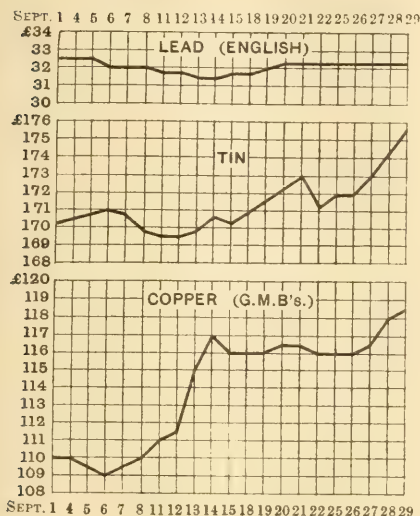
SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.						
	Dividend		Price Oct. 3, 1916.	Rise or fall this week.	Yield p.c.	
	1914.	1915.				
HOME ELECTRICITY COMPANIES.						
Brompton Ordinary ..	10	10	62	—	27 11 0	
Charing Cross Ordinary ..	5	5	35	—	7 1 4	
do. do. 4½ Pref. ..	4	4	87	—	6 0 4	
Chelsea ..	6	4	—	—	6 18 4	
City of London ..	9	8	122	—	6 10 8	
do. do. 6 per cent. Pref. ..	6	6	102	—	6 15 8	
County of London ..	7	7	107	—	6 9 8	
do. do. 6 per cent. Pref. ..	6	6	102	—	6 15 8	
Kensington Ordinary ..	9	7	56	—	6 4 5	
London Electric ..	4	4	18	—	6 10 4	
do. do. 6 per cent. Pref. ..	6	6	42	—	6 11 4	
Metropolitan ..	3	3	24	—	5 9 1	
do. do. 4½ per cent. Pref. 4½	4	4	34	—	7 4 0	
St. James' and Pall Mall ..	10	8	32	—	6 8 6	
South London ..	6	5	24	—	6 16 1	
South Metropolitan Pref. ..	7	7	125	—	6 7 3	
Westminster Ordinary ..	9	7	62	—	6 12 0	
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref. ..	6	6	102	—	5 17 6	
do. do. Def. ..	80½	33½	234	+ ½	7 8 3	
Chile Telephone ..	8	8	7	—	6 14 5	
Cuba Sub. Ord. ..	6	5	84	—	6 8 6	
Eastern Extension ..	7	8	142	—	5 9 6	
Eastern Tel. Ord. ..	7	8	145	—	5 10 0	
Globe Tel. and T. Ord. ..	6	7	123	—	6 11 0	
do. do. Pref. ..	6	6	101	—	5 11 7	
Great Northern Tel. ..	22	22	42	—	5 4 9	
Indo-European ..	13	13	49	—	6 12 8	
Marconi ..	10	10	39	—	5 10 0	
New York Tel. 4½ ..	10	10	100	—	4 6 6	
Oriental Telephone Ord. ..	10	10	25	—	5 18 5	
United R. Plate Tel. ..	8	8	6	—	5 18 5	
West India and Pan. ..	1	1	14	—	5 8 6	
Western Telegraph ..	7	8	142	—	5 8 6	
HOME RAILS.						
Central London, Ord. Assented	4	4	73	—	5 9 7	
Metropolitan ..	12	1	284	-1½	4 5 1	
do. District ..	Nil	Nil	17	—	Nil	
Underground Electric Ordinary	Nil	Nil	123	—	Nil	
do. do. "A" ..	Nil	Nil	5½	-61.	Nil	
do. do. Income ..	6	6	88	—	5 16 4	
FOREIGN TRAMS, &c.						
Adelaide Sup. 6 per cent. Pref.	6	6	43	—	6 1 6	
Anglo-Arg. Trams, First Pref.	5½	5½	3½	—	7 14 5	
do. do. 2nd Pref. ..	5½	5½	—	—	6 12 4	
do. do. 5 Deb. ..	6	6	76	—	6 14 6	
Brazil Tractions ..	6	4	594	-1½	6 14 8	
Bombay Electric Pref. ..	6	6	100	—	6 14 8	
British Columbia Elec. Ry. Pice. 5	5	5	75	—	6 13 4	
do. do. Preferred ..	Nil	61	—	+1	Nil	
do. do. Deferred ..	Nil	60	—	+1	Nil	
do. do. Deb. 42	42	42	67	—	6 10 9	
Mexico Trams 5 per cent. Bonds ..	Nil	44	—	+1	Nil	
do. do. 6 per cent. Bonds ..	Nil	90	—	—	Nil	
Mexican Light Common ..	Nil	Nil	18	-1	Nil	
do. do. Pref. ..	Nil	Nil	83	-3	Nil	
do. do. 1st Bonds ..	Nil	Nil	42	-3	—	
MANUFACTURING COMPANIES.						
Babcock & Wilcox ..	14	15	29½	—	4 18 0	
British Aluminium Ord. ..	6	7	123	+1/4	6 10 4	
British Insulated Ord. ..	15	17½	123	—	7 0 0	
British Westinghouse Pref. ..	73	73	22	—	6 0 0	
Callenders ..	15	20	123	—	6 0 0	
do. 5 Pref. ..	6	6	12	—	5 17 8	
Casner-Kellner ..	20	—	82	—	5 6 8	
Edison & Swan, £8 paid ..	Nil	—	10	—	Nil	
do. do. fully paid ..	Nil	—	12	—	Nil	
do. do. 5 per cent. Deb. 6	6	5	62	—	8 0 0	
Electric Construction ..	6	7½	33	+ ½	8 0 0	
Gen. Elec. Pref. ..	6	6	10	—	6 0 0	
do. Ord. ..	10	10	13	—	6 15 7	
Henley ..	20	25	142	—	7 9 2	
do. 4½ Pref. ..	44	44	12	—	5 6 0	
India-Rubber ..	10	10	12	—	5 8 3	
Telegraph Con. ..	20	20	89	- ½	5 6 3	

* Dividends paid free of income-tax.

METAL MARKET.

Fluctuations in September.



AMERICAN VIEWS ON THE DESIGN AND MANUFACTURE OF ELECTRIC COOKING STOVES.

THE report of the Electric Range Committee at the recent Chicago Convention of the National Electric Light Association contained, amongst other things, an instructive summary of American central station opinion as to design, manufacture, &c., of electric cooking stoves.

Although great progress is being made in electric cooking in the States, it will be noted that the conditions affecting design and production are not unlike those which prevail here.

As regards design, a summary of answers to questions addressed to 46 operating companies shows that types of ranges sold up to the present time have been the products of five manufacturers, all but one of whom have been making various electric appliances for some years past. There were 4,659 ranges reported sold, the majority of those apparently giving good satisfaction both as to operation and number of burners and sizes of ovens. The principal mechanical complaints were burning out of elements, slowness of operation, and fragile construction. There seems to be a variance of opinion regarding the relative merits of the open coil and enclosed burners, the former apparently being the more popular. The type of electric range most desired seems to follow the lines of the popular gas ranges. There should be four three-heat burners on the top (one 1,500-watt, two 1,000-watt, and one 750-watt). The side and upper ovens are by far the most popular. Ovens should be at least 12 by 15 by 18 in., and should contain a broiling element and a baking element. A warming oven above or below the baking and broiling oven is a desirable adjunct. The doors on side ovens should open down.

It will be noted that the gas stove has set the fashion in America as here, although the arrangement of the stove is quite different from that favoured on this side, being much less compact.

Apparently those undertakings which have connected the greatest number of ranges are doing all the wiring in connection with the installations. The costs for installing vary from \$4 to \$30, and average \$12½, and cost price is usually charged.

The demand of the American consumer is for a cooker costing from \$30 to \$40, but apparently many of them pay another \$10 to get "just what they want."

These prices presumably include control switches, which are, we believe, usually attached to American stoves, although frequently forming an item of additional cost in this country.

The majority of the supply undertakings hold the view that a durable and efficient stove, with at least three hot-plates and a side or upper oven, should, under present conditions, be obtainable at as low a price as \$30 to \$35, but some concerns fear that low price may mean a sacrifice in quality, which will do harm in the future to electric cooking.

Such a price for an efficient and durable stove of the kind indicated is low, judging by English prices even before the war, but presumably there are reasonable grounds for believing that a stove which will satisfy the consumer can be made at the price in America, whatever may be the case here.

We note that it is recommended that rotary snap switches controlling the service to various heaters should have a distinctive feature, either in colour or position of indicator, or both, when current is off. The distinctive feature at the present time on most of these switches is the reading of the word "off," but in a dim light, or when the eyesight is not of the best, reading is not always easy. A distinctive colour for the lettering of the word "off," or the uniform or distinctive position for the indicator, will quickly convey the idea to the operator whether or not the circuit is disconnected, even if only a hasty glance is given.

British practice for large installations appears to favour the use of pilot lamps as indicators, but very small pilot lamps are open to objection, and, in any case, are an extra which one would rather dispense with, if some satisfactory distinctive feature could be incorporated in the switch; possibly self-luminous lettering might answer the purpose, as in the case of the numerous luminous dial watches for night use.

We note that a large number of ranges have been placed on short-period deferred payments not extending beyond a year; simple hiring-out of stoves does not seem to be practised—at any rate, it is not mentioned.

Refining Zinc by Electrolysis.—A good deal of experimental work has been carried out during the past few years at the works of the Consolidated Mining and Smelting Co. at Trail, in the Rossland Division of British Columbia, in connection with the refining of zinc by electrolytic means. Spelter of good quality having in this way been produced to the extent of about half a ton per day, it was, some time ago, decided to establish a special plant capable of turning out up to 35 tons per day. The installation, which includes departments for grinding, roasting, leaching, electrolyzing, and melting, an electric power station, and a special dust-collecting plant, is now rapidly approaching completion. The experiments have, so far, been practically confined to the ore obtained from the company's own mines, and thus it is not possible to say whether the same process is capable of dealing with the prevailing zinc-lead ores of the district.

The Electrolytic Coating of Silvered Mirrors.—The old method of coating mirrors by the mercury process is a long, tedious, and unwholesome operation, which has been nearly universally replaced by silvering. The latter method is, however, by no means perfect; the very thin film deposited by reduction of a solution of nitrate of silver is neither as white nor as brilliant as that of tin amalgam; it is deficient in strength, being detached by the slightest friction, and tarnished on exposure to sulphurous fumes. These faults are only very imperfectly overcome by a backing of varnish, of itself often a source of deterioration. Long ago an electrolytic deposit had been considered as a substitute, but experiments in this field yielded only mediocre results, whose irregularity was mainly due to the extreme thinness of the silver coating. Indeed, in the electrolytic method, it is this metallic film which constitutes the kathode, whose very minute cross-section is a poor conductor. When the contact is made around the periphery of the silvered glass, the electrolytic deposit takes place almost entirely in its immediate vicinity, and at points remote from the edges the thickness of the deposit diminishes rapidly, so that at the centre there is scarcely any deposit.

This drawback has been cleverly overcome by Delere, Gresy and Pascalis, whose method is in actual use in Paris by the Compagnie des Glaces de Saint-Gobain. The process consists in multiplying the number of current-carrying points of contact on the silver kathode by means of flexibly supported metallic combs. These combs have brass teeth, to each of which is attached a globule of tin, a soft metal which avoids scratching the silvering. All parts of the electrode immersed in the electrolyte are covered with an insulating layer of paraffin, with the exception of the points in contact with the silvering. The anodes consist of bands of pure copper supported between the contact points. The mirror to be coated is laid, silvered side up, in a shallow tray containing the electrolyte, the latter being kept of uniform strength by forced circulation. During the plating the current is interrupted every few minutes, and the contact points are shifted a short distance. The electrolytic action is thus uniformly distributed over the entire surface, resulting in a very homogeneous deposit of copper. Mirrors so protected resist the action of sulphurous fumes under the most unfavourable conditions, and possess the unexpected advantage of increased reflecting power.—*Journal of the Franklin Institute.*

A very interesting section of the report which we particularly commend to the attention of British central station engineers, is that giving the ideas of some of the supply companies on dealing with manufacturers in order to obtain an ideal electric range at the lowest possible price; these confirm the views previously expressed in our pages*, and are summarised as follows:—

"The manufacturer should be willing to stand behind his product with a proper guarantee, and willing to deter some of the profits from the business until a future date, and not hope to make all on the first few ranges sold, but bring the price down as low as possible, and let the central station have an opportunity to put out more ranges."

"Standardise requirements of the central stations, so as to limit the types of ranges made by different manufacturers, and thus reduce their overhead expenses. Also show manufacturers that increased output depends primarily upon lower-priced ranges."

"Develop hot water attachment and durable elements."

"It seems as if a canvass of number contemplated to be used would allow greater number to be made, and this would allow cut in price, or manufacturing company could sign tentative contract to sell at certain reduced price if specified number were ordered by entire trade."

"Power companies to combine, in order to secure quantity prices."

"Standardisation of types should reduce production costs. Some method of collective bargaining between representatives of the manufacturers and central stations to establish standard designs for a pre-determined period might work to the mutual advantage of all concerned."

"Standardise and cut out novelty idea."

"A maximum production to lower unit cost."

"Through increased output, central stations could club together and order a certain number in advance."

"Dispense with nickel and frills, unless especially ordered."

"Standardise, so as to cut down manufacturers' cost."

"Study the gas range closely, and capitalise its experience."

"Let the electric manufacturers make the element and the stove manufacturers the stove."

"Ship complete line of repair parts to the distributor."

"Manufacturers should be more particular in details and mechanical construction."

"Do not load the development costs on first shipments."

"Better insulation in oven on cheaper ranges."

"Standardise on design and equipment. Reduce number of types of ranges, and talk quantity to the manufacturers."

We again take the opportunity of urging those interested in promoting electric cooking in this country to abandon the haphazard systems of the past in regard not only to design, but also to manufacture and marketing of the electric stove.

It is useless to attempt to grapple with an immense business, such as electric cooking has a good prospect of becoming, on any but commercially-organised lines, the logical essentials of which are quantity production on standardised lines, interchangeability of parts which may have to be replaced by the user, and mutual guarantees as between manufacturers and supply authorities as regards price and disposal of output.

Only in some such way as this—with present electric-heating methods—can we hope to place electric cooking on a really competitive basis and to achieve real success with it.

THE BRITISH ASSOCIATION.—V.

Address to the Economic Science and Statistics Section.

By PROP. A. W. KIRKALDY, M.A., PRESIDENT OF THE SECTION.

(Abstract.)

(Concluded from page 364.)

INDUSTRIAL ORGANISATION.

The industrial army of labour force of this country includes all those who either organise industry or take any part, however important or however humble, in its working, from the captain of industry down to the humblest weekly wage earner. In connection with this force we now have two sets of organisations whose interests some people consider to be antagonistic. I would emphasise the fact that these two are really one force, their main interests are identical, and they can best serve those interests by striving to minimise differences and by doing all that is possible to work in harmony.

British trade unions have a fairly long history behind them, and may be said to be in advance of any similar unions the world over. But the fact that of recent years there has been a tendency for small unofficial sections of given unions to kick over the traces and disregard the policy and agreements

of their leaders shows that perfection of organisation has by no means been attained.

Employers' associations are of more recent formation, nor have they so far attained to anything like the same completeness. Both organisations, especially the employers', are in need of further development. The economist can point to imperfections and make suggestions—only those conversant with practical working facts can formulate a practical policy. The individual British business man is unexcelled by the business man of any other country. In times of rapid transition and crisis he has again and again shown his leadership. He knows his business thoroughly, and as a working unit he has taken a very high place. But one of the most marked developments of modern trade is a growing interdependence of industries. Hand in hand with this we have become familiar with another phenomenon, the amalgamation of businesses of various dimensions into one great company or corporation. This phenomenon is common to both commercial and manufacturing interests. It is as marked among banks as among steel and iron companies. The comparatively small manufacturer or business man is giving place to bigger and inclusive organisations. These two and somewhat parallel developments are making a new demand on the individual. He and his predecessors exemplified individualism; the new stage upon which we have entered demands a modification of the old policy. Business, like everything else, is subject to evolution, and evolution on healthy lines can only be obtained by grasping fundamental facts and applying experience in accordance with economic laws. There need be nothing revolutionary about the required changes in our business organisation. We merely have to note what has already occurred, mark healthy tendencies, and clear away or prevent obstructions to natural growth. Our past history amply justifies us in pursuing this policy without uncertainty as to the result. Our entire industrial history is one of the best examples of steady and, on the whole, well-ordered evolution. We have shown our ability to adapt ourselves to the needs of the moment. As a race we are healthily conservative without being reactionary—that is to say, we know how to preserve what is good in the old and amalgamate it with the new. In other words, our organisation enjoys that useful quality of elasticity which enables us to keep abreast of the times.

Our business man's qualities emphasise his defects. For generations our business men have worked as units, and individualism has become almost second nature. The call now is that the individual shall sink a part of his personality and become, so far as one side of his activities is concerned, a member of an association. We have had employers' alliances, federations, and associations. Some have failed, some have managed to keep afloat, others have had a certain amount of success. None have hitherto quite attained to what is required. To the onlooker it would appear that when our employers meet as an association there is a lack of sympathy among the members, and if this should persist it would be fatal. Each individual knows his own business; he does not know, and perhaps it would be true to say he does not care to know, his neighbour's concerns. At any rate, as a result there is a lack of cohesion, there is a lack, too, of that co-operation which is required if the association is to be really successful and accomplish the objects for which it has been formed. This working in co-operation, the large organisations of capital, and the working together in associations, are comparatively new things to our business community. Time and experience will put things right; at present we have not accustomed ourselves to a newly-developing condition of affairs. Our business men, then, need to focus their attention on these early ailments of the movement and get them removed as soon as possible.

A second group of defects arises indirectly, but almost inevitably, from that which has just been considered. Some alliances, rings, and associations have failed and come to an end. And in certain cases the cause has been unmistakable, for there has been a lamentable want of loyalty, and even in some cases it must be said honesty, to the agreements entered into by the association.

Only to mention one group as an instance of this—the new trades combination movement, which caused quite a considerable stir during the late 'nineties of last century, especially in the Midlands among the metal trades. Articles appeared in the journals, and a book was written explaining the movement, and great hopes were entertained that a new era had opened out before both Capital and Labour. But all ended in a failure. There was for a time a kind of syndicalism—a syndicated industry enabling employers to increase their profits, and the workpeople to earn abnormally high wages. So long as competition could be kept out of the market, things went swimmingly, and a specious prosperity developed. But the consumer was being exploited—the increased prices charged for such goods as metal bedsteads gave would-be competitors and unscrupulous members of the alliance their chance. The cheap wooden bedstead, however, made its appearance on the one hand, and on the other there were such things as secret discounts and commissions, and this special alliance ended in failure. The history of that short, but industrially instructive, movement has yet to be written. Its cardinal facts should be known to those who now have an opportunity for shaping the industrial future of this country. Three lessons stand out from this experience:—

1. We must learn to work together in association.

* ELECTRICAL REVIEW, January 14th, 1916.

2. All members of an association must be absolutely loyal and honest to their engagements, either written or implied.

3. Such associations must be regulated or the community will be exploited.

Nor is it impossible to suggest a method by means of which this may result. When employers' associations have justified themselves it should be possible to obtain State recognition for them, and it would be practical politics, when both employers' associations and trade unions have developed to the point at which both merit State recognition, to enforce under penalty agreements made between them on all those, either employers or workpeople, who wished to work at the industry within the area under the recognised organisations. Thus it would not be necessary to make membership compulsory; self-interest would be the extent of the pressure.

Turning to workpeople's unions, we also find defects which require removing. The policy of union has been practised among the workers for upwards of a century, and for at least half that time with well-marked success in certain directions. In the first instance it was the aristocracy of labour that realised the advantage of collective action, but, notably since the late 'eighties of last century, efforts have been made to extend the policy to all grades of labour. Hence the ailments which have to be noted are rather more mature than those affecting employers' associations. Success in certain directions has perhaps led some of the more ardent spirits to expect more from their unions than working conditions allow. The experience of old and tried leaders has led them to adopt a more cautious policy than the young bloods are inclined to accept. Hence there has been a want of loyalty, different, it is true, from that met with among employers, but equally disastrous if persisted in to the object in view.

All the men in a given industry should be members of the union, provided that the union is well organised and ably administered. This should, however, be the result of self-interest and a regard for the good of fellow-workers, rather than of compulsion; how that may be attained has been suggested. Perfection of organisation will come when workpeople not only realise the real possibilities of collective action, but are prepared to follow loyally leaders who have been constitutionally elected. The leaders are in a better position to know the facts of the case immediately under review, but if their leadership has been found faulty there should be adequate machinery for replacing them with men who command the confidence of the majority of the members. When agreements have been entered into, the terms should be implicitly observed, even though they may turn out to be less advantageous than was expected. Periodical revision would make it possible to rectify mistakes or misapprehensions. But it cannot be too strongly emphasised that for both sets of organisations the great factor making for smooth and satisfactory working is absolute loyalty to the pledged word. A large employer of skilled labour writing to me on this point said: "In my opinion no industrial harmony can exist between employers and employees until trade unions through their executives can compel their members to adhere to and honourably carry out all agreements entered into with the employers. . . . In fact, until a more honest code of morals exists on both sides no improvement can be looked for."

Further, there is a need for a more complete and authoritative central authority, both for individual industries and for federated trades. The machinery for this exists; it merely requires development. When the local and central machinery has been perfected, the right to *strike*, which, in common with the right to *lock out* as a final resource, should be jealously maintained, would be carefully regulated, and would only be resorted to as the considered judgment of the most experienced men on either side. It should be impossible for either an individual association or a section of it to order a strike or a lock-out on its own responsibility.

What, then, do I consider should be the main outline of industrial organisation? Employers should be organised into:—

- (a) Associations of one trade in a given district.
- (b) National associations of one trade.
- (c) Local federations of trades.
- (d) National federations of trades.

Of these, b and d should be organised under a system of representation.

Workpeople should have unions and federations corresponding to those of the employers, and in both cases the national federations should be carefully organised councils who would enjoy a large measure of authority, tempered by the necessity to win and preserve the confidence of their electors. From these two representative bodies there could be elected an industrial council as a court of appeal, representative of the whole industrial activity of the country, and so far as these various bodies were approved by the State they would enjoy far-reaching powers.

Approval by the State should depend on the observance of moderation and working in conformity with carefully devised regulations. For the State in this matter would be the representative of the consumer and of the national interest. Without this you get something not very far removed from syndicalism, but under careful regulation abuses might be avoided.

At the head of the organisation there would be a real industrial council representing the industry of the country. The Industrial Council established in the year 1911 has never

had a fair chance to show its mettle. It was established at a critical time; perhaps the Government did not feel justified to throw a great responsibility on an untried body. Nevertheless, it exemplified a very wise policy, and one regrets that it has not been tested, for even now both employers and workpeople feel that some such council is preferable to State interference, and there is a clearly articulated distrust on both sides of official arbitration.

We do not need at the present juncture to attempt a new experiment. Our old system, whatever its failings, has been tried and proved sound. Its elasticity has been its salvation, and it is capable of still further evolution without calling for drastic changes. The improved organisation that is now suggested would contain nothing that is new or untried. It would consist of natural developments of what already exists. Employers and workpeople have organised themselves into associations and unions, some of these have developed federations of similar or even of unconnected interests; and both parties have their national congresses, or at any rate the germ of them. The demand now is that the organisations already in existence be perfected, and that those perfected organisations shall in all their agreements be loyally and honestly supported by their members. Success depends on absolute loyalty to the pledged word.

Here we have a practical policy suited to the needs of this critical stage in our history. The ideal organisation has yet to be formulated, but what is here proposed would form a definite step in advance, and the very elasticity of the system would be a good augury for the future.

Among the innovations recently introduced into this country, and one calculated to have important effects on our industrial well-being, is automatic and semi-automatic machinery. We have been accustomed to the use of labour-saving machines—indeed, this country was the birthplace of many of them. The re-equipment, however, of our factories for war purposes, both in tools and workpeople, has wrought a revolution comparable with that effected by the introduction of the steam engine.

From the point of view of craftsmanship our old system had much in its favour. Our mechanics in certain trades had to be highly skilled, for the description of work turned out made considerable demands on the operative. In America and Germany standardisation has been carried very much further than in this country, and consequently repetition work was much more generally practised than with us.

One may grieve over the passing of our old methods, as one is sometimes tempted to regret the days of cottage industries. Neither, however, is compatible with modern conditions, and an important part of the work of reconstruction and reorganisation will be connected with standardisation and the further introduction of repetition work. This will call for the exercise of careful and experienced industrial statesmanship, if trouble is to be avoided, for agreements will have to be framed which will in the long run work equitably and satisfactorily to all the parties concerned.

A Committee of this Association has been investigating for the past two years into the extent to which women have recently replaced men in industry. A certain amount of exaggeration exists as to the number of women who have entered our factories or undertaken services left vacant by men who have joined the Forces. The total number is in round figures about 600,000, as against five million men who have joined either the Navy or the Army as a consequence of the war.

The entry of large numbers of women into industry has been viewed with a certain amount of alarm by the men, and trade unions have naturally stipulated, where possible, that these women shall receive the same rates of pay for the same work as the men, and that when the men return the women shall give place to them.

That there was little ground for alarm as to the influx of women can be realised by a consideration of a few facts and figures. The majority of men who enlisted were workpeople of one sort or another; of these, unhappily, some have been killed in battle or have been rendered incapable for work. Even so, the majority will come home requiring occupation. What opportunities will they find?

To answer this question at all satisfactorily it is necessary to consider some determining factors. Thousands of men have left indoor occupations and their accustomed town life and have been trained, drilled, and disciplined under open-air conditions. They have lived, worked, and fought in the open country in some cases for many months. The new experience has had potent effects. Physique has improved, the outlook on life has changed, in many cases new hopes for the future have been formed. Inquiry shows that there is a division of opinion as to the extent to which disbanded members of the Forces will decide on making a radical change in their mode of life. Yet the experience of what occurred after the South African War warrants us in assuming that considerable numbers will only return to indoor occupations and town life if there be no alternative. It is too soon yet to form an opinion as to what opportunities there will be for land settlement. But it is known that offers will be made both at home and in various parts of the Empire. A moderate estimate of those accepting these offers, and of our losses of killed and permanently disabled, would be at least one million. Then we shall undoubtedly require, at any rate for some years, a much larger standing Army. Even on a peace footing this at a moderate computation may be put at a million men.

These two figures show neither of them cuts on the side of exaggeration, will absorb two million men who will be permanently lost to the old occupations.

Moreover, there is good ground for anticipating that if the war concludes before our resources are unduly strained, and there is every prospect that it will, there will be a period of good trade. We have to restore our own depleted stocks of goods, our mercantile marine demands a large amount of new tonnage, railways and other transport services will require much new equipment. Turning to the Continent, parts of France, Belgium, and other of the entente countries will need reconstruction works of considerable proportions, and in this work we shall play a great part. World markets, too, have been kept short of many manufactured goods. We shall be in a position both to finance and carry on a greatly extended system of industry and commerce, for not only is our banking system prepared to face this, but our man force has been greatly improved, and our industrial equipment to a great extent remodelled.

Reverting to the somewhat thorny question of the women who have been engaged on what were men's occupations, I see no cause for alarm. Many women came forward from motives of patriotism and will gladly resume their former state. The question, I believe, will rather be how can we obtain the labour necessary to cope with the post-war demand.

The new equipment of our factories will place us in a position to increase very greatly our output, and this should enable us not only to face a possible labour shortage, but if the recommendations made by this Section of the Association meet with a favourable response, our labour force should enter upon a new period of prosperity consequent on a re-modelling which has been rendered possible by a reorganisation of our industrial machinery. This new epoch for labour would include higher wages, shorter hours, and better working conditions. To effect these salutary advances both employers and employed need to exercise sanity of judgment, frankness in mutual discussions, and a recognition of the fact that the prosperity and material well-being of each is bound up in a common effort to maintain and develop our industrial and commercial position.

Electricity in the Chemical Industries.

IN the course of his address as President to the Chemical Section, Prof. G. G. HENDERSON, F.R.S., stated that many of the more striking results in the field of modern chemical industry had been obtained by taking advantage of the powers we now possess to carry out operations economically both at very high and at very low temperatures, and by the employment on the manufacturing scale of electrolytic and catalytic methods of production. Thanks largely to the invention of the dynamo, the technologist is now able to utilise electrical energy both for the production of high temperatures in the different types of electric furnace and for electrolytic processes of the most varied description. Among the operations carried out with the help of the electric furnace may be mentioned the manufacture of graphite, silicon, and phosphorus; of chromium and other metals; of carbides, silicides, and nitrides; and the smelting and refining of iron and steel. Calcium carbide claims a prominent place in the list, in the first place because of the ease with which it yields acetylene, which is not only used as an illuminant, and, in the oxy-acetylene burner, as a means of producing a temperature so high that the cutting and welding of steel is now a comparatively simple matter, but also promises to serve as the starting-point for the industrial synthesis of acetaldehyde and many other valuable organic compounds. Moreover, calcium carbide is readily converted in the electric furnace into calcium cyanamide, which is employed as an efficient fertiliser in place of sodium nitrate or ammonium sulphate, and as a source of ammonia and of alkali cyanides. Among the silicides carborundum is increasingly used as an abrasive and a refractory material, and calcium silicide, which is now a commercial product, forms a constituent of some blasting explosives. The Serpek process for the preparation of alumina and ammonia, by the formation of aluminium nitride from bauxite in the electric furnace and its subsequent decomposition by caustic soda, should also be mentioned. Further, the electric furnace has made possible the manufacture of silica apparatus of all kinds, both for the laboratory and the works, and of alundum ware, also used for operations at high temperature. Finally, the first step in the manufacture of nitric acid and of nitrates from air, now in operation on a very large scale, is the combustion of nitrogen in the electric arc.

Electrolytic methods are now extensively employed in the manufacture of both inorganic and organic substances, and older processes are being displaced by these modern rivals in steadily increasing number. It is sufficient to refer to the preparation of sodium, magnesium, calcium, and aluminium, by electrolysis of fused compounds of these metals; the refining of iron, copper, silver, and gold; the extraction of gold and nickel from solution; the recovery of tin from waste tin-plate; the preparation of caustic alkalis (and simultaneously of chlorine), of hypochlorites, chlorates, and perchlorates, of hydrosulphites, of permanganates and ferricyanides, of persulphates and percarbonates; the regeneration of chromic acid from chromium salts; the preparation of hydrogen and oxygen. As regards organic compounds, we find chiefly in use electrolytic methods of reduction, which are specially effective in

the case of many nitro compounds, and of oxidation, as for instance the conversion of anthracene into anthraquinone. At the same time a number of other compounds, for example iodoform, are also prepared electrolytically.

Referring to the training for chemists supplied by the universities and technical colleges, Prof. Henderson said that the facilities for practical instruction with respect to accommodation and equipment were generally adequate, but the *personnel* could with advantage be largely increased, and at least the junior members of the staffs were miserably underpaid; if the best brains in the country were to be attracted towards science, as they ought to be, some greater inducement than a mere living wage should be held out. Hence no opportunity should be lost of impressing upon the Government the necessity for increasing the grants to the scientific departments of our higher teaching institutions, and for the provision of research scholarships. Wealthy men in this country should acquire more generally the habit of devoting some part of their means to the endowment of higher education. The private donations for science and education made in the United States during the last 43 years amounted to the magnificent sum of £117,000,000, and recently the average annual benefactions for educational purposes totalled nearly *£100,000*.

The chief difficulty which confronted those who were eager for progress in educational matters was that so many of our most famous schools were still conducted on mediæval lines, in the sense that the "education" administered was almost wholly classical. Consequently, "though science enters into every part of modern life, and scientific method is necessary for success in all undertakings, the affairs of the country are in the hands of legislators who not only have little or no acquaintance with the fundamental facts and principles signified by these aspects of knowledge, but also do not understand how such matters can be used to strengthen and develop the State. Our administrative officials are also mostly under the same disabilities on account of their want of a scientific training. They are educated at schools where science can receive little encouragement, and they do not take up scientific subjects in the examinations for the Civil Service, because marks can be much more easily obtained by attention to Latin and Greek; and the result of it all is that science is usually treated with indifference, often with contempt, and rarely with intelligent appreciation by the statesmen and members of the public services whose decisions and acts largely determine the country's welfare. The defects of a system which places the chief power of an organisation which needs understanding of science in every department in the hands of people who have not received any training in scientific subjects or methods are obvious."* The remedy was also obvious.

Female v. Male Labour.

AT a meeting of the Economic Science Section of the British Association at Newcastle-on-Tyne, on September 8th, the report was considered of the committee appointed to investigate the replacement of male by female labour in consequence of the war. The official abstract of the report follows:—

The activity of the Ministry of Munitions, the schemes for the "dilution of labour," and the scarcity of skilled male labour have brought about in the second year of the war a marked development in the demand for female labour. At the present time (July, 1916) over half a million women have replaced men who have left their occupations for more urgent national service.

The women who have taken the men's places have for the most part had previous industrial experience, though seldom (in industry proper) of the kind of work they are now doing. Many of them are married women, or single women transferred from other occupations. Generally the supply has been drawn from the neighbourhood, but some of the munitions establishments have attracted women from a wide geographical area, not always limited to the British Isles.

Besides the employment of women on tramways and railways, in banks, and as postal servants (positions open to the public view), replacement has occurred through the whole of industry. Few women are to be found taking the place of highly skilled men; but large numbers have released the unskilled and those termed, in engineering, "semi-skilled." But when the work of the men involved a degree of skill and experience which women seldom possess, new machinery of a more automatic kind has been introduced (sometimes to such an extent as almost to transform an industry), and subdivision of processes has changed highly skilled work into a series of repetition operations which can be accomplished by relatively untrained workers. This has to be borne in mind when women are stated to be doing the work of skilled men.

The success of the women on these repetition processes is marked. They learn quickly; they are good timekeepers; they have, so far at least, stood the strain of long hours extremely well, and their manual dexterity enables them to achieve good results in the way of output on repetitive processes. On work demanding greater judgment and adaptability the evidence of their success is not so great; but their industrial training has been short.

For some time the employment of women on men's processes was opposed by trade unions, which still in some in-

* *Nature*.

dustries bring forward strong objections to replacement. But in the most important industries agreements have been reached between men and employers as to the conditions on which replacement may be carried out during the period of the war. Those conditions usually include an agreement as to women's wage-rates and a guarantee of the re-employment of the men replaced.

The wages of women in war-time have been influenced by the fixing of a minimum for certain kinds of munition workers in certain classes of munition establishments; by the competition of munitions with other industries in the demand for female labour; by the pressure of the trade unions; and by the general rise in prices. The fact that even in districts where the competition of munitions is keenest the wage-rates for women in other industries, on processes involving similar skill and exertion, have not always risen to the munition level, suggests that the withdrawal of the minimum regulation, twelve months after the war, will lead to a fall in women's wages. But it is unlikely that they will fall to their general pre-war level.

The fact that not a great proportion of the women war workers were previously occupied suggests that after the war the problem of a large surplus of women may not be so serious as has been feared. The married women are for the most part in industry only for the period of the war; and inquiry among women workers generally shows that many of them have no desire to remain in competition with men. But this involves the question of the increased demand for women on repetitive processes; and if, as seems likely, the subdivision of processes and the highly automatic machinery introduced owing to war conditions have come to stay, there may be a change in the relative demand for skilled and for unskilled labour to the disadvantage of the former.

Prof. Scott (Chairman of the Committee) said women were stated as yet to be deficient in the higher industrial qualities, but they had, however, shown that they excelled in those operations which required deftness of touch, and in those operations that were of a comparatively routine character.

Gaseous Explosions.—The interim report of the Committee (Dr. DUGALD CLERK, Chairman) stated that during the session most of the members of the Committee were engaged on work in connection with the war, and no Notes were submitted for consideration. Consequently the grant of £50 made to the Committee at the Manchester meeting of the Association in 1915 was not drawn upon by the Chairman. The Committee recommended that it be reappointed, and that a sum of £50 be granted to it for the ensuing session, so that should the war come to an end during that time the work of the Committee could be resumed without delay.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

War-time Generosity.

We all know that many people are badly hit by the war, but one would hardly be so venturesome as to suggest that firms carrying out Government contracts are short of cash, hence their "response" to a recent appeal for donations sent out by the Professional Classes War Relief Council, which is doing such a large and, unfortunately, necessary work, is all the more significant. 27,000 of such firms were appealed to at a cost of £216. The result of the appeal was the magnificent average contribution of 4.9d. each (i.e., the total receipt from this source was £540).

For purposes of comparison, it may be stated that the same appeal was sent to 14,000 Justices of the Peace, who contributed £1,044, or an average of 1s. 6d. each, while 10,000 directors of public companies contributed £995, an average of 2s., which, to say the least of it, makes the manufacturers' 4.9d. look small, and leads me, as one of them, to sign myself

Shylock.

September 28th, 1916.

Munitions Work Wanted.

May I, as the founder of the Amateur Ordnance Volunteer Association, which aims to find munition work for home workers who are debarred from any other form of national service, ask the favour of your kind interest in making our wants known to any of your readers who can find us any repetition work, fine screw-bolts and straining eyes, taper pins, or any small munition components? We are at present on shrapnel sockets for the Ministry, but these are a little too complicated to employ all our workers. We have been doing shell bases, which we can do well up to the 6in. sizes. Both Messrs. Armstrong and the Ministry speak well of our work, and it seems a pity for thousands of pounds' worth of precision tools and workers trained on model making to work within fine limits, to be standing idle at this crisis. We only want to be helpful, not competitive, and we make

no personal profit. Should any of your readers see an opening for us, would they be kind enough to communicate with me?

(Rev.) W. M. W. Pitchford.

Lampport Rectory, Northampton, September 27th.

The Institution Wiring Rules.

We have read with interest Mr. Swanton Munro's remarks in the ELECTRICAL REVIEW of September 20th, particularly those dealing with Rule 65, and have little doubt that some of them refer to the Henley wiring system.

We think some comment is desirable in reply to his remarks as to the "special metal" sheathing to which he refers. It is true that it was, and still is, considered necessary to specify a high percentage of pure lead for cable covering generally. This is to ensure that the lead is refined and free from deleterious matter, whereas the "special metal" sheathing in question is composed of an alloy of pure lead and other metals which are mixed with it in certain predetermined proportions for specific purposes, which is quite a different thing from using impure lead.

Mr. Munro may also be interested to know that we have supplied considerable quantities of our "special metal" sheathed wires covered with compounded tape for special situations.

We are pleased to see that Mr. Munro considers that lead-covered systems are better than some of the other systems that are permitted more freedom under the rules. Lead-covered wiring has been used for very many years, but failed to grow in popularity owing to the absence of suitable fittings and means of earthing until the introduction of the Henley wiring system some five or six years ago.

We can assure Mr. Munro that the host of contractors, and even consultants, to whom he refers do not regret having what he calls "risked the experiment," but we suggest that it can hardly be called an experiment now, in view of the length of time and the large amount of work that has been carried out under the system.

W. T. Henley's Telegraph Works Co., Ltd.

London, E.C., October 2nd, 1916.

Closing Down The Electrical Co., Ltd.

With reference to the closing of enemy businesses, I was extremely glad to note in the paper some considerable time ago that the Electrical Co., Ltd., was to be closed, but until I received a notice regarding the sale of their stock I was not certain whether this was not another case of closing an enemy business and keeping it warm until such time as the enemy was able to come back to it, in a similar manner to that of the Sanatogen Co.

I note on the advertisement sent me a foot-note, which states: "The Controller, Mr. Maurice Jenks, is prepared to receive offers for the trade and business connections as lately carried on by the above company," and I am of opinion that this is directly opposed to the question of closing the enemy concerns down, as it simply leaves a loophole for the present owners to purchase the business and keep it going until such time as the war is ended.

There seems to be a good deal of explanation required by the public with regard to this so-called closing of enemy businesses, as if the authorities are serious in saying that the business is closed, this should mean that the whole concern is done away with and the stock sold.

Contractor.

To Go—or Not to Go?

In reply to "North-East Coast," I am not "fed up," nor am I "one of those young men perpetually permeated with the spirit of discontent," nor even "one who has come to pick up all the information they can in order to better their positions," and in support of this, if "North-East Coast" will guarantee me a decent living wage with progression according to ability after the war, I shall stop where I am; in fact shall be glad to do so. I do not want what some North-East Coast officials call a "living wage"—it is not so long ago since a certain one highly-placed in that quarter made the statement that £1 per week was enough for any single man to live on. "Ye Gods!"

He goes on to refer to the speeches made before the British Association, and makes the statement that only semi-skilled labour is necessary for the operation of power stations and systems; if so, I don't want a system engineer's position. "N.E.C." will find plenty of women nowadays to undertake semi-skilled and repetition work. As for the combination of mechanical with electrical experience, I should like to know in what manner does "N.E.C." find where it lies. Does he expect it to show itself from the man on the switchboard with full leave to inspect his oil rings hourly, or maybe to replace a burnt-out lamp?

In turn, I refer "N.E.C." to a paper read by Mr. R. P. Sloan before the B.A., in which he states that the present high-class state of electrical affairs on the Tyne has been brought about by utilising . . . to the best advantage with the aid of a highly skilled technical staff (ELECTRICAL REVIEW, p. 334). Yet skilled labour is not needed.

Perhaps if I did stick it for so long as there are volts on

the system, I might as well look to myself. I think it the worst thing that has happened in 18 and 21 years of age cannot keep himself with the system. It is the extent of half his wages it might be as well if this war should see the end of the world.

Balanced Up.

In reply to your correspondents "Unsettled," "Balanced Up," "North-East Coast," and "Industrial Conscript," my advice is to clear out of station engineering as quickly as possible, as the prospects do not compensate for the trouble and time taken to become a station engineer. Fortunately, the war cannot last for ever, and as soon as things are normal again, with no controlled firms to hamper your movements, and decide how much work you have to do, for the "salary" they choose to offer you, I say look out for something else; there is not much fear of its being any worse. I, for one, will never again take a "starred" employment, and when I get my discharge from the Army, after the war, if England is not once again a free country, as of yore, it will never see me again.

My own experience is very similar to that of "B.U.," inasmuch as I have been associated with the North-East Coast for a number of years, but, fortunately, I am now out of station engineering of from 1 to 20,000 volts, and most fervently say, "Never again!"

"N.E.C." rather gives me the impression that he is closely associated with some of those patriotic employers who regard nearly all their employés (on pay days) as semi-skilled, and themselves as benevolent teachers. Let us, for their sake, hope that after the war is over the process of "unbadging" will take a few days, as they otherwise might find their staff reduced to a few old hands, without interest or prospects in life.

Safely Out.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NICARAGUA.—The Board of Trade have received a copy of the Nicaraguan Law of July 7th which provides for a general increase of the Customs duties leviable on goods (with certain exceptions) imported into Nicaragua, by 33½ per cent. (not 38½ per cent. as originally reported by H.M. Consul at Managua—see the ELECTRICAL REVIEW of August 18th).

The Law, which came into force on the date of publication, viz., July 17th, authorises the collection of import duties at the rate of 80 cents to the peso of the Tariff, in place of 60 cents, as hitherto, the effect being that the duties are increased by one-third. This increase is the same for all goods, with a few specified exceptions.

TRANSIT OF GOODS THROUGH FRANCE.—Certain amendments have been made in the official statement published on May 11th—see the REVIEW of June 9th—giving particulars of the arrangements for transit through France of goods sent from the United Kingdom to Switzerland, Italy, and Spain *via* France. Full information on the subject can be obtained from the Commercial Intelligence Branch of the Board of Trade.

SWITZERLAND.—A list of articles in respect of which licences for export to Switzerland are only granted if the goods are consigned to the Société Suisse de Surveillance Economique has been issued by the Contraband Department of the Foreign Office. The list includes electrical and allied goods as follows:—Accumulators, electric, and accumulator plates; batteries, electric and parts; cable, insulated; carbons (electric)—carbons for electricity (except electrodes) and carbon brushes for dynamos can be sent under the small parcel scheme (see below); copper wares, including carbons for electricity containing copper, and including all metal articles containing 10 per cent. or more of copper and its alloys; perforated copper plates; copper leaf; copper cables, insulated and non-insulated; insulated electric copper wires; copper cables with lead sheath, or iron fittings; electrical cables of all kinds containing copper; electrical appliances adapted for use in war, and their component parts; electrical fire lighters; electrical insulated wire cables; electrodes, piles, and component parts; gloves, rubber; electrical machinery, electric dynamos, and motors; magnetos and their parts; metal, antifriction; mica, crude or in sheets; mica splittings; ground mica and mica wares; rubber, viz., balata, gutta-percha, rubber wares, rubber-proofed and rubber-mixed goods, and rubber preservatives; rubber, vulcanised, in sheets; searchlights; shoes, rubber; telegraph and telephone apparatus, parts of; telegraph and telephone materials; and wire, insulated.

The articles printed in italics are allowed to benefit under the special scheme for small parcels, i.e., they may be exported to Switzerland without an acceptance certificate being previously obtained from the S.S.S. Parcels thus exported, whether by post or otherwise, must nevertheless be consigned to the S.S.S. for the account of the ultimate consignee *via* the International Postal Parcels Bureau, Pontarlier.

[It should be noted that articles or substances composed wholly or partially of products named in the list must themselves be consigned to the S.S.S.]

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

- 13,221. "Method of adapting tungsten, &c., for contacts in magnetos." J. A. NICHOLS. September 18th, 1915.
- 13,222. "Electric circuit breaker." C. J. J. BEANDE. September 18th, 1915.
- 13,237. "Telephone systems." R. C. M. HASTINGS. September 18th, 1915.
- 13,244. "Electric circuit breaker." J. S. WILKINS, K.C. September 18th, 1915.
- 13,260. "Electric circuit breaker." L. W. AUSTIN, L. COHEN & G. O. SUTHER. September 19th, 1915.
- 13,277. "Telegraphy." L. W. AUSTIN, L. COHEN & G. O. SUTHER. September 19th, 1915.
- 13,279. "Production of electric currents." J. F. SEPULCHRE. September 19th, 1915.
- 13,284. "Electric ignition systems employing magneto-electric machines." BUTTISH THOMSON-HOUSTON CO. & A. P. YOUNG. September 19th, 1915.
- 13,302. "Ignition magnetos." L. BIGON & J. C. ROUSSET. September 19th, 1915.
- 13,303. "Transmitting apparatus of radio-telegraph and radio-telephone stations." F. G. SIMMONS. September 19th, 1915.
- 13,304. "High-tension electric current collecting and transmitting or conducting apparatus." BUTTISH THOMSON-HOUSTON CO. & A. P. YOUNG. September 19th, 1915.
- 13,314. "Ship's stockhold, &c., telegraphic apparatus." W. CHADBURN and W. R. CHADBURN. September 20th, 1915.
- 13,342. "Electrically depositing metal." E. H. JONES. September 20th, 1915.
- 13,343. "Method of forming metal electrodes used in electric-arc soldering." E. H. JONES. September 20th, 1915.
- 13,366. "Automatic and semi-automatic telephone systems." T. M. INMAN and THE RELAY AUTOMATIC TELEPHONE CO. September 20th, 1915.
- 13,383. "Vacuum tubes." M. O'GORMAN & R. WHIDDINGTON. September 20th, 1915.
- 13,390. "Electric pocket lamps, torches, &c." E. A. BELLOW. September 21st, 1915.
- 13,422. "Electric lampholders of the Edison screw type." B.T.H. Co. and A. N. BURN. September 21st, 1915.
- 13,439. "Production of electric currents." J. F. SEPULCHRE. September 21st, 1915.
- 13,443. "Dynamo-electric machines." ANSCHUTZ & Co. September 21st, 1915.
- 13,478. "Improvement in electric apparatus." J. BURN. September 22nd, 1915.
- 13,483. "Storage battery plates." A. E. WHITE (U.S. Light & Heat Corporation). September 22nd, 1915.
- 13,486. "Electrically-heated soldering bolt or bit." F. HUSBAND & A. E. WOODHOUSE. September 22nd, 1915.
- 13,487. "Galvanic batteries." J. E. DRESDEN. September 22nd, 1915.
- 13,488. "Automatic telephone systems." B. B. JOHNSON. September 22nd, 1915.
- 13,489. "Automatic telephone systems." L. C. BYGRAVE, H. J. HEERINK, THE RELAY AUTOMATIC TELEPHONE CO. & F. M. WARD. September 22nd, 1915.

PUBLISHED SPECIFICATIONS.

1914.

- 24,629. REGULATING MEANS FOR ELECTRICAL INSTALLATIONS. Soc. Anon. des Etablissements L. Bleriot. December 24th. (December 27th, 1913.)

1915.

519. POLYPHASE GENERATOR FOR HIGH-FREQUENCY CURRENTS WITH POLYPHASE TUNED SPARK GAP. L. Rouzet. January 12th. (January 12th, 1914.)
- 8,334. DYNAMO-ELECTRIC POWER TRANSMISSION APPARATUS OF THE UNIVERSAL TYPE. M. Bredart. June 4th. (June 4th, 1914.)
- 8,451. PRINTING TELEGRAPH SYSTEMS. A. D. Cardwell. June 7th.
- 11,412. SPOOLING MACHINES SPECIALLY APPLICABLE FOR THE WINDING OF COILS FOR ELECTRICAL APPARATUS. Walter McGee & Son, Ltd., and A. G. Walls. August 7th. (Cognate application, 14,994/15.)
- 12,644. ELECTRIC TESTING APPARATUS. J. C. Crozier & W. G. Wheller. September 3rd.
- 12,761. ELECTRIC LIGHTING OF VEHICLES. P. F. Smith & V. S. Robinson. September 7th.
- 12,792. ELECTRIC INCANDESCENT LAMPS. British Thomson-Houston Co. (General Electric Co., U.S.A.). September 7th.
- 12,936. WASHING APPARATUS FOR USE IN CONNECTION WITH SECONDARY STORAGE BATTERIES. O. Oldham. September 9th.
- 12,984. ELECTRICAL COOKING APPARATUS AND SWITCHGEAR THEREFOR. F. S. Grogan & E. W. B. Burder. September 10th.
- 13,283. MEANS FOR REGULATING THE OUTPUT OF DYNAMO-ELECTRIC MACHINES DRIVEN AT VARIABLE SPEEDS. N. E. Duffy. September 17th.
- 13,057. X-RAY APPARATUS. E. E. Greville. October 25th. (Addition to 21,609/14.)
- 13,222. COMBINED ELECTRIC LAMPHOLDER AND DETACHABLE SHADE SUPPORT. G. St. J. Day. October 28th.
- 13,427. COMBINED ELECTRIC SWITCHES AND PLUG COUPLINGS. J. B. McLédoe. November 2nd. (Cognate application, 6,258/16.)
- 16,471. METHOD FOR PRODUCING DURABLE PRIMARY GALVANIC BATTERY CELLS WITH ZINC ANODES AND ALKALINE ELECTROLYTE. J. N. Brönsted & Helleseus, H. Enck & V. Luchingen firm of. November 22nd.
- 16,516. ELECTRIC BATTERIES. F. J. Beaumont. November 23rd.
- 16,731. PORTABLE BATTERY LAMPS. C. A. Vandervell. November 26th.
- 17,480. CONSTRUCTION OF CORD GRIPHOLDER FOR USE IN CONNECTION WITH ELECTRICAL APPARATUS. G. Markt. December 14th.

1916.

The numbers in brackets are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

412. SWITCHING DEVICES FOR STARTING INTERNAL-COMBUSTION ENGINES. R. Bosch (firm of). January 11th, 1915. [100,017.]
- 3,758. MACHINE SWITCHING TELEPHONE SYSTEMS. Western Electric Co. March 19th, 1915. [100,198.]
- 6,044. METHOD OF AND MEANS FOR ASSEMBLING AND UNITING OR CONNECTING TOGETHER CALL DISTRIBUTOR PLATES. A. Allegrezza. April 27th, 1916. [101,321.]
- 7,258. CALL DISTRIBUTING TELEPHONE SYSTEMS. Western Electric Co. May 22nd, 1915. [100,335.]
- 8,211. PRINTING TELEGRAPH SYSTEMS. A. D. Cardwell. June 7th, 1915. (Divided application on 8,451/15.) [101,329.]
- 8,285. PORTABLE ELECTRIC LIGHTERS FOR GAS. R. W. Sanders. June 12th, 1916. [101,340.]

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NATIONAL ELECTRIC POWER SUPPLY.

On Tuesday last, as though by pre-arrangement, but doubtless as the result of pure coincidence, we received a number of documents relating to the reform of electricity supply in this country, which must be regarded as of the first importance to the industry. Particulars will be found elsewhere in this issue of the Memorandum which the Joint Committee appointed by the Incorporated Municipal Electrical Association and the Incorporated Association of Electric Power Companies has addressed to electricity supply undertakers throughout the country, and of the Interim Report of the Committee for the Interconnection of Lancashire and Cheshire Electricity Supply Systems—the first body to take action in the matter; another paper, to which, for want of space, we cannot do justice in this issue, and which is, therefore, deferred for the moment, is the presidential address of Mr. R. A. Chattock to the Birmingham Association of Mechanical Engineers, in which the author discusses the present position of the engineering industry, and advocates the erection—under compulsion by the Government if necessary—of “super-stations” for the generation of electrical energy from coal under the most economical conditions.

These several communications clearly prove that the electricity supply industry is now very wide awake to the defects of the existing system, or, rather, negation of system, on which it is working, and is determined to inaugurate a new era as quickly as possible. The activity of the Lancashire and Cheshire Committee merits the highest commendation; with the start gained by its own initiative, and the impetus imparted by the energy of its leaders, it has already shot ahead, and appears to be well on the way to the formation of a provisional Joint Board of Control without awaiting the formal appointment of a Board on the more leisurely lines of a Government Department. The splendid field in which it operates—embracing undertakings capitalised at over eight millions sterling, generating plant rated at 260,918 kw., and an annual output of 421 million units—affords magnificent scope for the adoption of co-operative methods on the largest scale, and the economy foreshadowed as regards the consumption of coal alone, a matter of £82,000 a year at 17s. 6d. per ton, but far greater at present export prices, amply justifies the capital outlay involved, to say nothing of the 30 per cent. increase in effective capacity, and the many other advantages presented by the scheme. A feature of the Committee's report which is of the first importance is the statement that the Treasury will be prepared to

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find the money necessary for the scheme of inter-connection. We note, too, with satisfaction, that the inclusion of the power companies in the scheme is *regarded as essential*. We trust that in this significant phrase we see the end of the old-time jealousy and distrust with which the municipal authorities viewed the activities and advances of the great companies which, in the face of innumerable obstacles, have laboured to establish their undertakings firmly on what often appeared to be barren soil.

Once more we may draw attention in this connection to the crying need for compulsory wayleaves. Now that the ruling powers have set their minds on the development of connecting links between the different districts, surely they will realise the absolute necessity of providing the facilities required for that purpose, as well as for the ordinary development of any supply undertaking.

Let it not be thought that, because we give pride of place to the speedy Northerners, we do not adequately appraise the value of the important step that has been taken by the Joint Committee. In a sense, the work of the latter covers that of the former, just as the greater includes the less; the Joint Committee, in fact, is calling upon all districts to do that which the Lancashire and Cheshire districts have already done, and is providing the necessary machinery to facilitate the work. The Memorandum which it has issued is admirably conceived, and well backed-up with practical illustrations of some of the advantages of interconnection. Much of what we have said regarding the concrete scheme applies equally to the abstract recommendations of the Joint Committee, and we heartily welcome the evidence of its activity and practical methods of operation. Of the proceedings of the allied Committee—that of the Institution of Electrical Engineers—we have no information as yet, but we have no doubt that it is making progress with its part of the work.

In conclusion, we have one word to say with regard to the Borough of Eccles. It is stated in the Committee's interim report that that borough withheld the information required for the purpose of the investigation. No reason is given for this action, or inaction, but the natural inference is that Eccles wishes to have nothing to do with the scheme. So much the worse for Eccles—but we do not hesitate to say that to oppose a scheme of national economy such as this is to strike a blow for the Germans. At such a time local interests, even if apparently threatened, should not be placed before those of the nation, and we trust that the patriotism of Eccles will yet be manifested by its entry into the scheme.

have been appearing in the newspaper Press, and all the speeches that have been delivered from public platforms, will avail us little unless they lead to action. The search for a basis for negotiations has occupied many men of eminence in public life during the past few weeks, and we sometimes note with feelings of regret that there is a disposition to ask for practically a new heaven and a new earth in exchange for a truce. We sympathise deeply with the demand of Labour for better conditions, but it will be a pity if the prospects of peace and prosperity are spoiled by arguing for more than industry has it in its power to give. Some of the things that are sought will, we believe, prove to be matters for the legislature and the nation as a whole; others it will be within the power of industry to confer by direct negotiation and agreement with the authorised delegates of the industrial workers. In order that these matters may be exhaustively investigated, affording a basis for a reasonable policy in which the nation, the industries, and the workers shall recognise and carry their own peculiar responsibilities, it is necessary that machinery should exist capable of handling the problems with intelligence, experience, and authority. We therefore extend our hearty good wishes to the new department which Mr. Arthur Henderson, M.P., the Labour Adviser to the Government, has now brought into full operation. We gather from a reference thereto in the *Times* that one of Mr. Henderson's prime objects is to lay the foundations for a regular and definite system of co-operation and communication between industry and the Government. This is most essential if we are to proceed on sure lines, and it is satisfactory to learn that consultative committees of employers and trade unionists have already been appointed, a separate committee being set up to deal with the subject of women's labour. There will also be colonial and international committees which will assist the Department as may be found necessary. One of the great virtues of the foregoing arrangement is that the Department will give all the interests concerned an opportunity for being heard before particular conclusions are arrived at. The industries affected will be able to make their representations from both the employers' and the workmen's standpoints whenever material points are at issue. Mr. Henderson and those associated with him in this very important undertaking are anxious to have the co-operation of all sections of the industry, and the invitation given through the Press to employers and workpeople alike to submit information as to important points of principle to which they desire consideration to be given, will doubtless be accepted. We hope that this is no haphazard or casual invitation. If it is to meet with the response that is necessary it should be brought directly under the attention of at least all the organised bodies that it may concern; probably steps have been taken to that end. Given a proper co-operation on the part of everybody who is eager for the plans of our industrial future to be correctly drawn up, the efforts of the new Department, assuming that its *personnel* is rightly chosen, should have at hand before long just the very material out of which the new basis can be chosen. When such a basis has been decided upon, however, everything will depend upon the spirit in which all parties enter into the deliberations leading up to its general adoption. The spirit of compromise and sweet reasonableness should fully possess all parties, so that we may avoid the abominable waste of dissipating energies which industrial strife would bring if Peace within our borders were broken when Peace between the nations returned. Utopian

HOWEVER long the war may last
Industrial it is important that measures be
Harmony. taken in good time to secure industrial harmony after Peace is declared. All the articles and correspondence that

dreams of Labour will be as out of place as will the old obdurate spirit of an unbending Capitalism. All things will have to be subject to searching analysis which economic conditions and actual practicalities will inevitably impose, but there will also have to be applied a considerable share of sympathy and regard for fair dealing toward the worker, who will require to give efficient service in exchange for adequate compensation. The difficulties are great, but, given a continuance of the present atmosphere, they should not be overwhelming. Again, we wish success to the new Department, for its work is really the beginning of a national effort toward securing industrial harmony—perhaps by settling the terms upon which a truce for a period of years may be arranged. We are not concerned so much with whether that truce shall be for three or for five years; all that is necessary is for it to be sufficiently lengthy for us to see what the new world conditions during the period of readjustment are going to be and to bring, and what the actual effects of the truce itself will be upon our industries, our workpeople, and our national life, as well as what will be the consequences of those effects upon our relations with our Colonies, our Allies, and the world at large.

Pig Lead. THERE has been a deadlock in trading on the Metal Exchange for some weeks past. The slackness of business in the open market, indeed, has been such that the transactions arranged could almost be counted on the fingers of one hand. Official quotations practically throughout have been nominal, and though showing hardly any alteration, there is no mistaking the fact that consumers have experienced considerable difficulty in covering their needs in one direction or another. For one thing, early delivery has been hard to secure, as testified by the comparatively high prices which have been paid privately by consumers, up to about £32. Complaints have been frequently heard of from consumers in that respect, who should bear in mind, however, that the Metal Exchange official quotations cover only shipments in the current and next two months. There can be no free market under present conditions, while the situation is more than ever under the control of the authorities. Operators are, in any case, under restraint inasmuch as persistent efforts are understood to be made to keep down prices. There is probably not much metal coming in that is not earmarked for special requirements, and holders of uncontrolled lead have doubtless no difficulty in finding buyers privately practically on their own terms, regardless of the official prices. This state of affairs is not unlikely to continue until a better supply comes to market. Meanwhile, it is generally recognised that the position is tight, and that any important relief can hardly be brought about unless metal from controlled sources comes out. As to whether this will be realised shortly remains to be seen. There is a confident hope that a change towards easier or more comfortable conditions cannot be delayed much further.

Ordinary manufacturing needs in this country are probably comparatively small, but there is doubtless a constant big outlet in other directions, so that current output is being rapidly absorbed. It had been hoped for some time past that American lead would again come on offer on this side, but there is as yet no sign of this, for the price quoted in New York is still at a figure the equivalent of which represents many pounds a ton over London parity. The market there is apparently under strong control, the Trust showing no indication of undercutting

outside producers for the present. The margin there for export is at present small, while the domestic outlet has undoubtedly increased. The output, nevertheless, is heavy, and it is quite on the cards that prices in America will eventually be lowered to a less extravagant level, and possibly result in a renewal of shipments to this country. Spanish lead is coming in in rather limited quantities, due to the continued heavy tonnage sent direct from Spain to France, the total thus dispatched for the first seven months of this year being 38,324 tons, as compared with 17,594 tons in 1915. The total imports by France for that period represented 46,509 tons, against 31,684 tons in the previous year. It is utterly impossible to form an idea of the statistical position in this country so long as returns of the tonnages coming in are incomplete, and chiefly represent metal which is not under control. In the absence of offers in the open market, buyers have lately come to the conclusion that it is almost useless to bid for supplies, which tends to keep prices down.

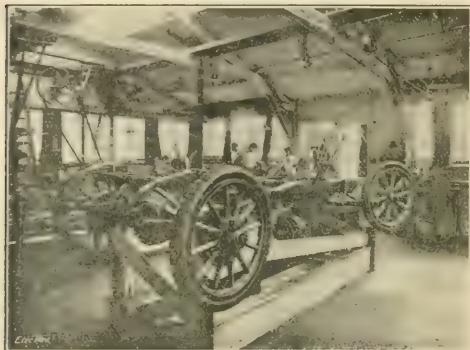
At a time when the prices of coal in France have reached a very high level, special interest attaches to the development of the hydro-electric works in that country, particularly as the consumption of coal annually increases in a greater proportion than the native production. Unless, therefore, a new and extensive coal basin is discovered—which is considered to be improbable—France will always be largely dependent upon supplies of foreign coal, aided by the use of the existing water powers. Fortunately, progress in the latter direction is being made, as is indicated by the information recently published by M. Lévy-Salvador, chief of the technical service of the Department of Agricultural Hydraulics at the Ministry of Agriculture. According to a census taken in regard to the situation at the end of 1915, the power utilised in the French Alps alone amounted to 738,000 H.P., and was divided among the following industries:—

Industries.	Horse-power installed.	Percentage of the total.
Lighting and power ...	291,000	40
Metallurgy ...	255,000	34
Electrochemistry ...	147,000	20
Traction ...	16,000	2
Saw and paper mills ...	23,000	2
Various (chalk, cement, mills, &c.) ...	6,000	1
Total ...	738,000	99

The great development which has taken place in the course of years is shown by a comparison of the preceding total H.P. with the state of affairs at the close of 1910, when the H.P. installed only reached 473,000. The number of works has grown in the same period from 126 to 205, those of a capacity exceeding 10,000 H.P. having risen from 13 to 28. Included in the increase is also a number of stations of an individual capacity of less than 500 H.P., these being mostly used for local lighting purposes and in connection with ironworks, textile mills, cement works, and paper mills. Apart from the works already in operation, many important schemes are at present either in course of being carried out or under consideration. The demand for the supply of energy is increasing to such an extent that the distribution companies are quite unable to meet it, and they are preoccupied with the question of drawing upon further water powers to cope with the requirements, whilst at the same time many manufacturers are also seeking locations for the erection of generating plant so as to overcome the difficulties incidental to the high prices of coal.

THE EMPLOYMENT OF DISABLED SAILORS AND SOLDIERS.

WE recently described (ELEC. REV., August 4th, 1916) the excellent work that is being done, under the aegis of the Institution of Electrical Engineers, by the Northampton Polytechnic Institute towards the training of disabled fighting men for employment in electricity supply undertakings. We are glad to draw attention in this connection to the admirable arrangements which have been made at Queen Mary's Convalescent Auxiliary Hospitals at Roe-



MOTOR AND LATHE ROOM.

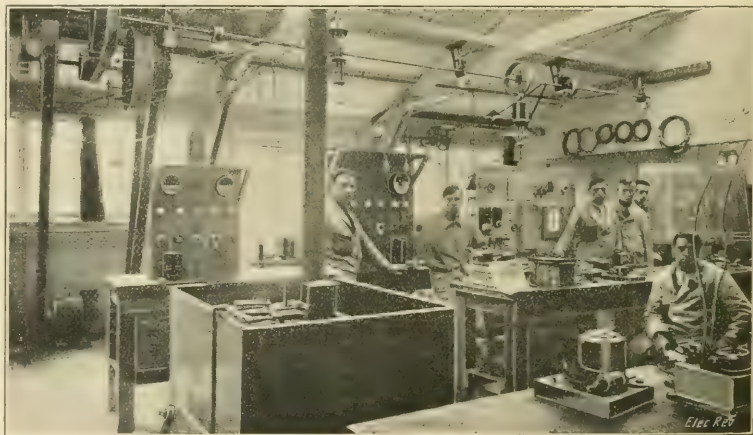
hampton, with similar ends in view. In this case, the men enter the hospital primarily for the purpose of being provided with artificial limbs, and as the process of fitting and testing these appliances occupies two or three weeks, advantage is taken of their presence to impart to them the rudiments of various trades, such as the installation and care of electric lamps, motors, bells, telephones, &c., the management of motor-car mechanism, wood working and cabinet-making, fancy leather work, basket making, and typewriting. By the courtesy of Mr. J. M. Andrew, superintendent of the department, we were recently enabled to pay a visit to the workshops, the technical side of which has been organised by Major Robt. Mitchell, Director of Education at the Polytechnic, Regent Street. The cost of the buildings and the original equipment was defrayed by Lady Wantage, and a good deal of additional equipment has been provided by manufacturers, but there is still need of more apparatus, especially in the electrical section. New and saleable apparatus is not essential; there must be hundreds of old and neglected instruments, machines, tools, &c., lying about the premises of manufacturers and contractors, a few of which would be most heartily welcomed by the of the electrical workshops, who would repair them and put them to good use. All kinds of accessories such as small switches (especially two-way

tumbler switches) and fuses, used wire and cable, lengths of conduit and fittings, bells and telephones, are acceptable, for reasons which will be obvious later; but the most pressing requirement is a small generating set consisting of an oil engine and dynamo for country-house lighting, up to 5 h.p. We may point out that the loan of such a set for the duration of the war would serve the purpose quite as well as the gift, and we can assure any reader who is willing to assist in this way that he will thus confer a great benefit upon many of those men whom we can never adequately repay for their sacrifice.

The workshops are situated in a range of substantial huts at the rear of the hospital, in pleasant surroundings, and, at present, provide accommodation for about 100 men; extensions are being added as circumstances allow. The men, whose attendance is entirely voluntary, and who select a trade to suit their own inclinations, normally attend from 9.30 to 12.15 daily; they may also spend the afternoon from 1.30 to 3.45 in the shops if they like, and many take advantage of the opportunity. It is interesting to note that electrical work is very popular, some 25 per cent. of the men who attend the workshops going in for it. The work is somewhat interrupted by the requirement that men newly fitted with artificial limbs shall parade for inspection at 11 a.m., but, as this is the main reason for their presence at the hospital, no complaint can be made on this score.

All the shops containing machinery are provided with electric motive power from the electrical shop, which affords opportunities for the care and management of motors to be studied; in the carpenter's shop there are power lathes and saws, and in the motor shop a complete chassis is driven by a small motor, this having been found, an excellent method of demonstrating the working of the engine and gearing.

In the electrical workshop a motor supplied with alternating current from the Barnes public mains drives, through belting and countershaft, a direct-current generator, which supplies current for power and lighting to the workshops; this plant is, of course, a valuable item from the educational point of view. The men work in small groups, and receive personal tuition from the instructors. First they spend a few days on bells, indicators, burglar alarms, &c., making all the usual connections; then they connect up three lampholders with single, two-way and intermediate switches, on the bench, and after-



INTERIOR OF ELECTRICAL WORKSHOP.

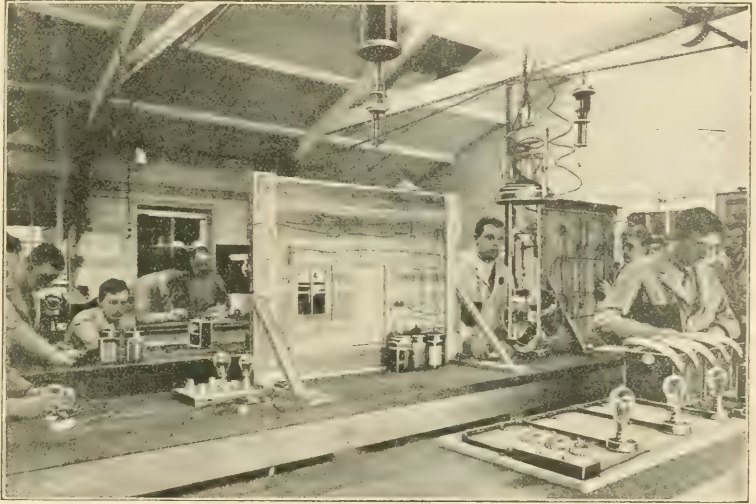
wards do this in tubing—which they find a much more difficult task. A three-light fitting with loop-in wires and two switches is the next exercise, after which, on the demonstration boards seen in our illustrations, they connect up six circuits, all different, with two bus-bars, ammeter and voltmeter; the circuits include a circuit-breaker, D.P. switch and fuses, a wall socket, &c., and a pressure of 100 volts is finally applied to the installation, sometimes with interesting, if unexpected, results. The

circuits wired on the wall in tubing are dismantled and completely re-erected; the main switchboard was fitted up by the men; simple jobs in the lathe and soldering are taught; a small armature is taken apart and rewound; telephone connections are studied—wisely deferred towards the end of the course—and all the usual connections are made for simple circuits. Later on, a set of three interphones will be introduced into the course, and some ideas about alternating currents also will be inculcated. Excellent wiring diagrams have been prepared by the instructors, and we must congratulate them upon the skill and assiduity with which they have devised, and are carrying out, an admirable system of tuition.

Many of the men go on for further instruction to the Regent Street Polytechnic, where they are given free tuition; assistance towards their maintenance is provided from private sources, pending arrangements by the London War Pensions Committee. At the Polytechnic they are instructed in the management of the bioscope, an occupation which is obviously admirably suited to their circumstances.

It is interesting to observe that of the total number of disabled men passing through the hospital, about 50 per cent. are able to return to the posts they occupied before enlisting; 25 per cent. are trained and provided with employment at Roehampton, and the remainder are passed on to the care of local committees in their own districts.

Men partially trained as wiremen are rapidly taken up, and are paid 32s. 6d. a week, plus food. Mr. Isidore Salmon is specially mentioned in this connection, as working hard to place the men, and taking many of them in his own business. Certificates are awarded to those who attend the workshops regularly, stating the number of hours during which they have received instruction. Every effort is made to assist the men to obtain satisfactory employment, and to settle their personal affairs, and the work that is being done by the Hospital appears to us to be worthy of the most cordial commendation and support.



VIEW IN ELECTRICAL WORKSHOP, SHOWING DEMONSTRATION BOARDS.

to the secretaries and engineers of company supply undertakings, together with a letter suggesting that the addressee should attend a general meeting of all the undertakings situated in the group or area in which it is suggested that that particular undertaking should be included, with a view to discussing the Memorandum and appointing a local Committee as indicated therein.

The problems to be considered by the local Committees include:—

1. The consideration of the areas shown on the accompanying map with a view to their better division if considered desirable;
2. The best methods of inter-linking the existing generating stations with a view to their more economical operation, and to the better security of the supply;
3. The best means of providing the capital required for the plant and mains that are necessary, and for the equitable allocation of the same;
4. The best methods of payment between undertakings for any current supplied or interchanged;
5. Any special local arrangements that are considered desirable.

The Memorandum, after referring to the importance to the electric supply industry of the Board of Trade circular letter of May 25th, 1916, and to the forming of the Joint Com-

mittee to consider the question of linking-up in all its aspects, states that the importance of linking-up several large stations, and equally of linking-up large stations with small ones, where such linking-up can be carried out without undue capital expenditure, is now becoming more generally realised.

The Joint Committee has arrived at the following conclusions with regard to the suggestion contained in the Board of Trade letter:—

1. That linking-up is important for the purposes of saving fuel, saving labour and increasing the security of supply, and, in the future, making for economy of capital.
2. That the question of linking-up should be considered broadly from the national point of view, and having in mind not only the saving of fuel but the interests of consumers in obtaining a cheap supply of electricity for all purposes.
3. That while the generation of electricity as distinct from its distribution must be considered broadly and irrespective of the present areas of electricity supply undertakings, clearly all existing rights must be respected and existing areas must not be interfered with as regards distribution.
4. That the linking-up of many existing stations could be carried out immediately without further legislation.
5. That in order to arrive at a better understanding of the problem, committees of engineers representative of local electricity supply interests should be appointed in various parts of the country.

NATIONAL ELECTRIC POWER SUPPLY.

Interconnection of Generating Stations.

THE JOINT COMMITTEE'S MEMORANDUM.

We have received from the Hon. Secretaries of the Joint Committee appointed by the Incorporated Municipal Electrical Association and the Incorporated Association of Electric Power Companies to consider the question of the linking-up of electricity supply undertakings, a copy of a Memorandum which has been sent to the various town clerks and engineers of municipal supply undertakings, and

To facilitate the formation and work of the local committees the accompanying map has been prepared showing a provisional sub-division of the country into areas, but if local circumstances (known better to engineers) in any area make it desirable to alter the definition of these areas, it is, of course, open to them to suggest any such alteration.

A local committee has already commenced work in the Lancashire area, and the schedule appended shows the information that the committee decided to obtain.

If the local committees will communicate from time to time to the Joint Committee the results of their labours, the experience gained by each local committee can be made available for the use of all, and the Joint Committee is prepared to assist in every possible way.

An Appendix "A" gives two examples showing advantages which in practice have been realised by linking-up, and an Appendix "B" contains a diagram and description illustrating

Since the year 1900 several companies have been authorised to supply electricity under Special Power Acts, their areas covering the greater part of the industrial districts of the country, and these undertakings are not subject to compulsory purchase.

These three groups provide all the public electric supply in the country, but there are still various tramway undertakings, railway companies, and other industrial concerns providing their own electric supply from independent power stations.

Sufficient time has elapsed, and sufficient experience is available, to show the defects of the original legislation. Experience has shown that the comparatively small areas of the companies and local authorities working under Provisional Orders are, in many cases, insufficient to enable advantage to be taken of modern improvements in plant. It is also evident that the liability to compulsory purchase imposed upon the undertakings of companies working under Provisional Orders has restricted enterprise and retarded the development of electricity supply. Since some of the companies operate in very important districts, immediate measures should be adopted to deal with this difficulty.

One of the most important problems, both at the present time and in the future, is the better utilisation of our coal supplies. An extension of this problem consists in utilising the coal in such a way as to avoid the waste of its valuable constituents and by-products. This object can be attained in a very satisfactory way only by treating the coal at central points on a large scale. Electricity offers by far the most economical and convenient method of distributing the power from these centres.

The following is the schedule of information desired by the Lancashire Local Committee:—(1) Name of authority; (2) area of supply; (3) system of generation and transmission; (4) voltage of generation and transmission; (5) periodicity of system; (6) capacity and type of generating plant installed; (7) total plant capacity in kw. installed, (a) a.c., (b) c.c.; (8) capacity of boiler plant installed, expressed in kw.; (9) coincident maximum load on system in kw. 1915-16, (a) generated, (b) purchased; (10) expected coincident maximum load in kw. 1916-17, (a) generated, (b) purchased; (11) effective generating plant capacity in kw. when plant on order is completed, giving date of latter; (12) facilities for future extensions on existing site; (13) contemplated extensions on new site; (14) maximum Sunday load in kw., (a) in winter, (b) in summer; (15) total kw.-hours for last completed financial year, (a) generated, (b) purchased; (16) general remarks.

Appendix "A."—(Actual Results of Linking-up.) I.—Two power stations, each carrying about 7,000 kw. of load, were linked up at a cost of £3,000, the link having a capacity of 3,000 to 4,000 kw.

By shutting down one station each night (12 midnight to 6 a.m.) and weekends (from noon Saturday to 6 a.m. Monday): (1) The plant load factor at each station has been increased from 67 to 72 per cent; (2) the total saving of coal per annum in both stations has been 2,000 tons, and it is anticipated that this saving will be increased to 3,000 tons.

II.—A power station having a maximum load of 2,000 kw. was linked up with another power station having a maximum load of 15,000 kw.

(1) During the second year of working "linked up," the coal consumption of the smaller station was reduced by 2½ lb. of coal per unit on all units generated by that station; (2) the combined saving of coal, due to interchange of current, in the second year of working, amounted to 5,500 tons.

In addition to the saving of coal, linking-up has resulted in the following further advantages:—(1) Greater security of supply, (2) reduction in the number of shifts run and wages paid, (3) reduced maintenance charges due to fewer plant hours run, (4) facility for carrying out repairs when stations are shut down, (5) a saving in future capital expenditure owing to reduced amount of stand-by plant and the use of larger generating sets.

Appendix "B."—(Linking-up Proposal.) A power station (A) having a maximum load of 3,000 kw. links up with another power station (B) having a maximum load of 20,000 kw.

(A) runs for 8 hours (one shift) a day only (and possibly not at all on Sundays), (B) taking the load during the re-



NATIONAL ELECTRIC SUPPLY: MAP SHOWING SUGGESTED SUB-DIVISION INTO AREAS.
INDUSTRIAL AREAS SHADED.

an arrangement likely to be found applicable to many actual cases.

The Memorandum is signed by the following:—Messrs. J. H. Bowden, W. A. Chamen (Chairman), R. A. Chattock, J. S. Highfield, W. W. Lackie, Charles H. Merz, S. L. Pearce, Thos. Roles, D. A. Starr, W. B. Woodhouse; Hon. Secretaries, H. Faraday Proctor, The Exchange, Bristol; A. de Turckheim, Caxton House, Westminster, S.W.

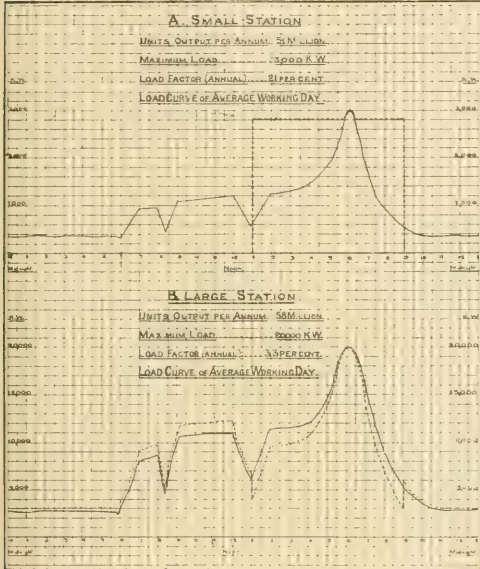
An explanatory note attached to the Memorandum states that the first public distribution of electricity was carried out by companies working under Provisional Orders granted under the Electric Lighting Acts, 1882 and 1888. Under these Acts their plant and mains are subject to compulsory purchase after 42 years from the date of the Order, and thereafter after recurring periods of 10 years.

The practicability of the business having been proved, many municipal corporations entered the field, supplying in their municipal areas under Provisional Orders, and in other cases they bought up the undertakings of local companies under agreement or arbitration.

maintaining 16 hours. During the 8 hours when (A) is running, which would include (A's) peak load, (B) would transfer to (A) sufficient load to keep (A) at a uniform load of 2,800 kW. except at the hours when (A's) own load is 2,800 kW. and over. Such a division of load would result in maintaining (A's) output at $5\frac{1}{2}$ million units while increasing his plant load factor threefold, (B's) load factor remaining unaltered, while the units delivered from (A) to (B) during the 8 hours when (A) is running would be returned by (B) to (A) during the remaining 16 hours.

Advantages.—(1) Fuel saved; because (A's) load is always sufficient to enable all machines running to be run at most economical load, and (B) gets a better load during the slack hours. A saving of 1 lb. of coal per unit on $5\frac{1}{2}$ million units is equivalent to 2,500 tons per annum, or, at present prices, say, £1,500 to £3,000, depending upon the locality.

(2) Wages saved; because (A) works one shift instead of three, thereby saving more than half his wages bill and reducing his maintenance charges (because of fewer plant hours).



It will be seen that such arrangement would not only result in a saving to the nation of 2,500 tons of coal per annum, but a saving to the two electric supply undertakings of, say, £3,000 per annum, including wages, &c., which would give a return of 10 per cent even if it cost £30,000 to connect up

LANCASHIRE AND CHESHIRE SCHEME.

In connection with the same subject, we have received from Mr. J. A. Robertson, hon. secretary of the Committee for the Interconnection of Lancashire and Cheshire Electricity Supply Systems, a copy of the Interim Report of the Committee, which forms very interesting reading. It is dated September, 1916, and after discussing the question of economy and the needs of the existing situation generally, details the proceedings of the Committee since its inception on May 9th, 1916. Various recommendations are made with a view to co-ordinating the electrical supplies in the districts concerned, and in a number of appendices a mass of data and statistics is set forth. We reproduce on page 400 a map which accompanies the report, showing the generating stations, existing E.H.T. mains, and proposed new mains in the areas included in the scheme. It is interesting to note that the economy anticipated in coal consumption alone, as the result of interconnection of the generating stations, is estimated at £82,000 per annum at 17s. 6d. per ton.

The report, after drawing attention to the necessity for conserving the nation's resources and increasing its producing capacity during and after the war, which has made the subject of electricity supply one of vital and immediate importance, states that it does not profess to deal with questions of general policy, nor does it advocate any comprehensive scheme of centralisation. Its object is rather to indicate the means which can be adopted at once for utilising existing facilities to the fullest extent, so as to meet the present abnormal conditions, and to prepare for the situation which will arise after the war.

Certain conditions arising out of the war have an important bearing on the question.

(a) The restrictions imposed by the Government on capital expenditure, and the consequent postponement or abandonment of extensions to existing supply undertakings.

(b) The increased price of fuel and other materials, and the scarcity and high price of labour.

(c) The increased adoption of electricity for power purposes, and the necessity for cheapening its production to meet industrial requirements after the war.

To cope with these conditions, the Committee has drawn up a scheme for the interconnection of existing electrical undertakings in certain districts in Lancashire and Cheshire, as a result of which it is believed that the following immediate benefits will be derived:—

(a) The supply from existing stations could be greatly increased, as the generating stations in each district would to a considerable extent act as a reserve or stand-by to each other, thus reducing the amount of reserve plant which has to be kept in readiness in each station in case of emergency. It is estimated that if the generating systems in the areas under review were interconnected the aggregate maximum demand on the whole system could, under normal working conditions, be increased by 30 per cent.

(b) The risk of interruption to supply would be materially diminished in the event of an accident occurring to the plant in one station, as the supply could be maintained from one or more stations in the same district.

(c) By making the fullest use of the efficient plant on each system, and only running the less efficient plant at times of heavy demand, a considerable saving could be effected in fuel, and to a lesser degree in wages, repairs, and other items of expenditure.

(d) A number of the generating stations in each district could be shut down at week-ends, and at times of light load, thus improving the general efficiency of the system, and permitting necessary repairs and overhauling of plant to be carried out with convenience and economy.

(e) The interconnection of electrical undertakings by reducing the amount of stand-by plant would greatly conduce to economy of capital expenditure in future.

The Committee was formed on May 9th, some weeks before the Board of Trade circular on interconnection was issued, held its first meeting on May 16th, 1916, and decided to consider the problem in the first place from its engineering aspect. For the purpose of the scheme the undertakings in the area were divided into six groups, namely:—

GROUP A.

Altrincham Electric Supply Co.; Eccles Corporation; Lancashire and Yorkshire Railway; Middleton, Manchester, and Salford Corporations; Sale and Stretford U.D.C.'s; Stockport Corporation; Trafford Power and Light Supply, Ltd.

GROUP B.

Bolton and Bury Corporations; Heywood U.D.C.; Lancashire Electric Power Co. (Radcliffe); Leigh Corporation; Radcliffe U.D.C.; Rochdale Corporation; South Lancashire Tramways Co. (Atherton); Wigan Corporation.

GROUP C.

Ashton-under-Lyne Corporation; Glossop Supply Co.; Oldham Corporation; Stalybridge, Hyde, &c. (joint board).

GROUP D.

Accrington, Blackburn, Burnley, Colne, Darwen, and Nelson Corporations; Preston Corporation Tramways; Preston Electric Light Co.; Rawtenstall Corporation.

GROUP E.

Birkdale and District Electric Supply Co.; Birkenhead and Bootle Corporations; Hoylake and West Kirby U.D.C.; L. & Y. Railway (Formby); Liverpool Corporation; Liverpool and District Co.; Liverpool Overhead Railway Co.; Mersey Railway Co.; Mersey Power Co. (Runcorn); Ormskirk (Company); Prescot and District Lighting Co.; St. Helens, Southport, Wallasey, and Warrington Corporations.

GROUP F.

Alderley and Wilmslow Electric Supply Co., Ltd.; Crewe and Chester Corporations; Macclesfield Electricity Co., Ltd.; Northwich Electric Supply Co.

A technical census of these undertakings has been made, and the results are tabulated in an appendix. The map on page 400 shows the position of the generating stations, and the extent to which extra-high-pressure mains have already been laid in the area of supply under consideration.

At an early stage in the proceedings the Committee came to the conclusion that no useful purpose would be served by the inclusion of the five undertakings of Group F, and consequently these have been dropped out of the scheme.

Extra-high-pressure mains have been laid to a much greater extent in the districts included in Groups A, B, and C than in the others, and a scheme for interconnecting the undertakings within these groups could be carried out at a comparatively small cost and with little delay. The majority of the undertakings included in Group D can also be conveniently linked up with each other, but the interconnecting of this group with Groups A, B, and C is not provided for at present. The district within which the undertakings included in Group E are situated is a very wide one, and to interconnect all these undertakings at the present time would entail a capital expenditure out of proportion to the realisable savings. This does not, however, rule out the possibility of adjacent undertakings in this district linking up by mutual agreement.

The Committee, after careful consideration, therefore, has decided for the present to confine its proposals to the four Groups, A, B, C, and D, comprising 32 undertakings. In Group A, the cost of linking up Sale and Altrincham with the other undertakings in the Group could not be justified at present and this also applies to the two Preston undertakings in Group D. There remain, therefore, 28 undertakings, which include the Lancashire and Yorkshire Railway Co.'s 25-cycle system and the undertaking of the borough of Eccles. The Committee makes no proposals for dealing with these two undertakings in this report, the first named on the ground of expenditure involved, and the last named on account of the necessary information being withheld. Of the remaining 26 undertakings, the majority are operating on the three-phase alternating-current supply system, with 6,600 volts as the pressure of generation and transmission, and 50 periods as the frequency of the system.

Six appendices give information regarding the undertakings

- (b) For stand-by purposes, *i.e.*, for emergencies.
(c) For bulk supplies, *i.e.*, in case of a shortage of plant or for economical reasons.

The Committee, after careful consideration, has come to the conclusion that if the undertakings in Groups A, B, C, and D are interconnected the average coal consumption per unit generated, *viz.* 324 lb., can be reduced by not less than 15 lb. of coal per unit. With coal at 17s. 6d. per ton, this reduction represents an annual saving on the present output of the undertakings of about £82,000.

Having arrived at these preliminary conclusions, the Committee considered it desirable to ascertain more definitely the views of the Government departments concerned on this question, and after correspondence, a deputation consisting of Mr. Pearce, Mr. Purrett, Mr. Welbourn, Mr. Robertson, Mr. Watson, and Mr. Wheelwright, on July 13th, was received by representatives of the Board of Trade, the Local Government Board, and the Treasury.

The deputation, in the first place, fully explained the steps that



LANCASHIRE AND CHESHIRE SCHEME: MAP OF AREA, INCLUDING GROUPS A, B, C, AND D.

included in Groups A, B, C, and D, under the following heads:

- Capital expenditure and plant capacity.
- Units generated and coal consumption.
- The estimated capital expenditure involved.
- New mains and transformers to be provided for interconnecting purposes.

Principal features of the returns from the undertakings.
Lancashire and Cheshire Electricity Supply Systems—tabulation of technical data.

The estimates in Appendix 3 are based on the abnormal prices now ruling for materials, and, with one or two exceptions, allow a section of not less than 0.15 sq. in. of copper on all new mains, and sufficient capacity of transforming plant to enable any undertaking to receive not less than 3,000 kW. from the adjacent undertakings with which it is connected.

Interconnected stations would enter into arrangements to give, receive or exchange electrical supplies for one or more of the following objects:—

- (a) For the purposes of economy only—*i.e.*, to avoid the inefficient running of plant or to facilitate the shutting-down of stations during the week-ends at night and at all other times of light loads.

had been taken, and advanced the view that, as the whole scheme was part of a national effort to effect economies, and as the return on the outlay involved was so substantial, the Government might favourably consider the question of providing the necessary capital to effect the interconnection proposals on such terms as would prove a strong inducement to the several parties interested to proceed with the scheme. A representative from the Treasury said he was authorised to say that the Treasury would favourably consider the expenditure of moneys required for the scheme, provided that the Local Government Board and the Board of Trade were satisfied with the proposals which might hereafter be submitted to them.

With regard to the coal saving, a representative of the Board of Trade pointed out that, viewed from the national standpoint, the annual saving to the country would be substantially greater than the sum of £82,000 estimated by the Committee, as the present-day export value of coal was 45s. to 50s. per ton.

Considerable discussion ensued with regard to the procedure which would be necessary to give effect to the Committee's proposals.

The deputation considered that powers should be given to a Joint Committee or Joint Board, with a view to co-ordinating the electrical supplies in the various districts on the following lines:—

- (a) To raise capital from time to time for the provision of

linking-up mains, transformers, and such other works as may be required for interconnecting purposes, and to allocate all expenditure on the joint scheme on an equitable basis between the undertakings participating in the joint scheme.

(b) To adjust the running hours of the existing generating stations in such a way that the maximum fuel saving might be effected. This would entail the shutting-down of certain stations during the night or week-ends, or at times of light load, the supply being furnished by the stations possessing the more economical plant.

(c) To lay down general rules for determining the charges to be made for:—

- 1. Reciprocal supplies.
- 2. Stand-by supplies.
- 3. Bulk supplies.

(d) To act in an advisory capacity in regard to future extensions of plant; that is to say, to recommend where such extensions could be carried out to the greatest advantage.

(e) To appoint from time to time such officials as may be necessary to act in an advisory capacity to the Board, and to carry out the instructions of the Board, under powers which may hereafter be conferred by the Government.

The representatives of the Government Departments recognised that some measure of control should be vested in such a Joint Committee if the best results were to be obtained from the scheme.

As a result of its investigation the Committee is satisfied that very substantial economies can be effected by the interconnection of the various electrical undertakings comprised in Groups A, B, C, and D, as indicated above.

a In order to bring the scheme before the local authorities and others concerned, the Committee recommends that a conference should be held at an early date of all the statutory supply authorities included in Groups A, B, C, and D. Such conference to be presided over by a Government official.

(b) That, subject to general approval being given to the scheme by the authorities concerned, an application should be made to the Board of Trade to set up a Joint Committee or Board, under Section 8 of the Electric Lighting Act, 1909, with general powers on the lines recommended in the report, and with the addition of further powers, if required, to enable agreements to be entered into with the power companies, whose inclusion in the scheme is regarded as essential.

(c) That pending the appointment of such a Joint Committee or Board, undertakings favourably situated may enter into voluntary arrangements for joint working. Provided that where existing works or works to be laid down for the purpose of interconnecting are suitable and sufficient to form part of the whole co-ordinated scheme at a later date, the capital expenditure on such works, or the annual charges on same, shall be recoverable from the Joint Committee or Board.

(d) In order to ensure that any local scheme for interconnecting shall be carried out in such a way as to conform with the requirements of the scheme as a whole, the Committee recommends that if the proposals contained in this report are adopted, the local authorities interested should temporarily appoint a Joint Committee, to which all proposals for the provision of mains or other interconnecting works shall be submitted for approval or otherwise before such works are commenced.

The report is signed on behalf of the Committee by Mr. S. L. Pearce (chairman) and Mr. J. A. Robertson (hon. secretary).

The estimated expenditure is as follows:—

(1) Estimate of cost to interconnect existing systems in Group A	£58,839
(2) Estimate of cost to interconnect existing systems in Group B	31,375
(3) Estimate of cost to interconnect existing systems in Group C	23,900
(4) Estimate of cost to interconnect Group A with Group B and Group C	8,783
(5) Estimate of cost to interconnect existing systems in Group D	8,500
Total	£281,397

The new mains required average 22,000 yards per group, ranging from 8,800 to 48,400 yards; with 20,680 yards for interconnecting the groups, the aggregate length is 109,550 yards, or about 62½ miles. The total capital expenditure and other details regarding the groups are given below:—

Group.	Capital outlay.	Generating plant capacity, kw.	Boiler plant capacity, kw.	Coal consumed per unit gen., lb.
A ...	£4,383,748	131,968	123,680	2.95
B ...	2,112,015	65,636	58,000	3.60
C ...	895,728	33,085	23,530	3.39
D ...	954,097	30,229	22,600	4.01
Total ...	£8,345,588	260,918	228,710	

The total maximum demand of the 26 undertakings scheduled last winter was 138,429 kW.; next winter it is expected to be 160,862 kW. The total units generated in the last completed year amounted to over 421 millions, and the average coal consumption of all the stations was 3.24 lb. per unit generated.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Convertible Electric Fires.

The BIRMINGHAM ELECTRICAL APPLIANCES MANUFACTURING CO., LTD., of Whitmore Street, Hockley, Birmingham, has recently introduced a series of low-priced heating devices, amongst which attention may be drawn to the patent convertible electric fire, which can be used either as a decorative fire or as a heater for cooking and kettle boiling. Figs. 1 and 2 show the firm's No. 1

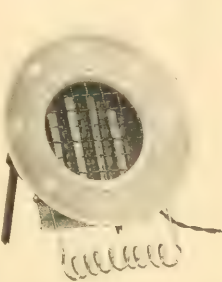


FIG. 1. CONVERTIBLE FIRE. FIG. 2. FIRE USED FOR WATER HEATING. PATENT.

(1,000-watt) pattern in the two positions: the framework is of vitreous enamelled cast iron, with the heater carried in a steel box and protected in front by a grill.

The firm also supplies a little torpedo radiator for putting under office desks or tables, with a loading of 1 to 1 kW., and the "Smootha" electric iron—a neat little appliance, at a very moderate price. All elements are guaranteed for 12 months, and spare elements are stocked and can be forwarded for the consumer to effect his own replacements.

"Lightning Bug" Electric Lantern.

We understand that MESSRS. W. YOUNG, ROBINSON & CO., of Windsor House, Kingsway, W.C., have placed on the market a new type of electric lantern known as the "Lightning Bug."



FIG. 3.—"LIGHTNING BUG" LANTERN.

A special three-volt battery is supplied with the lantern, which is claimed to give twice the volume of light and to burn three and a-half times as long as a single-cell battery. The lantern will accommodate a standard single-cell battery if desired; it is fire-lined, and finished in back enamel, with nickel-plated trimmings.

The Ediswan Escro Buzzer.

A neat and efficient buzzer has been placed on the market by the EDISON SWAN ELECTRIC CO., LTD., of Ponder's End, and is illus-



FIGS. 4 AND 5.—"EDISWAN" BUZZER.

trated herewith. This buzzer operates with from 2 to 10 dry cells, and is provided with a screw adjustment outside the case by means of which 5, 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 tones can be obtained. The adjusting device is shown on the side view. Gold-silver contacts are employed, and the resistance is about two ohms; the finish is black japan, with black painted case and the instrument measures $2\frac{1}{2} \times 1\frac{1}{2} \times 1\frac{1}{2}$ in. over all. The buzzer is useful in substitution for a bell in many situations, and would be suitable for signalling sets, with which many Volunteer signallers provide themselves.

Liquid Starting Gear.

MESSRS. SANDYCROFT, LTD., of Chester, have extended the variety of their enclosed liquid starting switches to meet additional requirements. A large three-phase starter is provided with worm-gear operation to ensure slow motion; the starting time recommended is from 15 seconds for motors up to 75 H.P. to 30 seconds for motors up to 600 H.P., the motor starting against one and one-half times to twice full-load torque three times per hour. The

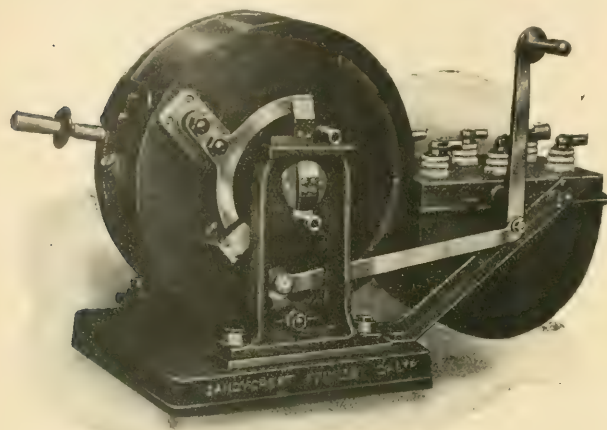


FIG. 6.—THREE-PHASE LIQUID STARTER INTERLOCKED WITH D.P. OIL-IMMERSED STATOR REVERSING SWITCH.

standard three-phase starter can be combined and interlocked with a D.P. oil-immersed stator reversing switch, as in fig. 6, and a special type having four coupled resistance units on one base-plate, is made for use with the firm's "Cascade" motors. The device is suitable also for haulage motors and automatic control gear for air compressors, &c.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Reform of Electricity Supply.

In the discussion which is proceeding on the proposals for the reform of the electricity supply of Great Britain, the issues, which were originally fairly clear, are becoming involved due to misconception and misunderstanding. Partisanship that barrier to reform, it tending to grow must be checked. It is very unfortunate that the word *nationalisation* has been mentioned, for in the paper I had the honour to read before the I.E.E. on this subject there is no proposal for the nationalisation of our electricity supply, to which I am opposed.

We are practically unanimous that reform is needed, and the proposals advanced by me were that we should attain that reform by (a) co-operation, and (b) co-ordination of control.

We must co-operate where centralisation would produce the best results, as, for example, in many instances in the generation and bulk distribution of electricity, but should remain independent where no advantage would accrue from centralisation, viz., in the distribution and application of electricity.

We must retain Government control of electricity supply in a not very satisfactory form, viz., the Home Office, Local Government Board, Board of Trade, and Parliament itself. There is no co-ordination of control, no live connection between the supply undertakers and the Government, and no scientific plan for the electricity supply of the country as a whole.

The proposal in the paper was to take this existing Government control and vest it in a professional public board, which

could watch over the industry as a whole, both in the interests of the public and the legitimate interests of the supply undertakers.

In so far as the powers of this board would be contained in a Parliamentary Bill, it would really be what might be termed a quasi-government Board, which is very different to a Government Department. The Board would have Government authority through its Bill without many of the restrictions of Government departments. The Port of London Authority is a somewhat similar organisation, and the remarkable success of its administration is its justification. Again, the Public Trustee Office is run on less restricted lines than an ordinary Government department, and is self-supporting, and its success is shown in the rapid rise of this office.

Under this Board enterprise would be extended, and it was to be part of the Board's duties to encourage private enterprise to the maximum extent. The Board would operate in conjunction with existing undertakers when this was to the interests of all, and would operate in such districts as were unprovided for, and for which no private or municipal enterprise sought powers.

Shareholders of companies should realise that if reform can be effected in which their interests are protected, and in which their further enterprise is encouraged, then they have everything to gain by it. Those companies in particular whose powers are not in perpetuity would be given a new lease of life under the scheme.

Another point made in the paper was that drastic alterations and the immediate sweeping away of existing generating stations were not proposed. The proposed Board would lay out plans for the supply of this country to meet its requirements, say, 15 years hence, and then see that all new plant, new stations, new interconnecting mains, &c., &c., were devised to form part of the final scheme. The necessity for, and value of, a transition period was insisted on, both for economic and administrative reasons.

To sum up—reform by co-operation and co-ordination was to take place on the basis of protecting and advancing the interests of existing undertakings and those who had invested their money in them, whether shareholders or corporations. It is possible to do this and at the same time benefit the country as a whole, because the electricity supply industry is rapidly growing. The saving in coal alone under the scheme would amount to several millions sterling per annum. The owners of the undertakings, as well as the general public, would participate in this beneficial result.

Moreover, it must not be lost sight of that if the supply industry is not reformed from within it will be taken that the industry is not capable of effecting such much-needed reform. This leaves it open to attack from without, when probably more drastic and less equitable action would result. Apart from this, it is the duty of all to look at the problem from the standpoint of the national need, and seek to attain the desired end.

It is useless to expect to achieve this result by taking a short and narrow view. Any particular series of proposals if looked at from the standpoint of the immediate results might not be considered advantageous, but studied with a view to the ultimate result, for which all undertakings would be working on a preconceived and scientific plan, would certainly be carried out. In this connection, the establishment of the Public Electricity Board would inspire confidence and justify the broader view being accepted by individual undertakings.

There is no reason to fear that because powers are vested in a public board sympathetic to electricity supply, personal interests will suffer—we may reasonably expect the opposite. So long as these interests are adequately protected in the Bill, and we can be assured those responsible will see to this, then the shareholders should work for the reform as being in their interests and the interests of the whole country.

Finally, let us not make the foolish mistake of distrusting those who represent the industry in positions of influence. The recommendation (2) of the Council of the I.E.E. to the Board of Trade means, I take it, neither more nor less than it states, and the Council of the I.E.E. deserves the thanks and encouragement of the industry for all the trouble it has taken in this matter.

When we read the names of those who constitute the committees dealing with this reform in electricity supply we can be assured, by their past and present achievements, that they will only take such steps as they are satisfied will be steps of true progress, which includes the interests of the industry itself as well as those of the greater public.

I hope the time may not be far distant when the Council, with the support of the whole industry and shareholders, may be able to boldly approach the Government and ask for the Parliamentary authorisation of a complete scheme somewhat as outlined in the paper discussed by the Institution.

Ernest T. Williams.

London, N.W., October 3rd, 1916.

Precedence for Disabled Men.

I must apologise for the delay in tendering my thanks for the ELECTRICAL REVIEW, which continues to arrive regularly. Owing to the fact that we have been engaged in the recent "strafe" here, postal arrangements have been somewhat upset, and the arrival of six copies at one time meant some concentration to get into touch again with current events. I need hardly say—since others in like case have already expressed their views—that your valuable paper is the great barrier between us and "rust" in matters electrical.

Those of us who were serving with the Territorial Force, other than in a specialist unit, at the outbreak of war have perhaps had occasion to regret the difficulties of getting transferred to a unit where we could use our technical knowledge in the interests of the country. We hope the time is past when technically-trained men will be debarred from leaving a "fighting" unit for a "specialist" unit.

Surely it is as essential to "run" the human element on as efficient lines as the mechanical?

It is gratifying to read the accounts in your columns of what is being done in training disabled soldiers and sailors for power-house and sub-station duties, &c. All honour to those who are willing to do so much for those who have given so much, and it is to be hoped that the disabled members of the Services who are now filling the gaps in electrical staffs may be able to continue to do so permanently.

In your issue of August 18th Mr. Killingworth Hedges, writing on this subject, raises a point, along with that of pensions, which to my mind is of as much importance as the pension question. I quote the passage: "As the disabled men will probably in some cases lose their jobs when the large number of mechanics now in the Army return to work."

It must be painfully obvious to most thinking people that the struggle we are now engaged in will not cease with "cease fire." We shall have as great a duty after as now, and we must have as fit armies industrially then as military now.

In four years' experience as attendance in sub-station and power house, I formed the conclusion that they are not the places to bring out the best in a man who wants to go further—rather, there is a tendency to "rest on one's oars" and be content to see that the kilowatts are delivered to those who are keeping the great industrial machine going. At the same time, this class of job is capable of providing a very fair living for a disabled man (or pair may be the latest pathetic combination), whether or no he (or they) is overburdened with his disablement pension.

Can there be no guarantee given to such men as prove suitable to be able to continue in the billet they have been fitted for, many of whom will perhaps have insufficient technical knowledge or practical experience outside what they have specialised in, to enable them to compete in other directions?

Such of us as return from this "strafe", physically sound should make it a point of honour to keep out of such jobs as our less fortunate comrades can fill, but who are, on account of their honourable disabilities, debarred from greater efforts.

As we are comrades in arms now, so let that camaraderie continue, and let the fittest be in the "first line" as a common duty in the struggle to come.

Perhaps station engineers and others in choosing their staffs later on will state the justice of giving preference to the disabled.

We have been told as "Tomnies," "Your sufferings and privations will not be forgotten by a grateful country," but we sometimes argue whether there will be time for sentiment later on. Let us give the unfit a chance first.

Maybe there is sufficient point in this argument to induce you to give publicity to a question liable to be overlooked, but which is a very real question to many men who have been through the war-mill and emerged "unfit for active service." Thanking you for your interest,

A. P. Holloway (Sergt.).

Egyptian Expeditionary Force.

[Those who are "willing to do so much" for our wounded heroes know well that they can never do enough for them; how can a man be adequately compensated for the sacrifice of a limb, or—worst of all—of sight? When all is done, we shall remain their debtors, and we heartily endorse Sergeant Holloway's appeal to station managers to give preference to the disabled, and to their comrades to make way for them.—EDS. ELEC. REV.]

Closing Down the Electrical Co., Ltd.

Referring to the note headed "Closing Down the Electrical Co., Ltd.," and signed "Contractor," appearing in your last issue, your anonymous correspondent is disturbing himself, and those of your readers who pay any attention to his views, quite unnecessarily. I am in a position to assure you that the Board of Trade, to whom all controllers are accountable, exercises the greatest possible care to see that any sale of a business as a going concern under the powers of the Trading with the Enemy Amendment Act, is a genuine sale to bona-fide new owners of British origin, and there is no possible "loophole for the present owners to purchase the business and keep it going until such time as the war is ended," as your correspondent suggests.

I should not have thought it worth while to refer to the matter had it not been for the criticisms that have been appearing in other journals recently regarding the Board of Trade's handling of the Trading with the Enemy Amendment Act, and I am, therefore, glad to take this opportunity of stating that in my opinion the Act is being administered by that Department in a most efficient and practical manner, and without any avoidable delays.

Maurice Jenks,

Controller to the Electrical Co., Ltd.,
and other German-owned businesses.

London, E.C., October 9th, 1916.

Ozone in Military Surgery.

I notice in the current number of the Review a note on "Ozone in Military Surgery," in which you speak of "a novel method of treatment." Surely you remember Dr. Stoker, of the Oxygen Hospital. Doctor, now Major, Stoker, R.A.M.C., is the one responsible for this treatment, but you create quite an erroneous impression by speaking of it as "a novel treatment." Major Stoker has been practising it and advocating it for years, and for more years than that it has been in regular use on the Continent. It is quite true that it is only recently that it has been possible to use it on such an extensive scale, but probably if there were a little more enlightenment on these subjects, and a little less official opposition, it would not take 12 or 15 years to introduce such a wonderful treatment, and at the end of the 12 or 15 years to have it brought under one's notice as "a novel method of treatment."

Ozonair, Ltd.

EDWARD A. JOSEPH, Director & General Manager.

[We recollect nothing of the Oxygen Hospital, but we feel certain that the use of ozone as described in our note is a real innovation in military surgery. Can Mr. Joseph show that the treatment has ever before been applied to wounds received in warfare?

If the process itself is old, and yet unknown: "surely" that is Mr. Joseph's fault; various articles on the uses of ozone have appeared in our pages, but this particular treatment has never been brought to our notice.—EDS. ELEC. REV.]

Domestic Electric Openings in India.

I shall be glad if you will kindly publish the following in your paper, for the purpose of showing the various electrical firms the domestic requirements in the Indian Bazaars:—There appears to be great demand for small domestic grinding mills suitable for grinding wheat, grain, and maize, for domestic purposes, driven by small electric motors of 220 volts p.c. The machine should be capable of adjustment for grinding coarse or fine flour of the various kinds. It should also be capable of grinding not more than 10 lb. an hour. Anything larger than this would not be a saleable article. The machine is intended for purely domestic use for grinding the household requirements, as the Indian, owing to his caste, prefers to have the wheat ground on his own premises.

Particulars are solicited from various electrical firms, and should be addressed to

H. C. Greenwood.

Chief Electrical Engineer.

Municipal Committee, Amritsar, September 15th, 1916.

WAR ITEMS.

Another Committee to be Appointed.—According to Mr. Percy Alden, M.P., the Government is appointing a Social and Economic Committee.

Wages in Railway Shops.—It has been agreed that all men employed in the railway workshops shall receive a war bonus of 5s. a week, and all boys (under 18) similarly employed 2s. 6d. a week.

Tramways and Munitions.—The Ministry of Munitions has intimated to the South Shields Corporation that the Corporation tramway undertaking is a certified trade, as it is of importance in connection with the carrying on of munition work.

Trading With the Enemy: Black List.—The Foreign Trade Department has issued a new consolidating list, containing the names of over 2,000 persons and firms with whom persons in the United Kingdom are forbidden to trade under the Trading with the Enemy (Statutory List) Proclamation, 1916. Although the list has now been in existence for seven months, cases still come to the notice of the department in which firms are corresponding with persons whose names appear in it. It is important, the department points out, that everyone engaged in foreign trade should realise that he is under obligation to make himself familiar with the statutory list, and to observe it in his dealings. Failure in this respect renders him liable to heavy penalties.—Daily Telegraph.

A Swiss Trade Forecast.—The U. S. Consul at Berne quotes the following views expressed by a leading Swiss firm respecting the present and future economic conditions in Europe: "We presume that the war will introduce a radical change in American trade relations, and that many European agencies now lodged solely in the hands of German firms will be better transferred to neutral ground. On the other hand, a great many articles, which America in the past was unable to send to Europe in successful competition with European products, will come to the front in view of America's greater financial supremacy and the dissipation in all the belligerent countries of all competitive power."

The Financial Results of Continental Companies in War-time. The accompanying table represents a list of a number of the investments held by the Bank for Electrical Undertakings, of Zurich, and shows the financial results of each, as far as ascertainable, for the past three years. The figures given are percentages on the ordinary shares:—

1913 or 1914 or 1915 or
1913-14, 1914-15, 1915-16.

[illegible]

Exemption Applications.—At the Shoreditch Tribunal, Mr. L. Davis (trading as the Reliance Wire Co.), of Curtain Road, E.C., appealed for G. W. Hardy (37), mechanical fitter. The firm were stated to be doing a large amount of electrical work for contractors who were working for the Ministry of Munitions. The work was of such a nature that they believed they were entitled to a badge, and had applied to the Ministry of Munitions for one. They had been told that the matter was

At Boston, Mr. R. W. Sanders, electrical engineer, applied for the retention of C. E. Clare (30), electrical case-maker, on the ground that he was indispensable. Mr. Sanders stated that the man was the only one he had on this class of work, and he was voluntarily badged. Major Bell replied that this class of badge had "run out." Clare said that he was the only man in the town who could do this class of work. The appeal was refused.

Application was made by Mr. F. G. Curel, engineer and manager of the electric light department of the Whitney U.D.C., for extended exemption for Victor Brice (19), electrician. Mr. Curel stated that it was quite impossible to replace Brice. He had advertised three times, but had received no replies. He had been passed for garrison duty at home. The Tribunal allowed two months in which to obtain a substitute.

At Reigate, Mr. Makovski, of Messrs. Tamplin & Makovski, electrical engineers, appealed for W. H. W. Peachey (19), passed for home garrison duty. The Military Representative said they were anxious to get hold of home service men to release others. The appeal was dismissed, the calling-up to be delayed until October 25th.

Before the West Kent Appeal Court, exemption was claimed for C. E. Stow, electrician to Mr. J. Russell, at Halstead Place, near Sevenoaks. Appellant said that he suffered from a dilated heart, and was only fit to do light work. The Military Representative intimated that there would be another medical examination when applicant was called up, and if he was a clever electrician he would probably be put in a part of the Army where he would be useful. The appeal was rejected.

At Holyhead, the municipal electrical engineer (Mr. P. Williams) appealed for a fireman, previously exempted until September 25th. He stated that all efforts to replace the man had failed, and, in the interests of the community, it was essential that someone should do the work. The Tribunal conceded two months.

At Southend-on-Sea, Messrs. H. Garon, Ltd., High Street, appealed for an electrician, aged 25, and he was granted until the New Year.

At the Winchester Tribunal, the Mayor and Ald. Stopher did not adjudicate in an application by the Corporation electricity department for the exemption of a shift engineer in the power station, aged 19. The engineer said that this was a certified occupation, and although he had been willing to

At Piracombe, the Electric Light Co. applied for the retention of Mr. H. J. Stewart, resident engineer and manager, certified occupation being claimed. On the same ground, exemption was sought for Alfred James Rudd, stoker. Each was granted conditional exemption.

At Bath, Messrs. R. Kendall & Sons applied for the re-

removal of a condition for exemption that an electric fitter named A. C. Brackstone (39), should obtain munition work within 14 days, on the ground that another of their employes had been taken for munition work. General Bradshaw intimated that if the man was in the C Class he would probably not oppose the application. For this purpose a medical examination was ordered.

At Ryde (I.O.W.), a letter was read from Mr. A. F. Braithwaite (39), electric power station engineer and local manager of the Ryde electric supply system, stating that in consequence of a serious illness, including an operation, he was not sufficiently strong to undertake military duties. A medical certificate enclosed stated that he was totally unfit for military service, and conditional exemption was granted.

Mr. A. L. Duncan, of Knossington Grange, appealed to the Melton Mowbray Tribunal for Edwin Stableford, his electrical engineer. Final exemption until January 1st was conceded.

At Maidstone, Messrs. Oswald Jones & Co., electrical engineers, appealed for Mr. E. W. Sells (33), their business manager. Mr. Jones stated that Mr. Sells was originally rejected, but had now been passed for general service. They had lost 12 out of 16 men. Exemption was refused.

At Barking, Mr. W. E. Kidnor, acting electrical engineer to the U.D.C., appealed for J. J. White, motor-man. He said that the Ministry of Munitions was not issuing badges, but intimated that men who were exclusively engaged in tramway work were in a certified occupation, and that appeal must be made to the local tribunal. Two months were allowed, with leave to appeal.

At Brighton, an electrical engineer who appealed stated that he had charge of four electric lifts, and of a firm's electrical appliances to enable all the hands to make munitions. Asked if a month's exemption would meet the case, appellant replied in the negative. Conditional exemption was given on appellant joining the Volunteers.

Before the Gloucestershire Appeal Court, the Bourton-on-the-Water Electric Light & Power Co., Ltd., appealed for the retention of an employe, aged 19, having the entire charge of the plant, and who could not be replaced, as a substitute could not be found. The Chairman expressed the opinion that a substitute could be found if the company offered higher wages. The appeal was dismissed, and the calling-up delayed for a month.

Maidenhead Tribunal has given exemption until January 1st, on his joining the V.T.C., to George P. Lovegrove (33), electric fitter with Mr. Jonathan Bond.

Before the Herts. Appeal Court, the North Metropolitan Electric Co. claimed exemption for Thomas George Brookwell (20), junior charge-engineer, claimed to be in a certified occupation. It transpired that Brookwell was only engaged on approval last July, and the Chairman observed that the company would have to put up a very strong case. The representative of the company said that the man was passed for sedentary work at home only. Mr. E. J. Gape (military representative): In that case, I don't want him. If you had taken the certificate before the City Tribunal you would have had exactly the same treatment. The appeal was dismissed, with right to appeal when Brookwell is called up.

At Shipley, an arc lamp trimmer, employed by the District Council, applied for exemption. He was given until November 1st, but was told to get work of national importance in the meantime.

BUSINESS NOTES.

Japanese Porcelain.—The U.S. Consul at Yokohama says that a considerable increase in the demand for Japanese porcelain, as a substitute for European products, in the United States, Canada, Australia, India and the South Seas is reported by the *Japan Chronicle*. Before the war, the yearly exports amounted to about \$1,994,000 in value, but this year more than \$2,492,500 worth has already been exported in the first six months. "In Owari, Mino, Kyoto, Kyushu and other porcelain-producing centres in Japan, manufacturers are almost suspending the manufacture of goods for domestic use, and are throwing their energies into articles for export. According to merchants here, Japanese porcelain goods, especially insulators and other articles for industrial purposes, shipped to India, Australia, and the South Seas compare quite favourably both in price and quality with European products, but table utensils exported to the United States, Canada and other places are inferior to German goods in many respects, and it is expected that the Japanese articles will find it difficult to maintain a place on the markets opened to them by the war."

Trade Combinations in Russia.—The U.S. Commercial Attaché at Petrograd in reporting, states that there has been legislation in Russia against combinations in restraint of trade, similar to anti-trust legislation in the United States. For instance, in Russia it is not possible for one company to hold stock of another company. The Russian Government, however, has not restricted the formation of community-of-interest organisations, which are not incorporated companies, but are associations of individuals with common meeting places. The Government does

not interfere with the holding of such meetings, and requires no official scrutiny of the records. At the meetings of such societies prospective orders from the Government and from private railways and other interests are discussed, and schedules are drawn up showing the capacities of the various works. Prospective orders are then apportioned to suit conditions, at prices common to all. In consideration of this apportionment of orders, the fitness of certain works to manufacture special classes of articles, such as cars or locomotives, or to furnish certain sections of rails, or structural material, or certain qualities of steel, is given careful attention at the meetings. Prominent among the community-of-interest organisations are the Prodamet, a combination of more than 30 big steel concerns; the Prodoparozov, a combination of seven locomotive makers; and the Prodovagon, a combination of 12 car builders. The central committees of these organisations act as both selling and purchasing agents. They are opposed to purchasing in foreign countries any goods that can be produced in Russia. There is no record that any member of these organisations has contravened the letter or the spirit of the agreements.

Book Notices.—The *Faraday House Journal* for the Michaelmas term contains the first of a series of "Notes on Electrical Engineering," by Dr. Alexander Russell; a biographical sketch of J. K. Stothert; and obituary notices of Second-Lieuts. F. R. Hoggett and J. H. Parr-Dudley, as well as additions to the lengthy Roll of Honour of Faraday House.

"Journal of the Manchester Municipal School of Technology." Vol. VIII. Manchester: The Education Committee.

"Proceedings of the American Institute of Electrical Engineers." Vol. XXXV. No. 9. September, 1916. New York: The Institute. Price \$1.

"Scientific Papers of the Bureau of Standards." No. 281. A study of the inductance of four-terminal resistance standards. Washington: Department of Commerce.

"Science Abstracts. A and B." Vol. XIX. Part 9. September 28th, 1916. London: E. and F. N. Spon, Ltd. Price (each copy) 1s. 6d. post free.

We have received a copy of the first number of *Cheap Steam*, which is a magazine published by Messrs. E. Bennis & Co., Ltd., of 28, Victoria Street, S.W., for establishing closer personal contact with the firm's friends, and as a medium for discussing questions arising in connection with boiler-house practice. There is a biographical article, with photograph, on the founder and managing director of the company, Mr. Edward Bennis, and other contributions deal with plant supplied to a Japanese paper mill, self-starting and self-stopping elevators, the performance of mechanical stokers on a fluctuating load, atmospheric pollution, the care of mechanical stokers, &c., as well as a number of articles of interest to the commercial man.

"British Opportunities in Russia." By L. A. Rojansky. London: The Anglo-Russian Translations Bureau, Ltd. Price 2d.

"Electrical Measurements and Testing, D. and A. C." By C. L. Dawes. London: Chapman & Hall. Price 3s. net.

"Engineering Applications of Higher Mathematics." By V. Karapetoff. London: Chapman & Hall. Price 3s. net.

"Eclipse or Empire?" By H. B. Gray and S. Turner. London: Nisbet & Co. Price 2s. net.

Electric Lamps for Argentina.—A circular, issued in September by the Compania Argentina de Lamparas Electricas Z. says:—"We have the pleasure to announce that this company has already received 328 cases of machinery, apparatus, and material for the manufacture of metallic-filament electric lamps. These cases have been unloaded from the Spanish ss. *Leon XIII*, and constitute our first consignment from Europe. For mid-October we expect to receive another consignment from the U.S.A. The manager of the company, Senor Eugenio Carrio, and the technical and mechanical staff, arrived on the *Leon XIII*. When circumstances become normal again, a commencement will be made on our great works at Longchamps, F.C.S. In the meantime our factory, workshops, and offices will be situated in the large building purchased by the company, situated at Avenida Alvear and Coronel Diaz, Nos. 2740-50-60, and Cervino, 3227-31, which will permit us, before the end of October, to offer the lamps of our manufacture to the public . . . implying an important departure in favour of national industry."—*Review of the River Plate*.

Trade Announcement.—MESSRS. MASON & BROWN have removed into their new works—Volta Works, Vestry Street, Leicester—and all communications should be addressed to them there.

Electrical Imports into Pernambuco.—The imports of electrical machinery, supplies, &c., into Pernambuco in 1914 and 1915 were:—

	1914.	1915.
Insulators	£2,042	£243
Machinery	39,991	8,048
Electric motors	2,529	300
Telegraph, telephone posts, bridge and fence material	13,552	4
Lighting apparatus	6,059	1,257

English Porcelain.—It is announced that MESSRS. DOULTON, of Lambeth, have, after lengthy experiments, succeeded in producing laboratory porcelain, which was, prior to the war, practically a German monopoly. Another development of the Lambeth business is the production of the special porcelain required in connection with the manufacture of sparking plugs.

The Electrical Position in South Africa. In the course of a recent visit to the South African Mining Industry, says—

In connection with the present position, it is however remarked that the war situation has made it imperative that stocks must be kept up to provide for fluctuations. As a result, prices have not been any fluctuations of any moment during the past month. There is a little shortage of electrical goods particularly those which enter into the construction of machinery. There is no sign of the general run of mining material weakening, as freight seems rather inclined to harden. The foundries are all well employed with new work and repairs from the mines, which are giving work out quite freely, as many things cannot be obtained for certain from overseas, and that is where the local makers come in. In this connection the Quasi-Arc system of electric welding process is making much headway in Johannesburg. . . . At the beginning of the year, electrical materials were scarce; but since then stocks have gradually increased; therefore, Johannesburg is to-day well supplied, and, with a few exceptions, all every-day lines are available. However, the demand is anything but good, as the mines have large stocks on hand and the ordinary town business is exceptionally dull. Electrical bells of the larger kinds in pre-war days came from the Continent, and when those were absorbed considerable inconvenience was often caused in getting the right thing; but now British supplies are coming forward to fill up the gap. In connection with electrical spares, quite a lot is being done in Johannesburg in fixing up cord grip-holders as well as parts for electric torches. It is probable that this industry will continue even after the war. There may be an advance in the price of lamps through increased costs in the manufacture; however, as the stocks in South Africa are at present on the big side, nothing of importance is likely to happen for the next few months.

Catalogues and Lists.—**ENGINEERING AND ARC LAMPS.** LTD., Sphere Works, St. Albans.—Leaflet giving particulars and prices of the "Nevalon" adaptor for use with electrical apparatus using flexible connections, such as electric laundry and other irons, electric drills, &c. It obviates the difficulty of fangling and ultimate breakage of flexibles. Also an illustrated list concerning fittings for "Half-watt" (nitrogen filled) and metal-filament lamps.

MESSERS. DRAKE & GORHAM, LTD., of 66, Victoria Street, London, S.W., in issuing a pamphlet giving prices and illustrations of a number of their half-watt lanterns, half-watt and one-watt lamps of various makes, bowl fittings, &c., have included a feature which is of special interest to most of us at the present time. It consists of illustrations, executed in their appropriate colours, of ribbons of honours conferred for distinguished naval, military and civil service, by Britain, France, Russia, Belgium, Prussia and Turkey.

ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., 109-111, New Oxford Street, London, W.C.—Forty-page catalogue (No. AB 1), giving illustrations and tabulated prices of carbon materials for the electrical and allied industries—cinema carbons, arc lamp carbons, carbon brushes, battery rods and plates, carbon electrodes, &c.

MESSERS. W. SANDERS & CO., Falcon Electrical Works, Wednesbury.—Circular containing an illustrated description of their new type of fuseboard, in which the use of all-china and slate bases is obviated.

"Z" ELECTRIC LAMP MANUFACTURING CO., LTD., Southfields, S.W.—Advertising blotters have been prepared for free distribution to the trade, and numbers can be over-printed with the dealer's name if required.

Bankruptcy Proceedings.—In the course of the public examination of Mr. TOMAS MAKINSON SANDERS, civil engineer, of Throgmorton Street, E.C., whose gross liabilities are returned at £27,412, against assets estimated to produce a surplus of £91,627, the debtor said that in 1910 he contracted to purchase, for £350,000, an option for the supply of hydro-electric current in bulk to undertakings in Mexico. Companies were formed, in one of which he received a shareholding of £3,000,000, and arrangements were made for a bond issue of £6,000,000. Owing to the disturbed state of Mexico, the issue had not yet been successful, and in May, 1912, he assigned his interest. At the time he went into that business he was worth a million of money, but he came out of it with only £100,000.

Morse Silent Chains.—Referring to the description in our last issue (p. 380) of a large chain drive employed to transmit 5,000 H.P., and furnished by the Morse Chain Co., of Ithaca, New York, U.S.A., the WESTINGHOUSE BRAKE CO., LTD., of 82, York Road, King's Cross, inform us that they are the sole licensees outside of the American Continent for the manufacture of silent chains under the Morse patents, and that such chains are manufactured at their works in London.

E.C.C. Hospital Fund.—The employees of the ELECTRIC CONSTRUCTION CO., LTD., Wolverhampton, have contributed £88 10s. to the Wolverhampton and Staffordshire Hospital this year against £70 last year.

For Sale.—**MESSERS. DENNER & RUMMEL** will sell by auction on October 17th the wireless plant, tools, patents and land at Norman's Bay, Sussex, of Universal Cheap Cables, Ltd., by order of the liquidator. Particulars may be found in our advertisement pages.

The Electrical Co., Ltd.—**MESSERS. WHEATLEY KIRK, PRICE & CO.** have issued a bulky catalogue of the stock of the Electrical Co., Ltd., for which tenders must be delivered by

Thursday next. There is a large variety of accessories, including motors and motor parts, small motors, fans, heating and cooking apparatus, dial fuse gear, conduit fittings, Sunshine are lamps, meters, instruments, Siemens carbons, flame and other carbons, Nernst material, Aegma lamps, miniature carbon lamps, &c.

Condensing Plant Contracts.—**THE MIRRLEES WATSON CO., LTD.**, Glasgow, have recently received orders for 34 sets of condensing plants of varying steam duties up to 130,000 lb. steam per hour.

LIGHTING AND POWER NOTES.

Aberdeen.—**PUBLIC LIGHTING.** A movement is on foot for an improved scheme of street lighting, and Mr. Bell, city electrical engineer, and Mr. Forbes, inspector of lighting, are to report to the T.C. as to the cost, &c. It is proposed to have electric lamps in the principal streets connected with the police office, so that on warning being given the whole of these lamps can be extinguished simultaneously. The difficulty of dealing in the same way with the gas lamps precludes any extension of the public gas lighting.

Australia. A public meeting of Glen Innes, N.S.W., residents has condemned the action of the Municipal Council in rejecting the electric lighting proposals, and a resolution to obtain a report for further consideration from Mr. J. F. Donoghue, electrical engineer, was carried.

The South Brisbane (Queensland) Municipal Council has endeavoured to obtain an electric supply for lighting and power, in addition to that supplied by the Brisbane Tramways Co. An Order in Council has now been made, granting powers to the City Electric Light Co. to supply electricity to South Brisbane. The Council has the power to take over the supply at the end of five years, and also to ask the Government to appoint a Committee for the purpose of reviewing the charges made for the supply for lighting and power. All mains and lines are permitted to be above ground.

The North Illawarra Council has received offers from the South Bulli and the Corremal-Balgownie Collieries to supply electricity for lighting in the municipality.—*Tenders.*

Ballyconnell (Co. Cavan).—**STREET LIGHTING.**—The R.D.C. has accepted the tender of the Ballyconnell Electric Co. to light the town until March next.

Barking.—**LOAN SANCTION.**—The U.D.C. has received sanction to a loan of £1250 for mains extensions and plant for a supply of energy to the Cape Asbestos Co.

Bentham.—**E.L. SCHEME.**—The new electric lighting installation was inaugurated last week. Owing to new applications, the works have had to be enlarged, and a new supply feeder has been erected from the generating station at Low Bentham.

Bolton.—**STREET LIGHTING.**—The Electricity Committee has suggested a joint meeting of the Gas and Electricity Committees to discuss the question of the control and supervision of the street lighting arrangements.

Burton-on-Trent.—The electrical engineer reports that during the past month the number of units sold for lighting, motors, heating, &c., was 322,511, and for traction 50,659, showing an increase of 60,042 in the former instance, and a decrease of 1,168 for traction, as compared with the corresponding month last year.

Carrrickmacross.—The Lighting Co. has increased the price of electricity by 2d. per unit.

Colchester.—In view of alleged smoke nuisance, it has been decided to give each stoker at the electricity works a bonus, conditional on satisfactory stoking.

Edinburgh.—**PUBLIC LIGHTING.**—The Lighting Committee has recently held a demonstration of modified street lighting, using a 50-C.P. metal lamp on each post and alternatively a 100-C.P. lamp on alternate posts, and the former arrangement is favoured. If approved it will be adopted on all car routes where electricity is the illuminant.

Gillingham (Kent).—**PRICE REVISION.**—From November 1st, the price of current is to be increased from 3d. per unit, plus 10 per cent., for heating, to 1d., plus 10 per cent., and all accounts (except in case of contracts) will be increased 15 per cent., in addition to 10 per cent. already added. The 10 per cent. charged for meters, radiators, cookers, and other hired apparatus is to be discontinued.

Hull.—**NEW PLANT.**—The Electricity Committee, in view of the growth of the load, has decided to purchase an additional boiler and to apply for sanction to the necessary expenditure.

London.—**BERMONDSEY.**—The B.C. has decided to increase the charges for electricity by a further 5 per cent. Coal and cartage account for an extra expenditure of £4,922 for the year.

Manchester. **PROFITS AND TAXES.**—At last week's meeting of the City Council, Alderman Ashton moved the following motion:—"That, having regard to the present high rate of income-tax, and to the liability thereto of the profits of the trading departments of the Corporation, a Special Committee of this Council be appointed to review the basis on which the Electricity, Tramways and other Committees have hitherto made annual contributions out of their profits in aid of the city rate, and to make such recommendation in regard thereto as they may consider desirable." The motion was deferred to another meeting of the Council.

Newcastle-under-Lyme.—**PRICE INCREASE.**—The price of electricity for lighting is to be increased to 7½d. per unit, less 5 per cent. discount.

Newport (Mon.).—**MARKET LIGHTING, &C.**—Negotiations are in progress with a firm on the east side of the river for taking a supply of energy estimated on a maximum demand of 300 kw. The Council is recommended to approve a draft agreement with Messrs. Smith's (Newport), Ltd., for a bulk supply. The Markets Committee is to ask the electricity department to install in the Market Hall 12 600-c.p. half-watt lamps, in lieu of the existing arc lamps which the Committee decided should be removed, the hire of the new lamps to be 5s. per lamp per quarter, and the charge for current and maintenance to be 1½d. per lamp per hour, such lamps, however, being intended to be a stand-by in case the lighting of the stalls fails at any time.

New Zealand.—The Public Works statement, presented last month to the New Zealand Parliament, shows that the Lake Coleridge hydro-electric power scheme has attained results beyond anticipation. Three units of generating plant capable of an output of 5,000 h.p. were originally installed. The demand for electricity warranted the installation of two further units, which would bring the output to 10,000 h.p. Arrangements are in hand for utilising the energy for tramway traction and for the operation of machinery in meat works, flour mills, tanneries, dairy factories and other established industries in and around Christchurch. The total expenditure to March 31st was £329,719. Survey and investigation for a comprehensive scheme to serve the North Island has been in progress, and several schemes are under consideration.—*Australian Mining and Engineering Review.*

Ripon.—**PROV. ORDER.**—The T.C. proposes to apply to the B. of T. for a prov. order for electric supply in the city and adjacent parishes.

Rotherham.—**NEW LOANS.**—Application has been made to the Treasury for sanction to the T.C. raising £75,000 for additional electrical plant. The L.G.B. has sanctioned the borrowing of £735 and £3,020 for the purchase of a motor-tipping wagon and a coal and ash conveyor plant respectively for the electricity department. The Electric Light Committee is recommending the Council to purchase land and buildings in Ramswarth Road, for the extension of the electricity works; the present owners are willing to postpone the completion of the purchase until 12 months after the termination of the war. The Committee proposes to enter into an arrangement with the Great Central Railway Co. for the provision of a railway siding at the electricity works.

Stockton-on-Tees.—**LOANS.**—The L.G.B. has sanctioned the borrowing of £805 for electricity mains, but is not prepared to sanction loans in respect of mains, £685, and services, £202.

Swansea.—The electrical engineer reported that during the month 1,212 applications for current for heating had been received, which he attributed to the new electrical showroom.

The Harbour Trust is to be asked on what terms it will take a bulk supply for dock lighting, &c.; the Trust has its own generating plant.

Stockport.—Application has been made to the B. of T. for consent to the extension of the generating station in Millgate.

It is anticipated that in addition to the new turbine which has just been officially tested, further provision will be needed in the near future. The engine room at the electricity work has been so designed that two further turbines can be installed when necessary.

Tasmania.—Electricity from the Great Lake scheme was supplied to the Hobart City Tramways and for street lighting on August 13th, and general use of the energy for power and lighting commenced on August 14th. The city is 65 miles from the power house, and the scheme is working satisfactorily.—*Tenders.*

Wadebridge.—**STREET LIGHTING.** The U.D.C. has decided to extend the contract for public lighting with the electric lighting company for three years, provided, on account of restricted lighting, the price is reduced by 15 per cent. whilst the present conditions are in force. The company had offered a 10 per cent. reduction.

Waterford.—**SUGGESTED E.L. SCHEME.**—At a Corporation meeting, the Mayor stated that Mr. W. F. Pearce, acting on the borough surveyor's suggestion, had communicated with several companies as to the installation of a public electric lighting system in the city, and one of the largest companies had sent a representative, who had inspected the whole area, and had stated he was prepared to recommend an offer. This gentleman was told, the Mayor added, that the Corporation had no money to spend on the

scheme, and the company should be prepared to finance it on behalf of that body.

Wigan.—**BREAKDOWN REPORT.**—The Special Committee appointed to inquire into the breakdown at the electricity works last December, has submitted its report. It concludes that the boiler failures were due to the use of canal water for feed purposes, the unsuitability of which had been demonstrated to the Electricity Committee from time to time during the past eight years; to the inefficient or non-cleaning of the boilers; and the insufficiency of the boiler-plant capacity. The only remedy adopted had been a water-softening plant, and an expert report on this seemed to show that it was inadequate for the work, and that lime and magnesia were getting through it to the boilers. A series of recommendations are made, including one regarding the use of town's water. The Committee appears to place all the blame on the ex-chief engineer, although it seems evident from the report that the Committee was equally to blame.

Worcester.—**SEVERN FISHERY BOARD AND WATER POWER.**—Plans have been submitted by the Corporation in connection with the development of the Powick water-power plant, to the Severn Board of Conservators. The Board is opposed to the suggested further development as being prejudicial to the fishing, and is to ask the Board of Agriculture and Fisheries to withhold its consent to any raising of the weir, and otherwise to oppose the scheme.

The Electricity Committee recommends the T.C. to purchase ten 60-kw. transformers and switchgear for same, and to apply for sanction to a loan of £1,000 for this purpose. It was intimated that the great increase in power demand rendered this necessary.

TRAMWAY and RAILWAY NOTES.

Australia.—The Bill to sanction the construction of a high-level cantilever bridge across Sydney Harbour has passed its second reading in the N.S.W. Parliament. It will be possible to carry out the preliminary work in conjunction with the city railway, but the bridge will not be built under existing war conditions.

MELBOURNE SUBURBAN RAILWAYS ELECTRIFICATION.—Mr. Jones, the Railways Commissioner, in co-operation with Mr. Merz, the consulting engineer, has cabled that arrangements have been made for the supply of certain switchgear and sub-station converting plant which Messrs. Siemens Bros. are unable to supply within the prescribed time, and for the acceleration of the deliveries of plant under other contracts to enable the Sandringham-Essendon line to be operated in January, 1918.—*Australian Mining Standard.*

Bacup.—Mr. McElroy, general manager of the Manchester Corporation Tramways, has been appointed by the B. of T. to act as Referee in the differences between the Bacup and Rawtenstall Corporations regarding tramway fares and stages.

Birmingham.—**FEMALE LABOUR.**—The Watch Committee has decided to sanction the application of the Tramways Committee that girls of 18 years and upwards should be licensed as conductors. Previously the age had been 21.

Another stoppage of the tramway service occurred recently owing to shortage of steam at the power station; fortunately the cars were only held up for half-an-hour.

Birkenhead.—**ANNUAL REPORT.**—The year's working of the Corporation Tramways to March 31st shows total receipts amounting to £73,820, an increase of £7,035; total working expenses to £38,833, and a gross profit of £33,987. After deducting sinking fund and other charges amounting to £23,417, a net profit remained of £10,570, an increase of £6,070 on the previous year. The balance has been allocated as follows:—In aid of rates, £4,000; reserve fund, £2,000; renewals fund, £4,570. The credits to reserve fund now stand at £3,040, and to renewals fund at £27,397. The number of car-miles run was 1,176,951, and the passengers carried numbered 16,676,922. The total income per car-mile was 14849d. War allowances to employees on active service amounted to £1,589, and war bonuses to £884.

Blackburn.—The number of passengers carried on the Corporation Tramways during the week ended October 4th was 234,875, and the receipts amounted to £1,221. Compared with the returns for the corresponding period last year, these figures show a decrease of 16,864 persons and £86 in receipts.

Darlington.—It has been decided to curtail the tramway service, owing to the shortage of men and difficulty of operating in dark streets. It was mentioned that the receipts were £350 up for the half-year, as compared with the corresponding period last year.

Edinburgh.—**TRAMWAY PURCHASE.**—The Tramway Committee has adopted the recommendation to refer all matters in dispute with the Tramway Co. to the arbiter under the lease. The principal point in dispute is the repairs required by the city engineer and the condition in which the lines should be left on the termination of the lease in 1919. The report by experts recommending the electric system of traction has also been before the T.C. With regard to the present difficulties, one of the unfortunate factors of the situation is already in evidence in the shape of an extensive relaying of tramway lines. The company refuses to go

beyond the limits of a contract in this matter and is only laying the basis of an estimate for its own system. Heavier rails, it is pointed out, are required for an electrical system, and it is not known how much heavier they have to be, and the heavier rails forthwith on some arrangement for repayment of the extra cost. The prospect at present is that rails which have only been in use for some three years will, on the expiry of the lease, have to be taken to the scrap.

Liverpool.—**FREE PASSES.**—The Corporation Tramways Commission has issued 84,466 free passes to soldiers, 240,200 to officers and 153,410 to nurses, representing an expenditure of £41,000.

Halifax.—The T.C. has decided to consider a suggestion that, owing to the severe lighting restrictions, the tramway service be curtailed late in the evening.

Newcastle-on-Tyne.—**ASSESSMENT.**—At the last meeting of the City Council it was announced that the proposal to advance the assessment of the tramway undertaking had been abandoned, the figures to remain at £40,000.

At the Quarter Sessions it was mentioned that the Tramway Committee's appeal had been withdrawn.

Oldham.—**FEMALE INSPECTORS.**—The manager has been authorised to appoint four women tramway inspectors, who will check tickets, supervise women conductors, but not regulate traffic. At present 100 women are employed.

Rotherham.—The whole of the sanctions necessary to enable the Corporation to carry out the work of doubling the tramway track in Westgate have now been received. Application is to be made to the B. of T. for sanction to the Corporation paying the cost of purchasing 12 cars from the Oldham Corporation out of the tramway capital account over a short term of years.

Sheffield.—**NEW CARS.**—The City Council is recommended to authorise the tramway manager to obtain tenders, at an early date, for 25 additional tramway-cars. The city architect and the general manager are to prepare plans and estimates for additional tramway passenger-shelters.

Stretford.—The U.D.C. is applying to the B. of T. for a further extension of the period limited for the construction of the tramways referred to in Section 31 of the Manchester Corporation Act, 1911.

West Hartlepool.—In response to the L.G.B.'s inquiry as to works likely to be undertaken after the war, the T.C. has decided to include the relaying of the Foggy Furze section of the tramways and the laying of a line on the south side of the municipal buildings.

York.—**RESTRICTED SERVICES.**—The Tramway Committee has decided to curtail the evening tramway services, and proposes to discontinue Sunday services of buses during the winter. This is due to the difficulty in staffing the cars and shortage of labour.

TELEGRAPH and TELEPHONE NOTES.

A Lonely Cable Station.—In *Telegraph and Telephone Age*, Mr. C. W. Person describes life on Midway Island, a landing station for the American cable between San Francisco and Manila. The distance between terminals is 7,300 miles, necessitating relay stations at Honolulu, Midway Island, and Guam; the island is 1,200 miles from Honolulu and 2,600 miles from Guam Island. Midway Island is "a patch of coral sand, 8 ft. above the water and $\frac{1}{4}$ miles in length and $\frac{1}{4}$ of a mile in width," surrounded by a coral reef 5 ft. high and 15 miles in circumference—to which it owes its existence. The island was barren when the first operating staff landed there 12 years ago; the invaders have transformed it into a garden of verdure, have introduced domestic fowls, pigeons, and cattle, and have erected buildings which provide accommodation and recreation rooms, libraries, &c., for a population of 20 men, one woman, and a baby. Garden soil is being gradually imported, the sand being useless for cultivation. The island is visited by a supply ship four times a year.

Automatic Telephony.—An automatic telephone exchange has been opened at Dudley, with accommodation for 500 lines, which can be ultimately increased to 5,000.

Cable Steamships.—The new cable repair ship *Lord Kelvin*, of the Western Union Telegraph Co., said to be the most completely-equipped vessel of her class, with oil-fired boilers, has arrived at Halifax, N.S., after effecting a repair in transit. The c.s. *Minia*, belonging to the same company, has been damaged by fire.—*T. and T. Age.*

Colossal Figures.—On July 31st, the Bell telephone system in the United States owned 19,122,921 miles of wire and 62,200,246 stations.—*T. and T. Age.*

Guatemala.—A U.S. Consul reports that the Telegraph Bureau handled 1,626,866 telegrams and 7,263 cablegrams during 1915, an increase of 267,240 telegrams and a decrease of nearly 2,000 cablegrams. The wireless station at Guatemala was reconstructed and its radius increased, messages being exchanged with

Arlington, U.S.A., and plans were discussed as to the possible erection of additional stations at San José de Guatemala and at Puerto Barrios.

Russia.—A wireless station has been established on Dickson Island, at the mouth of the Yenisei, for the purpose of sending meteorological telegrams to the physical observatory in Petrograd. *Nature.*

Storm Breakdowns.—Some particulars are given in the *Telegraph and Telephone Journal* of the effects of the great storm of March 27th in the Cardiff district. Out of 133 trunk circuits working into the Cardiff trunk exchange, the only circuits left were 16 Newport lines, which were underground. New underground cables to Swansea and Pontypridd were on the point of completion, and these were brought into use. The total faults in the district were:—Trunk ends, 348; junction ends, 572; subscribers' line faults, 5,311. Out of 7,346 lines working into 10 exchanges (mainly Cardiff and Newport), 3,826 were working after the storm, and 48 of the small exchanges were temporarily shut down. Of the poles 316 were broken, and 4,766 overturned; 1,290 miles of wire were down. The last subscriber's circuit was restored on August 19th, but a number of faulty trunk and junction circuits are still awaiting the re-erection of routes, there being only a small number of gangs available.

Telephone Operators' Courage.—An article and various notes in the *Telegraph and Telephone Journal* bear witness to the heroic devotion to duty of the telephone staffs at exchanges in districts visited by Zeppelins; even when the buildings shook with the force of explosions near at hand, the service was maintained without interruption, and there was no need to use calming words to induce the girls to remain at their positions. At an exchange on the North-East Coast the windows were blown in, but the service was carried on.

Train Dispatching.—There are now about 135 railway systems in the United States and Canada which have adopted the telephone method of dispatching trains, there being 780 circuits in operation, with 95,000 miles of wire.

Trans-Pacific Wireless.—In the course of a preliminary test direct wireless communication has been effected between the wireless station at San Francisco and the Japanese Government plant at Ochiishi.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—**SYDNEY.**—January 22nd, 1917. Electrical plant (converter, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.*

MELBOURNE.—October 31st and November 8th. Deputy P.M.G. Telephone parts; switchboard; instruments, &c. Schedules Nos. 1,363, 1,364, and 1,368.*

December 11th. City Council. Supply and erection of coal transporter plant. See "Official Notices" September 15th.

PERTH.—November 8th. P.M.G. Accumulator parts (Schedule 527 W.A.).*

SOUTH AUSTRALIA.—November 15th. P.M.G.'s Department. Automatic switchboards and all associated apparatus, for telephone exchanges, Brighton and Glenelg.

Dublin.—November 2nd. Great Northern Railway Co. (Ireland). Contracts for general stores for 12 months (including several electrical items). See "Official Notices" to-day.

Johannesburg.—Municipal Council. Twelve gross of carbon brushes for electric motors. (Contract No. 178).*

November 13th. S.A. Railways Administration. 71,778 tungsten drawn-wire lamps, 19,741 solid-drawn tungsten lamps, and 2,412 carbon-filament lamps.*

Leeds.—Electric lighting installation for slaughterhouse, &c., of Leeds Industrial Co-operative Society, Ltd., Gelderd Road. Secretary, 10, Albion Street.

Rochdale.—October 18th. 20,000 tons of gas coal, for the Gas and Electricity Committee. Chairman of Gas and Electricity Committee.

Spain.—November 24th. Construction and working, for 60 years, of an electric tramway in Saragossa.—*B. of T. Journal.*

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—Commonwealth P.M.G. :—

300 accumulator cells, £681.—Unbehan & Johnstons, Ltd. Apparatus for telegraph power-board, £124.—Edison Swan Electric Co., Ltd.

Victorian Railways Department :—

Motor-generator, &c., for battery charging of baggage trucks, £195; switchboard and connections, £239.—Electric Construction Co., Ltd. Fuse distribution boxes and fuses for electric equipment, Ballarat and Bendigo workshops, during a period of five years.—W. Lucy & Co., Ltd. Electric lamps for signal system.—Edison Swan Electric Co., Ltd. Lampholders for ditto.—Aust. General Electric Co.

N.S.W. Public Works Department

Installation of electric passenger lift, Newcastle Hospital, £978.—Standard Waygood-Hercules, Ltd.

The following tenders have been received for power-generating plant for the Queensland Government workshops, S. Brisbane :

Gardner, Waern & Co., £3,855 (Diesel engine).
Engineering Supply Co. of Australia, £4,955.
Norman, Bell & Co., £6,960.
Brisbane Electrical Co., £7,741 and £7,891.

Tenders.

Barking.—U.D.C. Accepted tenders :—

Siemens Bros. & Co., Cable, £1,914.
General Electric Co., Ltd.—Switchgear, &c., £888.
British Electrical Engineering Co.—Transformer, £611.
Babcock & Wilcox, Ltd.—Chain-grate stoker, superheater, &c., £602.

Croydon.—T.C. High-tension feeder cable to connect the generating station with Southbridge Road sub-station : Callender's Cable & Construction Co., Ltd. (estimated cost of cable and laying, £1,425).

Manchester.—Electricity Committee. Accepted tenders :

Cable.—Callender's Cable & Construction Co., Ltd.; B.I. & Helsby Cables, Ltd.; Pirelli General Cable Works, Ltd.; Liverpool Electric Cable Co., Ltd.; Western Electric Co., Ltd.; C. Macintosh & Co., Ltd.; Johnson & Phillips, Ltd.
Potential transformers.—British Westinghouse E. & M. Co., Ltd.
Current transformers.—Ferranti, Ltd.
C.c. amp./hour meters.—Chamberlain & Hookham, Ltd.; Ferranti, Ltd.
C.c. single-phase meters.—Ferranti, Ltd.
C.c. watt-hour meters.—G.E. Co., Ltd.
A.c. polyphase meters.—British Westinghouse E. & M. Co.
Motor starters.—Veysys, Ltd.; Ferranti, Ltd.
Motors.—Electromotors, Ltd.; British Westinghouse E. & M. Co., Ltd.
Fuse boxes.—B.I. & Helsby Cables, Ltd.
Switchgear.—B.T.H. Co., Ltd.; Ferranti, Ltd.
Electrically-driven circulating water pump.—Mather & Platt, Ltd.
Extension switchgear.—Ferranti, Ltd.
Switchboard.—B.T.H. Co., Ltd.

Gas Committee :

Electrical equipment for No. 1 retort house.—Messrs. Drakes, Ltd.

Tramways Committee :—

Lifting jacks.—Equipment & Engineering Co.

Rotherham.—The Ministry of Munitions having arranged to release a 5,500 turbo-alternator, the Clerk has been instructed to place a contract with the British Westinghouse Co. at £23,700. The tender of the British Niclausse, Ltd., for two water-tube boilers for £13,250 has been accepted. The Committee has decided not to enter into contracts for tramway stores, and has authorised the manager to purchase such goods as are required during the year, also to enter into no contracts for cable during the year; the engineer is to purchase cable as required.

Sheffield.—Electric Supply Department. Dewhurst's Engineering Co., Ltd., for a supply of steel boiler tubes.

The City Council is recommended to accept the tenders of the undermentioned firms for the supply of spare apparatus necessary to maintain the constant running of the whole of the auxiliary plant required to operate the generating machinery at Neepsend :—
Fidler Electrical & Manufacturing Co.—Motors, £2,373.
Siemens Bros. Dynamo Works, Ltd.—Motors, £864; transformer, £2,829.
British Westinghouse Co., Ltd.—Motors, £185.
Dick, Kerr & Co., Ltd.—Motors, £280.
J. P. Hall & Co.—Motors, £70.
Ikeranic Electric Co.—Motor starters, £210.

The above apparatus is absolutely necessary for the proper working of the plant under present abnormal conditions, and as it is not possible to obtain sanction to a loan on capital account for its purchase, the cost is to be charged to the renewal and special expenditure fund.

The Electricity Supply Committee has accepted the tenders of Messrs. A. Reyrolle & Co., Ltd., for 12 H.T. switches, at £209, and the Chatteris Engineering Co., Ltd., for the electrification of the 20-ton overhead travelling crane at Neepsend power house, at £902.

The Council is recommended to instruct the general manager of the Electricity Supply Department to place an order for 50 tons of electrolytic copper wire bars to be made up into cables as and when required.

The general manager of the Water Department has purchased from Mr. Fred. Spivey a 12-in. electrically-driven pump for £55, and from Messrs. T. Oxley, Ltd., a 100-H.P. motor with starter, cables, &c., for £215.

Sunderland.—T.C. Electricity and Lighting Committee :

Joseph Thompson & Co.—Crescoted redwood troughing.
Everett, Edgcombe & Co.—Surge arresters.
W. T. Henley's Telegraph Works, Ltd.—Cable.

Walsall.—Electricity Committee. Mid-Cannock slack coal, Messrs. William Harrison, Ltd.

Waterford.—Messrs. W. F. Peare, Ltd., of Waterford, have received a contract for switchboards and wiring for an extensive electrical installation at a national cartridge factory.

Wolverhampton.—T.C. Accepted tenders :—

Gibbons Bros., Ltd.—A new steel roof to the boiler house at the electricity works, £388.
Melville, Dundas & Whitson.—A new crane gantry, £411.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, October 13th. At 8 p.m. at Holborn Restaurant (King's Hall). Smoking concert.

University College, London.—Wednesday, October 18th. At 5.30 p.m. Public lecture on "Long-distance Telegraphy and Telephony," by Prof. J. A. Fleming, F.R.S.

Junior Institution of Engineers.—Wednesday, October 18th. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "Industrial Lighting by Electricity," by Mr. P. H. Taylor.

Belfast Association of Engineers.—Thursday, October 19th. At 7.45 p.m. At the Municipal Technical Institute, College Square. Presidential address.

Institution of Mechanical Engineers.—Friday, October 20th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, Westminster, S.W. Paper on "Trials on a Diesel Engine, and Application of Energy Diagram to obtain Heat Balance," by the late Lieut. Trevor Wilkins, to be presented by Professor Burstall.

NOTES.

Foreign Trade.—THE SEPTEMBER FIGURES.—The official returns of imports and exports during last month contain the following electrical and machinery figures :—

	S p.t.	Inc. or	Var. months, 1916.
	1916.	dec.	Inc. or dec.
IMPORTS :			
Electrical goods, &c.	£132,579	+ £25,210	+ £424,665
Machinery	590,947	— 214,640	— 581,429
EXPORTS :			
Electrical goods	397,281	+ 135,193	+ 924,613
Machinery	1,765,218	+ 153,768	+ 254,631

Electric Vehicle Committee.—At the last meeting of the Electric Vehicle Committee, Mr. E. S. Shrapnell-Smith, representing the Commercial Motor Users' Association, was unanimously elected Vice-Chairman of the Committee, and it was resolved to issue an invitation to the Institute of Cleansing Superintendents to nominate a representative to sit upon the Committee.

It was decided to send a circular letter to the British automobile manufacturers and another to the British electrical manufacturers, suggesting that they should consider the question of taking up, after the war, the manufacture of electric vehicles in the case of the first-mentioned, and electrical equipments for the same in the case of the second-mentioned class of manufacturers.

Upon the basis of a communication received from the Recorder of the Standards Committee, Society of Automobile Engineers of America, stating that breakages of charging plugs and receptacles made according to the present standard had indicated the necessity of increasing the length of the outer metal protective casing of the receptacle, and that the American standard design had accordingly been altered by increasing the length of the said outer casing by $\frac{1}{8}$ in. (18 mm.), the Committee decided to suggest to the British Engineering Standards Committee the desirability of altering the British standard in a similar manner. It may be mentioned that the said lengthening of the shell involves no alteration to the plug portion or to the contacts or moulded insulation of the receptacle.

It was mentioned that the loan for the three Bradford vehicles had been granted for a period of only four years, and the Secretary was instructed to write to the L.G.B. asking it, after the war, to consider evidence that the useful life of an electric vehicle is such as to warrant the granting of loans for a longer period than four years.

The question of better charging facilities on the route London to Birmingham was again under consideration; the Secretary was directed to write to the managers of the electricity supply undertakings at Coventry and Northampton, in order to enlist their assistance in this matter.

The Gilbert Club.—A general meeting of the Gilbert Club will be held on Wednesday, October 18th, at 3.30 p.m., the Right Hon. Lord Moulton, F.R.S., in the chair, for the purpose of winding up the club, the object of its formation having been attained, which was the translation, and issuing to the members, of William Gilbert's "De Magnete." The inaugural meeting of the club was held on November 28th, 1889, under the presidency of the late Lord Kelvin, then Sir William Thomson, and there has been no general meeting of the club since that date. The lamented death of Prof. Silvanus Thompson, F.R.S., the principal founder of the club, renders it advisable to wind up the club, and to settle its affairs as soon as possible.

Using the Canals.—The *Manchester Daily Dispatch* says :—"The old canal packet-boat system, which came into being long before the railways, seems to be enjoying a revival. Government demands, shortage of labour, and other factors have interfered with the expeditious handling of railway goods traffic, and traders have had to put up with repeated and vexatious delays. Many of them have consequently had their goods sent by water. An example of this is to be found in Lancashire, where the canal traffic between Manchester and Wigan is gradually increasing. The products in cloth and yarn of the Wigan factories are collected each night, and early the next morning are in the streets of Manchester being delivered to warehouses. On their return journey the boats carry general merchandise. 'We can beat the railways by days,' said a carrier, 'and there is every indication that, with increased facilities, the trade will develop largely.'"

The *Times*, in a recent comment, says :—"A substantial revival of our inland waterways would be one of the most curious results of what, as far as transport is concerned, is essentially a railway war."

Legal. WOOLLEY & WATSON, MARSH & CO., LTD., v. Lambeth County Court, before Judge Parry. Thomas Woolley, electrician, claimed, under the Workmen's Compensation Act, compensation for injuries sustained in the course of his employment the respondents being a firm of electrical engineers, of Rensselairey, N.W. It was stated for applicant that he was a skilled electrician and on May 14th he was working at Pike's Circuit Cinema, Charing Cross, which was in course of reconstruction. He was running steel tubing through the building to carry the wires, and requiring some tubing, he went to get it from the back of the premises. On the way, he met Wilson, the foreman, who stopped him to give some fresh instructions to run three instead of five points. As they were talking, a man came along with a barrow of cement and as he passed where they were standing, the barrow slipped, and a bag of cement fell on applicant's knee, knocking him down. He was picked up by the foreman, and taken by Mr. Marsh in a taxicab to the hospital. He had been unable to work since, and could neither kneel nor climb ladders. His wages averaged £2 4s. 2d. a week. He had been sent 9s. 10d. for the time he worked up to the day of the accident.

Evidence for the plaintiff having been given, the case for the respondents was stated. They said that applicant had left off work for them when the accident happened, and was assisting the labourer, who was working for another firm, with his barrow, and therefore the accident did not arise out of or in the course of his employment.

Judge Parry said he accepted the plaintiff's account of the accident, as he did not think he was helping with the barrow. Had he been doing so, the respondents could have called the man in support of their story. He deprecated all these quibbling points that were so often raised in cases of this kind. He made an award for the applicant of £1 a week from the date of the accident, with costs.

NORTHERN COUNTIES ELECTRIC SUPPLY CO., LTD., v. STEEL. At Morpeth County Court on 9th inst., David Steel, carrier, was sued by the Northern Counties Electric Supply Co. for £2 13s. 3d., for damage alleged to have been caused to a lighting standard at Ashington.—Mr. W. S. Burton, for the plaintiff company, said the claim arose out of a collision between a petrol wagon belonging to the defendant, and driven by him, and an electric light lamp-post. The defendant's wagon ran against the post, damaging it, and so causing it to become "alive"; a boy, who came into contact with it, received a shock.—Fred. Beattie, chemist, Ashington, said he saw the wagon collide with the post, and bend it.—The defendant said he never knew until afterwards that he came into contact with the post, but he now accepted Mr. Burton's statement.—Judgment was entered for the amount claimed.

ELECTRICIANS FINED.—At the Belfast Munitions Court, on Monday, W. R. Kubler and Lennox Morton, electricians, and E. Dalzell, apprentice electrician, were charged with playing cards and neglecting work during working hours. The defence was a denial of the charges. The Court, however, convicted the men, and fined Kubler 50s., Morton 40s., and Dalzell 10s., the amounts to be deducted from their wages.

Institution and Lecture Notes.—Association of Super-vising Electricians.—The following is the programme of meetings for the coming season:—

Tuesday, October 31st.—"Electric Heating and Cooking," Mr. A. F. Berry.
 Tuesday, December 12th.—"Electric Meters," Mr. J. Rennie.
 Tuesday, January 16th, 1917.—Half-yearly meeting and informal discussions.
 Tuesday, February 27th.—"Modern Power Cables," Mr. H. Savage.
 Tuesday, April 23rd.—"Wiring Rules of the I.E.E.," Mr. W. R. Rawlings.
 Tuesday, May 8th.—"Motor Control Gear," Mr. J. T. Mould.
 Tuesday, June 26th.—Annual general meeting.

Belfast Association of Engineers. The programme for the 1916-17 session includes the following arrangements:—

October 19th.—Presidential Address, Mr. Stanley Johnston.
 December 21st.—"Water Power in Ireland," Mr. A. W. Brown.
 January 18th, 1917.—"Electric Lifts for Land and Shipboard," Mr. C. G. Major.
 February 15th, 1917.—"Liquid Air," Mr. E. A. S. Swinson.
 March 15th.—"An Anticipating Governor for Marine Engines," Mr. A. Kerr.
 April 19th.—"Engineering Notes on a Tour in the Antipodes," Mr. J. H. Chambers.

Association of Municipal Authorities.—At the fifth annual Conference of the Association, in Belfast, last month, Mr. P. J. McAndrew read a paper on the development of the water power of Ireland for industrial purposes, stating that they had only to utilise their water power to supply power cheaply to factories, railways, tramways, farming, and other purposes, in order to place Ireland amongst the leading manufacturing centres of Europe. Having studied the economic conditions prevailing, he had decided to bring before the public bodies of Ireland the necessity of putting pressure upon the Government to grant facilities for passing the Irish hydroelectric schemes through Parliament. He had prepared a report on the water-power available on the Rivers Shannon and Erne, which contained the approximate cost of harnessing the powers in those rivers, as well as the approximate revenue to be derived from the supply of power for lighting and industrial purposes. That report had been investigated by one of the strongest financial groups in London, and their expert had recommended the scheme to them. Application had been made to the Treasury for permission to register a company to make the necessary detailed survey, and a large sum of money had been spent on that survey by a large staff of engineers. His report had not only been proved correct, but the result of the surveys proved the scheme to be considerably better. He could not give details of the scheme, for obvious reasons, but he could tell them that there was 50,000 H.P. available in each of the Rivers Shannon and Erne for eight

months of the year, and that it varied from 20,000 to 40,000 H.P. each for the remaining months. Unfortunately, they had been debarred from proceeding with the Bill last Session, in consequence of an order made by the Board of Trade stating that no private Bill would be allowed to proceed. In conclusion, he impressed upon the representatives present the absolute necessity for a determined effort to bring the "Irish hydroelectric" into being.

Junior Institution of Engineers.—The activities of the winter session commenced on Friday last, when Mr. E. Eade opened the series of Friday evening "informal discussions," taking for his subject, "Stability and Use of Cranes under Working Conditions." During October, similar lectures will be given on "Principles and Application of the Oil Engine," by Mr. W. H. Abrahams; and "Time-saving as a Science," by Mr. A. H. Stanley. The ordinary monthly meeting will be held on Wednesday, October 18th, when Mr. F. H. Taylor will read a paper on "Industrial Lighting by Electricity." A special series of five lectures will be given on alternate Friday evenings, from October 20th, by Mr. E. F. Etchells, on "A Common-sense Notation for Engineers"; "The Practical Use of Units in the Evaluation of Formulae"; "How to Memorise Formulae"; "Logic of the Differential and Integral Calculus"; "Practical and Illustrative Examples of the Application of the Newer Concepts."

Australian Science Meeting Abandoned.—According to an Australian exchange, it has been decided, owing to the war, not to hold the Hobart meeting of the Australasian Association for the Advancement of Science, which had been arranged for January, 1917.

Registration of Firms Bill.—The Wholesale Traders' Association held a conference yesterday with a view to urging the Board of Trade to secure early dealing with the Registration of Firms Bill in the Commons. It will be remembered that the House of Lords passed a Bill some months ago.

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, October 16th.—Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10. Signalling Class. Recruits' Drill, 6.25—8.

Tuesday, October 17th. School of Arms, 6—7. Lecture, 7.15. "Duties in Camp and Quarters," Company Commander Hynam. Range Practice.

Wednesday, October 18th. Instruction Class, 5.45. Platoon Drill, Platoon No. 2. Range Practice.

Thursday, October 19th.—Platoon Drill, Platoons Nos. 5 and 6. Range Practice.

Friday, October 20th.—Technical for Platoon No. 10, Regency Street. Squad and Platoon Drill, No. 9. Signalling Class. Recruits' Drill, 6.25—8.25.

Saturday, October 21st.—N.C.O.'s Class, 2.30; Company Commander Hynam.

Sunday, October 22nd.—Entrenching, Parade Victoria Station (S.E. & C. Railway). Booking-office, 8.45 a.m.

MACLEOD YEARSLEY, Adjutant.

October 14th, 1916.

3RD (OLD BOYS' CORPS) BATT. COUNTY OF LONDON VOLUNTEER REGIMENT.—Battalion Orders by Major R. J. C. Eastwood (Commandant), Thursday, October 12th, 1916:—

Week-end Parade.—There will be no Entrenching duty on Saturday and Sunday, 14th and 15th inst. Members will receive instructions from their Company Commanders for Sunday duty.

Recruits and Attestation.—The Officer Commanding will be at Headquarters, Lord's, on Mondays, Wednesdays and Fridays, to enrol Recruits, at 6-7 p.m., and also to attest any members who have not already attested.

The Commandant will be present at Lord's Cricket Ground on Saturday, 14th inst., at 3 p.m., to examine Recruits, with a view to dismissing those who are efficient from Recruit Drill.

Recruits will parade at Lord's Cricket Ground on Saturday, at 2.45 p.m., and on Sunday, at 11 a.m. and 2.30 p.m., for Recruit Drill.

G. H. F. DUNCAN, Acting Adjutant.

Appointment Vacant.—Temporary station superintendent for Redditch U.D.C. electricity works (£3). See our advertisement pages to-day.

Prohibited Exports.—A supplement to the *Board of Trade Journal* of October 12th contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported to various destinations from British India, Canada, New Zealand, South Africa, Newfoundland, Egypt, Malta, Cyprus, Mauritius, and Ceylon. The Supplement may be obtained from the usual sale agents for Government publications, price 3d., post free.

Educational.—NORTHAMPTON POLYTECHNIC INSTITUTE.—Classes for engineer salesmen and other technically-trained men on the commercial side of Electrical Engineering have been arranged for the coming session. Particulars will be found in our advertisement pages to-day.

British Chemical Industry.—Sir Charles Bedford, general secretary of the Association of British Chemical Manufacturers opened the session of the Edinburgh Section of the Society of Chemical Industry last week with an address on the "Organisation of British Chemical Manufacturers." He said the necessity for combination for mutual protection and extension of the chemical industry had been increasingly realised of late years; in view of the recent combination of all the German chemical firms, with the object of waging such an industrial war after the war as would suffice to recover, consolidate, and extend their hold over the world's chemical industries, it was necessary to counter such plans, and in other ways to develop and protect the industries of the British chemical industry. It was for that reason that the Manufacturers' Association had been formed. Most of the leading chemical firms in the country were already members of it, and a strong council had been formed. The members were selected on grounds of personal fitness, and in no way as representative of the largest interests alone. A quite mistaken impression had got abroad in certain parts of the country that this new Association was a large capitalist combine, and that smaller firms were not particularly wanted. Nothing could be further from the truth. Assistance to new industries and a large increase in productivity of essential and "key" industries was a feature of the Association's work, and they would also take concerted action regarding legislation affecting the industry, including patent law reform. Co-operation between the manufacturers and the Universities and the technical institutions would be another sphere of their activities.—*Morning Post*.

Science at Oxford.—In Convocation at Oxford, on Saturday, Dr. T. B. Strong, the Vice-Chancellor, said that about 10,500 members of the University were serving in the Army and Navy, and nearly 500 were in Government employment in other ways. Referring to the statute concerning the Honour School of Chemistry, he said it was an attempt on the part of the University to meet one of the educational needs which the war had brought to notice. They had neglected sadly the claims of natural science in education, and they must in some way remedy this. It was not merely that they wanted to produce more advanced students of natural science; they wanted everybody, including the average people, who would now be advanced students of anything, to be aware of, or in some degree to understand, the scientific point of view. He did not think this would be easy, because it would mean in the end a great psychological change in the nation; they would have to give up the profound distrust of expert knowledge which prevailed so widely among them. At the same time, it was, perhaps, legitimate to express the hope that if they set out on this adventurous course of reform, they would proceed on their own lines, and not attempt to import German methods and German rigidity of type into their system of education without serious and deliberate criticism. The knowledge that was most necessary of all, if the Empire was to continue and prosper, was the knowledge of men.—*The Times*.

Trade Policy after the War.—(Questions were asked in the House of Commons on Tuesday concerning the arrangements to be made to carry into effect the recommendations of the Paris Economic Conference. Mr. Bonar Law said that the Expert Committees which had been appointed to advise the Board of Trade had made considerable progress with their investigations, and Lord Balfour's Committee on British commercial policy after the war was sitting, and would be able to issue an interim report in a "very moderate space of time." Progress had been made with a view to safeguarding important key industries, but he was not yet in a position to make an announcement on the subject. Sir E. Carson asked whether any legislation would be introduced to prevent, in the event of peace, the dumping of German goods. Mr. Bonar Law, in reply, said that he had not looked into that matter. It might be necessary, but that particular point had not yet been considered.

Sunday Labour Stopped.—Recent investigations into the question of "Industrial Fatigue," a report on which was published last week, have shown that Sunday labour and overtime generally are detrimental to output, owing to the lack of opportunity to recuperate from fatigue. The Minister of Munitions has, therefore, decided to prohibit Sunday work where possible.

Board of Trade Reorganisation.—Mr. Runciman informed the House of Commons on Tuesday that he had decided to combine the existing Commercial Intelligence Branch of the Board of Trade and the Exhibitions Branch in a new and enlarged Commercial Intelligence Department. The reorganisation is now proceeding.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—Hartlepool T.C. has decided that the salaries of the two station superintendents be increased to £175 10s. per annum, inclusive of war bonus, and that an additional sum of 1s. weekly in the way of bonus be made to the employes of the Electricity Committee.

Mr. E. CRIME, of Leyton, has been appointed station superintendent at the Barking U.D.C. electricity works (in the place of Mr. W. Fraser, who had obtained the position of chief electrician of the National Shell and Projectile Factories), at £160 per annum.

Mr. BULPITT, who was shift engineer at the Barnes U.D.C. electricity works, has been gazetted second-lieutenant.

Mr. JOHN B. MORGAN has resigned his post of electrical engineer to the Horsham U.D.C., having accepted the post of works manager to Messrs. H. & E. Lintott, electrical and mechanical engineers and ironfounders, of Ilorsham. He will take up his new duties on January 1st.

Mr. A. M. SIMPSON, A.M.I.E.E., has taken over the management of the Malta Tramways, which are owned by Messrs. Macartney, McElroy & Co., Ltd., and he will be glad to receive lists from firms dealing in tramway supplies. His address is Tramway Building, Porta Reale, Valletta, Malta.

General.—At a recent board meeting of the British Thomson Co., Ltd., electrical engineers and manufacturers, of Rugby, Mr. J. F. NAUHEIM retired from the chairmanship as from September 30th, 1916. The managing director, Mr. H. C. LEVIS, was appointed chairman of the board, and also retains the managing directorship of the company.

Mr. W. A. TOOKEY, M.I.Mech.E., has changed his address from 212, Upper Thames Street, E.C., to 39, Victoria Street, Westminster, S.W.

COUN. JAMES JACKSON has been appointed chairman of the Bolton Electricity Committee for the remainder of the current financial year.

On September 28th, at Newhaven, Second-Lieutenant W. S. BROWNE, R.E. (T.), London Electrical Engineers, of the electrical department, Central Argentine Railway Co., was married to Miss Kathleen Spencer, daughter of Mr. and Mrs. B. Spencer, of London and Newhaven.

Roll of Honour.—Lieutenant M. McNAY, a member of the firm of McNAY & Sons, electrical and general machinery merchants, of Middlesbrough, has been wounded.

Captain W. A. DOUGLAS, Royal Scots, who was killed in August, was an electrical engineer, and a member of the firm of Messrs. James Gray & Son, ironmongers and electrical engineers, Edinburgh. He was 26 years old.

Mr. E. J. LEE, who was formerly in the employ of the Woolwich B.C. electricity department, has been awarded the Military Medal.

Lieutenant S. H. BILL, who up to joining the Navy a few months ago was electrical engineer under the Ilkley District Council, has been wounded.

Corporal W. BELLAMY, Bedfordshire Regiment, who enlisted in September, 1914, whilst with the Western Electric Co., has fallen in action in France, aged 20 years.

Second-Lieutenant T. P. WILSON, Bedfordshire Regiment, who enlisted in the Army Service Corps in December, 1914, whilst at Faraday House, London, has fallen in action in France at the age of 23.

Private A. PARKER (27), Border Regiment, who has been wounded, was formerly employed in the accountant's department (electricity) at the Manchester Town Hall.

Lieutenant FRANK A. EVE, Canadian Infantry, who died of wounds on September 15th, was, according to the *Times*, engaged for a time in telephone construction work in Canada. When the war broke out he joined the Canadian Infantry, and he served for a year at the front.

The War Office announce that Second-Lieutenant W. REGINALD GOFFE, Oxford and Bucks Light Infantry, who had been missing since July 30th last, was killed in action on that date, aged 29 years. He was on the staff of the St. James's and Pall Mall Electric Light Co., Ltd., and was a promising engineer. His father, Mr. Edward Goffe, A.R.I.B.A., a partner in the firm of Henry Dawson & Son, architects and surveyors, 122, Cannon Street, E.C., also passed away on the 24th ult.

The *Times* states that Captain KEITH LUCAS, Sc.D., F.R.S., of the Royal Flying Corps, who died as the result of injuries received in a collision of aeroplanes on October 5th, was a director of the Cambridge Scientific Instrument Co. He was 37 years of age, and was elected F.R.S. in 1913, being invited to give the Croonian Lecture to the Society even a year before his election. Before the war he was fully engaged in both teaching and research work at Cambridge, but he put aside all his interests in order to devote his rare instrumental skill and inventiveness to the Air Service. He is described as one of the most promising physiologists of the younger generation.

Private W. LISSAMER, Oxford and Bucks Light Infantry, aged 23, who has fallen in action, was with the British Thomson-Houston Co., Ltd., Rugby.

Private REG. BARTLETT, who was with the British Thomson-Houston Co., Ltd., has fallen in action. He had been previously wounded four times.

Lance-Corporal G. W. BENTLEY, formerly an inspector for 12 years with the Potteries Electric Traction Co., aged 46, has fallen in action. He went to Brisbane in 1912, and joined the Australian Contingent in August, 1915.

tion and export of electricity meters. As net profits the accounts show the sum of £21,000, as contrasted with £26,000 in 1914, and a dividend of 10 per cent. is proposed, as in the preceding year. The share capital is to be increased by £15,000 to £125,000; the orders on hand are said to be satisfactory, although those for Army requirements do not reach the capacity of the works.

The *Elektricitäts A.G., late H. Pape, of Chemnitz*, reports gross profits of £167,000 in 1915-16, as compared with £76,000 in the preceding year. After defraying general expenses, interest charges, and placing £22,000 to depreciation, as against £16,000 in 1914-15, the accounts show net profits of £38,000, as contrasted with £21,000. It is proposed to pay a dividend at the rate of 15 per cent., this comparing with 7½ per cent. in the previous year. The directors state that the orders on hand represent an increase over the corresponding period in 1915.

The report of the *Kabelwerk Rheynlt A.G., of Rheynlt*, states that the company was well occupied in 1915-16, particularly in the rolling mill works. It could, however, not be foreseen whether the present still satisfactory state of activity would continue. The stocks and debts owing had been very carefully estimated, as the conditions which would arise after the war were uncertain. The accounts exhibit gross profits of £255,000, as against £175,000 in 1914-15. After providing for general expenses, &c., and allocating £61,000 to depreciation, as contrasted with £25,000, the net profits are returned at £184,000, as compared with £140,000. The dividend is 30 per cent., as against 18 per cent. and 12 per cent. in the two previous years respectively.

Quebec Railway, Light, Heat & Power Co., Ltd.—The gross earnings from all sources for the year ended June, 1916, were \$1,968,601, an increase of \$184,527. The operating and maintenance expenses were \$1,029,750, an increase of \$104,994. The fixed charges and taxes were \$723,447, leaving a net surplus of \$215,403, which added to the previous surplus, leaves a total surplus to date of \$562,903. There was expended on maintenance during the year \$220,603.

Monterey Railway, Light & Power Co.,—At a meeting of 5 per cent. first mortgage debenture stock holders in London, last week, resolutions were passed appointing a committee to protect the interests of the bondholders, and assenting to the creation and issue of prior lien charges to the tune of 10 per cent. of the existing debenture stock.

Mexico Electric Tramways, Ltd.—At a meeting of the holders of the 5 per cent. first debentures, held on Tuesday in London, a resolution was passed deferring the interest due at July, 1916, and January, 1917, until July, 1917.

Indo-European Telegraph Co., Ltd.—Interim dividend for the half-year to June 30th at the rate of 5 per cent. per annum, free of income-tax.

Stock Exchange Notice.—The following securities are to be quoted in the Official List:—

Underground Electric Railways Co. of London, Ltd. £175,000 additional 6 per cent. income bonds of £100 each, Nos. 30,072 to 30,221.

Oriental Telephone & Electric Co., Ltd.—Interim dividends declared:—3 per cent. on the 6 per cent. cum. pref. shares for the current year, less income-tax; 4 per cent. on the ordinary shares, free of tax.

STOCKS AND SHARES.

TUESDAY EVENING.

THE first effects of the offer of 6 per cent. Exchequer Bonds may now be said to have worn off. Investors are familiarised with the new rate of interest; and the competition of this, and of the French National Loan, is fully recognised in all of the investment departments. Further falls have taken place in the market for Home Railway prior charge stocks. Metropolitan 3½ per cent. preference of both classes, for instance, is 2 points down on the week. The three Central London assented stocks—ordinary, preferred, and deferred—have fallen to the common level of 70, showing declines of 1-3 points.

Much talk is in the air of raising the military age limit, and this in itself is a deterrent upon commercial enterprise so far as the Stock Exchange is concerned. At the same time, the Board of Trade returns for September made a wonderfully good showing. There is plenty of money awaiting investment, and hints which have all the appearance of inspiration have begun to peep out in the Press concerning the probability of the public being able to exercise the option which they were given through the purchase of the 4½ per cent. War Loan—an option extended to the new Exchequer Bonds.

The opening of Parliament this week was expected to produce some sort of statement on the point, so the cat may be out of the bag before these lines are in print. If the Chancellor of the Exchequer or the Prime Minister, whoever may be the responsible party, fulfilled the obligation afforded in the issue of the 4½ per cent. War Loan, he would give a big impetus to subscriptions to the present Exchequer Bonds, and would impart a greater feeling of confidence to other markets as well.

The drop in the price of Central London stocks we have already mentioned. It seems a little curious that preferred, deferred, and ordinary stocks should all be standing at the same price; and the obvious inference is that, so far as the security is concerned, there is little indeed to choose between the stocks. At the present level, the return is still under 6 per cent. on the money. The market in the Steam stocks is inclined to harden up a little, except in that section devoted to the gilt-edged issues, which is overshadowed, of course, by the competition of the Exchequer Bonds. The optimist points to the recent statement that the Government will take the responsibility for the additional war bonus granted to the railwaymen, but it cannot be pretended that there is any public demand for railway stocks at present.

Metropolitans and Districts improved, and the latter retain their advance, Metropolitans, however, sagging back to their previous price of 23½. Underground Electrics are rather better, the 6 per cent. income bonds gaining ½, and the shilling shares hardening to 6s. In the prior charge group, Metropolitan 3½ per cent. preferences have gone back to 60.

The shares of electrical companies working at home are disposed to improve. County of London are good at 11, and St. James's have risen to 6½. On the other hand, Metropolitans are a trifle down at 2½, notwithstanding the amicable arrangement reached at the recent meeting. There is a steady demand for the principal shares, and this, of course, is the season of the year in which all investments connected with illumination usually receive a little favourable attention. The trouble is, as we have pointed out so frequently on previous occasions, to get any adequate supply of shares to satisfy the demand for them.

The telegraph market is weaker on the whole, there being falls in Great Northern, Western Telegraphs, Eastern Extensions, and Anglo-American Telegraph preferred. So far as the American stocks are concerned, these have weakened in consequence of the latest outbreak of submarine activity off the coast of New York. This has given rise to uneasiness in American circles, being an unexpected development in the situation, and most securities connected with the other side of the "pond" have given way.

In regard to the dullness in other parts of the cable section, this would appear to be due to a slight pressure to sell on account of executors; while the issue of the Exchequer Bonds and the French National Loan naturally weigh against such purely investment stocks as those in the Telegraph list. It is worth pointing out, however, that the returns on Eastern Telegraph, Eastern Extensions, and Western shares, averaging about 5½ per cent. on the money, are equivalent to 7½ per cent. yields paid less tax.

In which connection it may be useful to remind holders of stocks and shares, the dividends on which are paid free of tax, that this does not preclude them from claiming return of the tax in such cases as those in which they are entitled to do so. For instance, a holder of £100 Eastern Telegraph ordinary stock, who receives £8 per annum, has the right to reclaim about £2 10s. in respect of this dividend, supposing that he is not liable for income-tax at all. With income-tax standing at a reasonable figure, of course it is scarcely worth while to go to the trouble of reclaiming a portion of the tax; but when it comes to 5s. in the £, the investor who is liable for less than this rate naturally feels inclined to take advantage of whatever rebate he is entitled to. The vouchers attached to the dividend warrants are accepted by the Inland Revenue authorities in claiming in this manner, while as regards Underground Electric Income Bonds, the bankers will give a certificate at the time the coupons are cashed which will have the same effect.

Brazilian Tractions have been a particularly weak market, principally because of the further fall in the exchange and the growing fear that the Republic may have to extend its funding scheme on the Government bonds for a year or two after the date at which it was timed to expire. There have been a good many shares in the market lately; and, with the disfavour attaching to most Brazilian securities at the moment, some of the sellers had to slaughter their holdings. The price touched 53½, but recovered to 57½, at which it still shows a loss on the week of 2 points. Bombay Electric preferences have fallen ½. The Mexican group is weaker. British Columbia Electric issues retain most of their recent big rises; an advance of 2 points has occurred in the 4½ per cent. debenture stock, this attracting attention by reason of the good return which it yields and the character of the security. Calcutta Trams at 6½ are better. Rio Trams second mortgage bonds gave way to 78, and Sao Paulo, Tramway and Electric, bonds are lower.

British Aluminium ordinary recovered their dividend of 9d. per share, and are quiet at 29s. ex dividend. Other industrials are steady; the dullness in iron and steel varieties is somewhat noticeable. Marconis have lost ½ at 2 15/16. Americans and Canadians have been depressed with the parent shares.

The rubber share market is firm and active, the outstanding feature still being the large demand from the provinces, which demand London does its best to supply. The price of the raw stuff improved to the level half-a-crown per lb. on the report that some of the boats torpedoed by the U. S. 53 were carrying a good deal of the commodity.

Amongst copper shares, the tone is decidedly good and during the past fortnight a brisk rise in the price of tin, the metal, has attracted attention to the shares of companies dealing with it.

SHARE LIST OF ELECTRICAL COMPANIES

HOME ELECTRICITY COMPANIES.					
	Dividend		Price		Yield
	1914.	1915.	(Oct. 10, 1914.	Rise or fall this week.	per cent.
Beaconsfield Ordinary	10	10	62	—	27 11 4
Charing Cross Ordinary	5	5	34	—	7 1 4
do. do. do. 4½ Pref.	4	4½	3	—	8 6 4
Chelsea	5	4	3	—	6 18 4
City of London	9	8	124	—	6 10 8
do. do. 6 per cent. Pref.	6	8	103	—	6 15 8
County of London	7	7	111	+ ½	6 7 3
do. 6 per cent. Pref.	6	8	109	—	6 15 8
Kensington Ordinary	9	7	62	—	6 10 6
London Electric	4	3	12	—	6 11 4
do. do. 5 per cent. Pref.	6	4	45	—	5 14 3
Metropolitan	3½	3	34	— ¼	7 4 0
do. 4½ per cent. Pref. 4½	4	4½	34	—	6 3 1 1
St. James' and Pall Mall	10	8	21½	+ ½	6 16 3
South London	5	5	21	—	6 7 3
South Metropolitan Pref.	7	7	61	—	6 12 0
Westminster Ordinary	9	7	61	—	6 12 0

TELEGRAPHS AND TELEPHONES.

Anglo-Amn. Tel. Pro.	6	6	100	-2	6	0	0
do, Def.	30-	336	294		7	8	3
Chile Telephone	8	8	7		6	14	5
Cuba-San. Tel.	5	5	8		4	8	3
Eastern Extension	7	8	142	-2	*6	12	6
Eastern Tel. and	7	8	144	-1	*10	10	9
Globe Tel. Ord.	6	6	123	sd	*5	11	0
Globe Tel. and P. Ord.	6	6	10		5	11	0
do, Pref.							
Great Northern Tel.	22	22	4	-2	6	10	0
Indo-European	13	13	49		8	12	8
Marconi	10	10	215		3	7	2
New York Tel. 44	43	44	100	-2	1	0	0
Oriental Telephone Ord.	10	10	2		4	6	6
United R. Plate Tel.	8	8	14		*5	18	5
West India and Pan.	1	1	1				
Western Telegraph	7	8	143	-2	*6	10	0

HOME RAILS.

Central London, Ord. Assented	4	4	70	-3	5 14 4
Metropolitan	1½	1	24½	+ ½	4 4 8
do. District	Nil	Nil	18	+ 1	Nil
Underground Electric Ordinary	Nil	Nil	1½	-	Nil
do. do. "A"	Nil	Nil	6	+6d.	Nil
do. do. Income	6	6	88½	+ ½	*6 15 7

FOREIGN TRAMS, &c.

Adelaide Sup. 5 per cent. Pref.	6	4	41½	—	6 1 6
Anglo-Arg. Trams, First Pref.	5	5	3	—	7 17 2
do. do. 2nd Pref.	5½	5	8	—	
do. do. 6 Deb.	5	5	9	—	8 13 4
Brazil Tractions	4	4	57½	—	8 19 2
Bombay Electric Pref.	6	6	10½	—½	6 17 3
British Columbia Elec. Ry. Pfce.	5	5	75	—	6 14 4
do. do. Preferred	—	Nil	61	—	Nil
do. do. Deferred	—	Nil	5½	—	Nil
do. do. Deb.	4½	4½	69	+2	6 3 2
Mexico Trams 5 per cent. Bonds	—	Nil	43	-1	Nil
do. do. 6 per cent. Bonds	—	Nil	85	1	Nil
Mexican Light Common	—	Nil	18	—	Nil
do. do. Pref.	—	Nil	88	—	Nil
do. do. 1st Bonds	Nil	Nil	41	-1	—

MANUFACTURING COMPANIES.

Babcock & Wilcox	14	15	3	1	418	0
British Aluminium Ord.	5	17	29 1/2	+9d.	610	4
British Insulated Ord.	15	17	1	0	610	4
British Westinghouse Pref.	7 1/2	20	1	0	6	0
Callenders	15	23	12 1/2	0	6	0
do. & 5 Pref.	5	6	8	0	6	0
Casseler-Kellner	30	5	8	0	6	8
Edison & Swan, £3 paid	Nil	—	107	—	Nil	—
do. do. fully paid	Nil	—	18	—	Nil	—
do. do. 4 per cent. Deb.	5	6	62 1/2	0	8	0
Electric Construction	6	6	7 1/2	0	8	0
Gen. Elec. Pref.	5	10	10	0	6	0
do. do. Ord.	10	10	10	0	6	0
Henley	20	25	16 1/2	0	7	9
do. 1/4 Pref.	14	14	14	0	6	0
India Rubber	10	10	10	0	6	0
Telegraph Con.	30	20	89 1/2	0	6	3
					*6	3

* Dividends paid free of income-tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.	No. of weeks.	Total to date.	Route miles open.
		£	£	£	£
					Inc.
Bristol (Trams) ..	Sept. 24	21,358	+2,619	39	191,960 + 8,037 30'6"
Cork ..	" 24	2,186	- 52	33	19,984 - 1,765 9'93"
Dublin ..	" 24	36,493	- 874	39	238,175 - 2,448 5'43"
Hastings ..	" 29	881	+ 671	39	42,334 + 1,715 19'9"
Lancashire United ..	" 27	8,210	+ 365	39	71,246 + 2,873 42
Llandudno-Col. Bay ..	" 29	2,404	+ 506	44	16,575 + 989 6'6"
Anglo-Argentine ..	" 30	235,814	+5,491	39	1,977,883 - 7,792
Auckland ..	" 22	20,884	+ 618	12	62,858 + 3,663 26'49"
Calcutta ..	" 30	18,557	+1,719	39	1,977,883 - 4,767
Kalgoorlie, W.A. ..	July 3	2,521	254	31	17,438 + 896 20'3"
Madras ..	Sept. 29	4,432	+ 472	33	37,195 + 2,781
Montevideo ..	August	25,044	- 419	43	292,382 +19,936
Dublin-Lucan Rly.	Sept. 29	686	+ 75	13	2,463 + 202 1' ..

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, October 11th.

CHEMICALS. &c.		Latest Price.	Fortnightly Inc. or Dec.
a	Acid, Oxalic	per lb.	1/8
a	Ammonia Sal	per ton	£75
a	Ammonia, Murate (large crystal)	..	£40
a	Phosphate of Carbon .. ..	..	£25
a	Borax .. .. .	..	£34
a	Copper Sulphate .. .. .	..	£51
a	Potash, Chlorate	per lb.	2/6
a	Potash, Perchlorate .. ..	..	3/-
a	Shellac	per cwt.	122/-
a	Sulphate of Magnesia	per ton	£17
a	Sulphur, Sublimed Flowers ..	..	£16
a	Sulphur, Lump .. .. .	..	£13 10
a	Soda, Chlorate	per lb.	1/-
a	.. Crystals	per ton	120/-
a	Sodium Bichromate, cakes ..	per lb.	..
METALS. &c.			
c	Brass rolled metal 2 to 12 basis	per lb.	1/2 to 1 1/2
c	.. Tubes, sold drawn .. ..	..	1 1/4 to 1 1/2
c	.. Wire, best .. .. .	..	1 1/2 to 1 3/4
c	Copper Tubes (solid drawn) ..	..	1 1/4 to 1 1/2
g	.. Bars (best selected)	per ton	£168
g	.. Sheet .. .. .	..	£106
g	.. Rod .. .. .	..	£106
d	.. (Electrolytic) Bars .. ..	..	£142
d	.. " Sheets .. .. .	..	£160
d	.. " Rods .. .. .	..	£5 15/4
d	.. " H.C. Wire	per lb.	1/6
f	Phonite Rod .. .. .	..	3/-
f	.. Sheet .. .. .	..	2/6
g	German Silver Wire .. .. .	..	2/3
h	Gutta-percha, fine .. .. .	..	6-10
h	India-rubber, Para fine .. ..	..	3/4
i	Iron Pig (Cleveland warrants)	per ton	£24
i	.. Wire, galv. No. 8, P.O. qual.	..	£26
l	Lead, English Pig .. .. .	..	£33 5
g	Mercury	per bot.	£17 12 s to £17 16
e	Meas. (in original cases) small	..	6/-
e	.. " medium .. .. .	..	8/6 to 6/-
e	.. " large .. .. .	..	7/6 to 14/- & up.
d	Silicium Bronze Wire	per lb.	1/3
r	Steel, Magnet, in bars	per ton	£15
g	Tin, Block (English) .. ..	..	£12 to £13
n	.. Wire, Nos. 1 to 16	per lb.	2/10

Quotations supplied by—

<i>a</i> G. Boor & Co.	<i>g</i> James & Shakespeare.
<i>c</i> Thos. Bolton & Sons, Ltd.	<i>h</i> Edward Till & Co.
<i>d</i> Frederick Smith & Co.	<i>i</i> Bolling & Lowe.
<i>e</i> F. Wiggins & Sons.	<i>l</i> Richard Johnson & Nephew, Ltd.
<i>f</i> India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	<i>n</i> P. Ormiston & Sons.
	<i>r</i> W. F. Dennis & Co.

Companies Struck Off the Register.—The following companies have been struck off the Register, and are accordingly dissolved :—

Austrian Patents.
British-Mexican Service Co.
British Lumber Corp.
Bullington, Vincent & Co., Ltd., Superfine Co.
Campana, G. & Co., Ltd., Lumber Co., Ltd.
Diagon Regulators.
Educational Educational Co.
Electrical Advertising Co.
Electric Safety Boiler Cleaners.
Forest, Scott & Monahan.
Glasgow, Lums & Constructional Works.
J. Decker & Sons.
Kew-De Electric Co.
Machine Drying & Peat Fuel Co.
Mills Manufacturing Co.
National Lighting Corporation.
Platinum Corporation.

Mexican Light & Power Co.—At a meeting of the holders of the 5 per cent. first mortgage gold bonds, held in London last week, resolutions were passed giving effect to the policy approved in July in conjunction with the bondholders of the Mexico D.F. Light & Power Co. and others in the group. The chairman said that, after a year's experience, they were more than ever convinced that the policy of central control of all the group of companies, pooling of their resources, and showing a united front, was undoubtedly the right one and, indeed, the only one.

National Telewriter Co., Ltd.—The directors report that the results of the company's operations for the year ended June, 1916, which operations are very considerably hampered by the war, show a slight improvement upon those of the previous year, the net profit, after paying interest on debentures, being £1,120, as against £757 for the former period. The annual meeting was held on Monday.

Direct United States Cable Co., Ltd.—Interim dividend, 2s. per share, less income-tax at 5s. in the £, making a total of 1 per cent. for the half-year ended September.

Shanghai Electric Construction Co., Ltd.—Interim dividend at the rate of 4 per cent. actual (88. per share) on the share capital, less tax.

ELECTRICITY SUPPLY IN BETHNAL GREEN.

On Friday afternoon, last week, the electricity supply undertaking of the Bethnal Green Borough Council was formally inaugurated, the Mayor (Mr. Councillor W. J. Lewis) performing the opening ceremony of the New Tyssen Street and Digby Street sub-stations, which, together with the distribution system, constitute the initial equipment of what has long been the only London borough which had no public electricity supply. The undertaking is noteworthy.



E.H.T. CONTROL BOARD, NEW TYSSSEN STREET SUB-STATION.

in other ways, being the first "all three-phase system" to be laid out on the lines recommended by Messrs. Merz and McLellan in their 1914 report on London Electricity Supply, although this particular scheme was based on the earlier recommendation of Sir John Snell to the Bethnal Green Council in 1912; it is also of interest to note that it is a purely bulk-supply scheme, fed from the Stepney Borough Council's electricity undertaking, and that the control, management, and maintenance of the distribution is, by agreement, being undertaken by the Stepney authorities.

The Council obtained a provisional order for electricity supply in 1899, and subsequently the late Mr. Robt. Hammond prepared a scheme for a combined destructor and electricity station, which, however, was not carried out.

Sir John Snell's 1912 report recommended the Council to obtain a supply in bulk from some neighbouring authorised distributor, and ultimately the tender of the Stepney Borough Council was accepted, and an agreement entered into for the purchase of electricity in bulk for a period of years, the agreement being subsequently supplemented with a view to the Stepney Council also taking over the management of the undertaking. In the summer of 1914, Mr. H. W. Couzens was appointed consulting engineer to carry out the scheme as suggested, and the work was put in hand, but owing to the outbreak of war and consequent dislocation of business, it has only now been completed.

The contractors for the whole of the cables were the British Insulated and Helsby Cables, while the British

Westinghouse Co. supplied the complete sub-station electrical equipment. The bulk supply at 6,000 volts, three-phase, 50 periods, is delivered to the Stepney Borough boundary in Brick Lane by duplicate cables, from which point .05 sq. in. three-core, lead-covered cables, laid solid, run to the New Tyssen Street sub-station, and continue thence to the Digby Street sub-station; when the load increases in the northern area, it is proposed to construct an additional sub-station in that district.

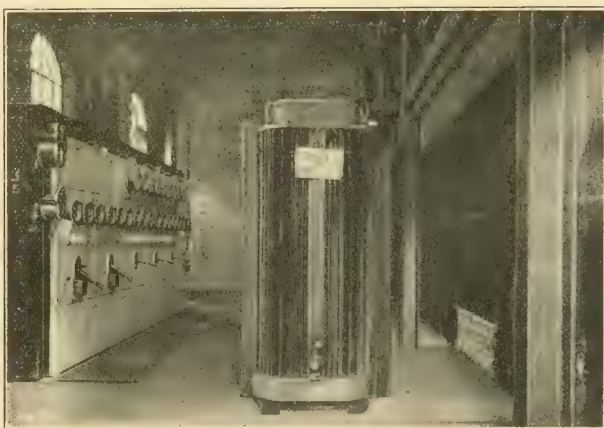
The sub-station buildings have been designed and constructed under the supervision of the borough engineer, Mr. A. E. Darby; an identical electrical equipment is provided in each, consisting of two oil-cooled transformers—one of 500 K.V.A. and one of 250 K.V.A.—together with the necessary E.H.T. and L.T. switchgear, on opposite sides of the building.

The switchgear is of standard pattern, the E.H.T. cubicles and oil switches, which are hand-operated, being on the floor with the control switchboard on a gallery above; the board is divided into two halves, coupled by means of an interconnector switch, and each half contains an incoming and outgoing E.H.T. feeder panel and a transformer panel, the interconnector panel being in the centre.

The feeder and transformer panels are equipped with relays in connection with the Merz-Price protective gear, which has been fitted, and provides for the instant isolation of a faulty feeder, the supply, of course, being maintained through the duplicate cable.

The L.T. switchboard contains two transformer panels and three outgoing L.T. feeder panels, as well as a station lighting panel, fed back from the distribution. The feeder panels are fitted with ammeters and power factor meters in each phase. Each sub-station is equipped with a 7½-ton hand-operated crane, supplied by Messrs. Higginbottom and Mannock.

Distribution cables have been laid through the main streets of the borough, but only on one side of the street, except in the case of Bethnal Green Road; the L.T. cables are of the four-core lead-covered type, laid solid—the supply to consumers being at 415 volts between phases for power, and 240 volts between each phase and neutral, for lighting. Although Bethnal Green has had no authorised supply in the past, yet a considerable number of consumers on the Shoreditch and Stepney boundaries have received temporary supplies of electricity from those boroughs, pending the availability of the Bethnal Green supply. It is therefore



INTERIOR OF NEW TYSSSEN STREET SUB-STATION, BETHNAL GREEN ELECTRICITY SUPPLY.

evident that so soon as these consumers' installations can be transferred (unfortunately, in this case, the change being from direct current to three-phase supply, will necessitate the replacement of motors, &c.), the Council will obtain a considerable business. It may be added that Bethnal Green contains a large number of small power industries, to whom a supply of electricity will be a great boon.

Energy in bulk is supplied by the Stepney authorities at £3 per k.w. of maximum demand, plus 1d. per unit: the primary charge is based on "maximum demand in any one hour," and a coal clause provides for the secondary charge increasing with the cost of coal; the agreement also contains clauses defining power factor and balancing conditions.

As previously mentioned, the Stepney Electricity Department, of which Mr. W. C. P. Tapper is the engineer and manager, will undertake the management of the concern for a period of years.

In conclusion, we are indebted to Mr. H. W. Couzens, consulting electrical engineer to the Council, for his assistance in connection with this description.

THE BRITISH ASSOCIATION.—VI.

The Influence of Pressure on the Electrical Ignition of Methane.

By W. M. THORNTON, D.Sc., D.Eng.

(Section G. Abstract.)

THE present experiments on the influence of pressure on gaseous ignition have been made with methane, in the mixture 9.5 per cent. in air, which just gives perfect combustion.

There are four kinds of single spark which may be used for experimental ignition, each of which has characteristic features, and all but one of which are in practical use. These are: (1) A transient electro-magnetic impulse, (2) the discharge of a condenser placed across the gap, (3) the short arc formed at the point of breaking a continuous-current circuit, (4) the same with alternating current. The last two differ so much in some of their effects that they have been examined separately. In each of these groups there are sparks which do not ignite the most inflammable mixtures of highly combustible gases and air.

Although an impulsive or jump spark starts by ionisation, usually across a fixed gap, its igniting power has been shown to follow a different law from that of rupture alone. Condenser discharge passes just before metallic contact of two terminals which are being brought together, and when the charging voltage and the poles are the same throughout occurs at the same spark length. It is, however, an exceedingly rapid effect, and it is probable that the ionisation with

for this is two-fold. In the first place the steps, either up or down, occur in mixtures in which the proportions of the atomic volumes of the two gases can be represented by whole numbers.

The occurrence of the steps in some gases with one kind of spark, in others with another, clearly depends on an intimate, but at present unknown, relation between the physical or chemical properties of the molecule, possibly on its structure, and the nature or duration of the spark.

Secondly, direct evidence that the steps are due to selective absorption is given by the ignition of hydrogen with alternating-current break sparks. In a mixture of 25 per cent. of gas in air and at a pressure approaching 40 lb. to the sq. in. a step is obtained having the well-known form of fig. 1. This type of change occurs in nature wherever there is selective absorption.

In the present experiments with methane, at pressures lower than atmospheric, the least igniting impulsive spark is measured by the primary current of the induction coil, which, when broken, causes a single secondary spark just giving ignition. This varies with the pressure, as in fig. 2.

The two curves given are with gas prepared by different methods and are seen to agree singularly well when the difficulties of obtaining the same conditions for every spark and precisely the same gas mixture are known. The fact that the steps are so clear is a proof that the selective action is definite and capable of quantitative determination. The collision frequency between combining molecules, or atoms when there is dissociation, can be changed by varying either the total or the partial pressures, that is, either the pressure in the explosion vessel or the percentage of combustible gas in the mixture. The latter has been shown to give rise to steps, and in fig. 3 they are also found by change of total pressure. The reduction of the total pressure by one-half has the same effect on collision frequency as halving the percentage of gas in a mixture at atmospheric pressure.

In fig. 3 it is shown that steps arise from change of pressure at successive multiples of an atmosphere. In the same way they are to be expected at sub-multiples of an atmosphere, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, ..., and there is evidence for each of these.

The interpretation of these steps must by the nature of the case be tentative. After consideration of every possible cause this appears to be the only one capable of explaining the facts.

When the mixtures are compressed before ignition there are also steps in the least igniting current curve which are very suggestive. The pressures at which they occur are 1, 2, 3, 4, and 5 atmospheres, absolute, as shown in fig. 3, the abscissæ of which are, however, pressures above atmospheric.

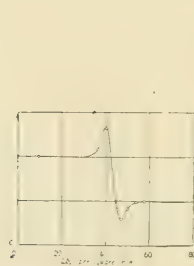


FIG. 1.

FIG. 1.—CHANGE WITH PRESSURE OF LEAST ALTERNATING CURRENT IGNITING AT BREAK A 25 PER CENT. MIXTURE OF HYDROGEN IN AIR.

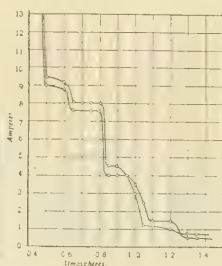


FIG. 2.

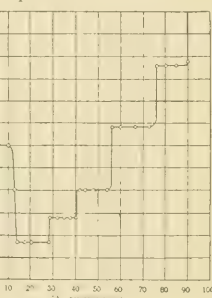


FIG. 3.

FIG. 2.—IGNITION OF METHANE IN AIR BY IMPULSIVE SPARKS, PLATINUM POINTS.

FIG. 3.—IMPULSIVE SPARKS, NICKEL POINTS.

FIG. 4.—CONDENSER DISCHARGE, 150 VOLTS, PLATINUM POINTS.

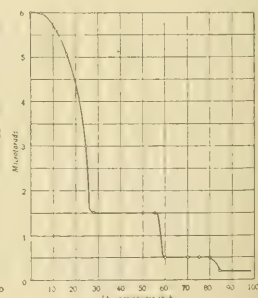


FIG. 4.

which it starts is masked by the intense activity of the discharge, so that the ultimate ignition is proportional to its energy or power.

The two circuit-break sparks are less simple. They are streams of electrons following a path which becomes more difficult as the gap opens. The momentum of the electrons of this stream is comparable with that of the molecules of gas around it. The latter, therefore, penetrate the arc, and are exposed to the dissociating influence of its high temperature. The conditions of ignition arise from the collision of the gas with the ions in the arc. The action is no doubt partly thermal and partly ionic; in some cases ignition is proportional to the current, in others, its change is proportional to the current squared. The extraordinary variety of the reaction between gas and spark, indicated by the limiting electrical conditions of ignition, is not to be accounted for on a simple thermal basis.

Ignition by Impulsive Coil Discharge.—Ignition at atmospheric pressure has been shown to have steps which appear, as the percentage of gas is varied, in certain well-defined mixtures. The precise origin of these steps is still obscure, but there can be no doubt that they are examples of selective action which occurs at certain frequencies of collision between the molecules of combustible gas and oxygen. The evidence

from this there can be no doubt that the steps are caused by the collision frequency reaching successive multiples of that at atmospheric pressure. It is, therefore, a physical effect, and will be shown to support the conclusion that in gaseous explosion, collision mechanics of the simplest kind are of importance.

The pressure most favourable to ignition by impulsive sparks is between two and three atmospheres absolute. There is reason to believe that the steps continue to much higher pressures, and this is now being investigated.

Ignition by Condenser Discharge differs from the above in two important features: (1) The least igniting spark is independent of the pressure from the lower limit at half an atmosphere to just above one atmosphere, and so forms one step. (The value of the least igniting capacity was 6 mfd. charged to 150 volts, at every pressure down to 0.5 atmosphere, below which ignition by condenser sparks failed completely.) (2) As the pressure is raised ignition becomes easier and there are steps, but now down, as 30 lb., 60 lb., and 85 lb. per sq. in. are approached. In fig. 4 there are steps at 1, 3, 5, and 7 atmospheres, but not in this case at 2, 4, or 6.

Apart from their physical interest these results are of some practical importance. The curve of fig. 3 is for ordinary magneto ignition; those of fig. 4 correspond to the Lodge

ignition by condenser discharge, the high effectiveness of which is well known, especially in poor mixtures highly compressed, which cannot be readily ignited by magneto sparks. Electro-magnetic jump sparks and condenser discharge, therefore, proceed in opposite directions, one becoming easier as the pressure is raised, the other more difficult. The former are examples of the relatively slow process of ionisation by collision, which is more difficult at high pressure. Condenser discharge, on the other hand, is one of the most sudden phenomena in nature, and the spark is, in addition, of high enough temperature to pit platinum freely. Most of the energy of the charge is dissipated in the spark. This is equivalent to the combustion of a definite mass of the gas, and the heat of the spark is rapidly communicated to the gas around. If the mass of the latter heated to ignition temperature is equal to or greater than that whose combustion would set free as much heat as there is in the spark, self-ignition can proceed. A short calculation from the observed least igniting capacity will serve to show that there is more than sufficient energy for the purpose, the remainder being absorbed by the poles or radiated, but the ratio of division cannot at present be measured.

Compression increases the mass of gas in contact with a spark of a given magnitude. It follows that at the higher pressures a smaller spark, provided that its energy is given to the gas as heat, should cause ignition.

On this view the product of least igniting capacity and gas pressure would be constant as a first approximation. The occurrence of steps rising as the pressure is lowered is a modification of this by selective collision. The next two kinds of ignition illustrate a smoother type of change.

Ignition by Continuous-current Circuit Break Sparks.—Below atmospheric pressure the least igniting current is found to increase, so that the product of the current and pressure is approximately constant, until at half an atmosphere there is a sudden and most remarkable increase of inflammability.

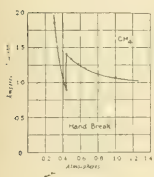


FIG. 5.

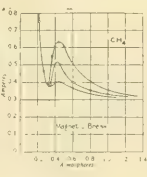


FIG. 6.

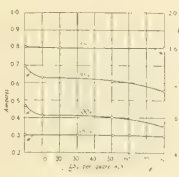


FIG. 7.

FIG. 5.—CONTINUOUS CURRENT, 100 VOLTS, CROSSED PLATINUM RODS.

FIG. 6.—CONTINUOUS CURRENT, 240 VOLTS, PLATINUM POINTS.

FIG. 7.—CONTINUOUS CURRENT, ELECTRO-MAGNETIC BREAK.

The curve of fig. 5 dips sharply and rises to the lower limit at a third of an atmosphere. The simplest explanation of this is that it is a continuation of the selective action which gives rise to the steps at higher pressures. Every gas examined exhibits this effect; in hydrogen it is so great that at the dip the igniting current falls almost to zero, the mixtures being those for perfect combustion. If, however, the break of circuit is made slowly the dip is entirely wiped out and the curve is hyperbolic.

When the break was relatively slow the lowest of the three curves of fig. 6 was obtained; increasing the speed of break caused the least igniting current to take the form of the upper curves, each of these having the same rate of break throughout.

There is, therefore, a critical relation between the collision frequency and the spark duration necessary for the observance of this effect. Above atmospheric pressure there is the singular result that the least igniting current is almost independent of pressure, falling slightly at the highest pressures. This is obtained at all voltages from 50 to 180, as shown in fig. 7.

Continuous-current spark ignition is, therefore, midway between impulsive and condenser ignition; that is, it is not a simple energy effect, for this would cause a falling curve with or without steps, nor does it work by ionisation alone. It would appear to be a very fair mean between ionic and thermal ignition.

Ignition by Alternating-current Break Sparks at the lower pressures follows the type of continuous-current slow-speed ignition; that is, the thermal action of the spark predominates, and at the higher pressures it remains nearly constant in value up to pressures approaching 80 lb. per sq. in., when it suddenly becomes easier.

This kind of spark has not been used in practice, but where break spark ignition by a movable tongue is still in use it might have some advantage. It is, however, better, if possible, to use continuous-current ignition with some inductance added to the circuit.

The influence of small changes of gas pressure upon electrical ignition is important in coal mining. Apart from the effect of pressure on the presence of gas or the dryness of the mine, a change from a low barometer of 28 in. to a normal 30 in. somewhat increases inflammability by impul-

sive sparks, as shown in fig. 2, but has little effect on that by condenser or circuit break sparks.

The compression of an explosive mixture increases its inflammability by condenser sparks, and lowers it when the sparks are impulsive. Circuit break sparks have the same igniting power over a long range of pressure. In every case there are mixtures in which ignition is abnormal, giving rise to steps or sudden changes in the form of the curves of observations.

The Calculation of the Capacity of Radio-Telegraph Antennae.

By PROF. G. W. O. HOWE, D.Sc., M.I.E.E.

(Section G. Abstract.)

UNTIL quite recently the calculation of the capacity of radio-telegraph antennae, except in the simplest cases, was looked upon as an impossibility, and one of the leading text-books on the subject stated that, "In the case of multiple-wire aerials, the only way to determine the capacity is to measure it." This is no longer the case, however, and it is shown in this paper that, even for aerials of complicated design, it is a relatively simple matter to predetermine the capacity and to calculate the effects of the earth, the masts, and anything else in close proximity to the aerial. The accuracy obtainable is more than sufficient for all practical purposes.

The principle of the method employed by the author has already been described before the British Association. It is assumed that the charge is uniformly distributed over the surface of the whole antenna, and the average potential of the antenna under this fictitious condition is then calculated. Formulae have been worked out by means of which the average potential can be easily determined even in the case of complicated antennae. The assumption is then made that this average potential differs but little from the actual potential which the antenna would have at every point if the same total charge were no longer uniformly distributed, but allowed to have its own natural distribution.

In the original paper, read before the British Association at Sydney, formulae and curves were given for flat multiple-wire antennae with any number of wires from 1 to 12, for four-wire aerials with the four wires at the corners of a square, and for wires meeting at various angles; the effect of the earth on both horizontal and vertical wires was considered, and some numerical examples of the application of the method to actual antennae were given. In September, 1915, the author published formulae and curves by means of which aerials of the umbrella type can be readily calculated.

In his "Principles of Electric Wave Telegraphy," Prof. Fleming gives a number of measured capacities of actual aerials of various types to serve as a guide in estimating the capacity of any other aerial. Some of these measured values agree fairly well with the calculated values, but others

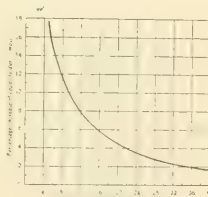


FIG. 1.

show a wide divergence; it was in seeking to explain these discrepancies that the author was led to devise a method of calculating the effect of masts and buildings.

In the paper it is shown that the use of a horizontal suspension cable for the antenna wires may increase the capacity of the aerial by 30 per cent. The presence of a mast increases the capacity of the aerial; the effect of altering the distance between the wire and the mast is shown in fig. 1.

The capacity here considered is that which would be measured by electrostatic or low-frequency methods, and is not necessarily the same as the effective capacity at radio frequencies. The latter will depend on the wave-length employed and on other factors. To electrostatic measurements a wooden mast will act as an earthed conductor, whereas at radio frequencies its high resistance will considerably modify its effect on the capacity of the aerial. If the masts be of iron or steel and not insulated, and if, as is now common, the wave-length employed is considerably greater than the fundamental wave-length of the aerial, the effective capacity will agree closely with that calculated by the method described.

The neighbourhood of a building also increases the capacity appreciably. All these cases are covered by the author's formulae, and in addition crucial tests were made to determine the accuracy which one might expect. For this purpose wires were stretched between insulators so that the distance between the wires could be adjusted, and the separate wires could be insulated, earthed, or connected together as desired. All the dimensions were accurately measured, and the capacity was determined by a bridge method.

It was found that, under a variety of conditions, the difference between the calculated and the measured values did not

exceed 4 per cent., except in the very extreme case where the wires were only 7.45 mm. apart. Considering the difficulty of measuring such small capacities, the uncertainty introduced by connecting wires, and the difficulty of accurately determining the dimensions when stranded wires 113 ft. long are suspended in the open at distances of 1 cm. or 2 cm., the agreement must be considered very good.

The results of measurement are sufficient to show that, even in extreme cases, the author's method of calculating static capacity gives results of greater accuracy than is usually obtained in technical measurements of such small capacities.

THE WOODS-GILBERT RAIL PLANER AND GRINDING MACHINE.

THE recent Municipal Tramways Association Conference afforded many managers the opportunity of observing the Woods-Gilbert Rail Planer Co.'s grinding and milling machine at work on the Bexley tramways, to the chief engineer and manager of which, Mr. H. P. Stokes, we are indebted for the following particulars.

This is the latest type of machine, and is designed so as to readily eliminate corrugations from rails, regardless of vertical or lateral rail distortion and differences in elevation of the rails.

The machine is composed of what might be termed the power unit and the working unit. The former is a substantially-built truck carrying a 60-H.P. motor, coupled through friction clutches, countershafts, &c., so as to provide an extremely mobile and flexible power unit.

The motor obtains its current from the overhead line, and is

to proceed. The side tracking is operated by chain drive on to massive spindles which, on being rotated, bring the road wheels into contact with the road, taking the entire weight of the machine from the tramway track.

When this operation is completed the operating clutch is thrown over in the opposite direction, and the machine at once commences to side track. The whole operation is capable of being performed in one minute. The machine can be side tracked in either direction.

The working unit, which is either the grinding head or milling head, as the case may be, is connected with the power unit by means of a pair of connecting links and a massive cantilever, pivoted so as to provide the necessary lift for removing the working unit entirely clear of the rail for fast travelling.

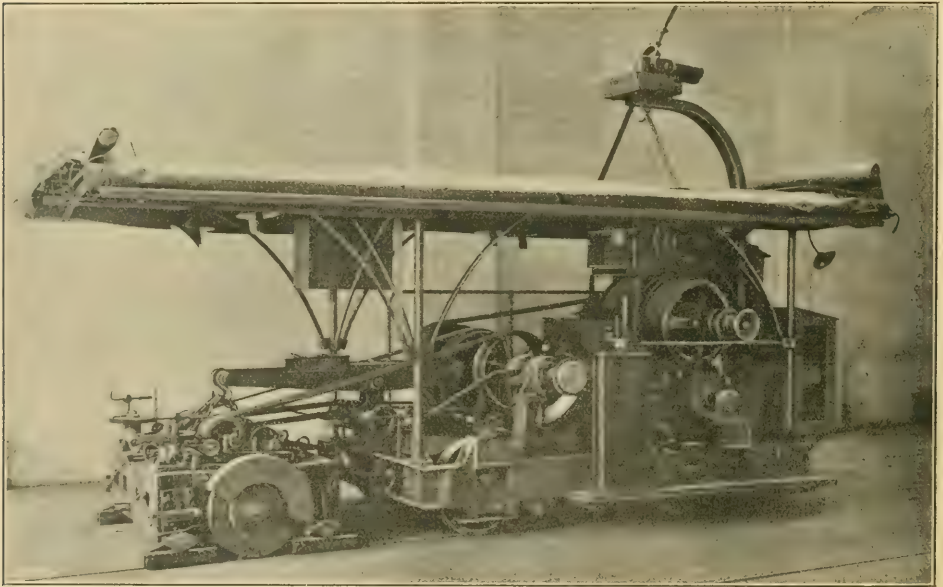
When the machine is fast travelling the interconnected links between the two units are locked together, so that neither truck moves out of relation to the other. The working unit is divided into two halves, each of which is dovetailed into the other, with a trunnion pin, so as to allow each side of the carriage to deal independently with the rail on which it is at work. By this means both vertical and lateral inequalities of the rail are automatically dealt with.

The grinding wheels also have hand-operated vertical and lateral adjustments.

Resting upon rails to be dressed, and supporting thereon each of the two sections of the divided fore carriage, are four sets of multiple rollers. Each set has seven rollers fixed in staggered position, which by this means eliminate all possibility of reproducing the corrugated surface of the rail during the grinding operation.

The two individual halves of the truck provide substantial weight, so as to give an effective cut to the abrasive wheels.

Each rail can be treated independently, or both can be dealt with together, the method of drive in each case being entirely free and independent of each other, thus allowing all possible variations and adjustments.



THE WOODS-GILBERT RAIL PLANER AND GRINDING MACHINE, SHOWING THE GRINDING HEAD ATTACHED.

capable of propelling the machine to the required situation at a speed of 20 miles per hour, in either direction.

The main power truck is mounted upon four track wheels provided with substantial bearings and springs, each pair of wheels being connected to the motor by a silent chain drive. This provides the fast travelling gear.

The motor, which is fitted with an extended shaft, is also provided with a large diameter belt pulley driving through a countershaft on to a pair of friction cones controlled by hand levers, which may be operated from either side of the machine.

The drive is transmitted from these cone wheels through worm gearing, which propels the machine slowly during the working operation, at the same time driving the working unit—i.e., grinding head or milling head, as the case may be.

The friction cones are very substantial in design, and provide both forward and reverse travel, giving perfect smoothness of action without any abnormal strain on the machine. The power unit is further provided with four heavy road wheels for the purpose of side tracking the machine—namely, removing it entirely from the tramway track on to the side of the road to allow tramway traffic

The milling head, which is attached for the purpose of deepening the grooves, cutting down projecting guard lips or other re-modelling work on the rails, is operated in a similar manner to the grinding head.

An indicator is provided in order that the depth of the cut and the dressing tool may be accurately regulated. This indicator is also provided in order that variations in the width of the track may be observed, and lateral adjustments in the dressing tools effected accordingly. It is sometimes found desirable, when milling rails, due to the rail being loose and showing a tendency to vibrate, to increase the weight upon the rail in order to effectively carry out the work.

This is readily provided for by operating the cantilever, which, when depressed at its outer end, will, by reason of links between it and the carriage sections, cause additional pressure to be exerted upon the working carriage in addition to its own weight.

In the case of the grinding carriage, suspension chains are provided instead of links, as it is not necessary to exert the pressure above referred to when grinding.

It will be seen that the main features of this machine are: The provision of a separate working carriage built in two sections providing for universal adjustments. Each half of the said carriage being driven independently, the utmost efficiency is obtained from each.

The method of connecting the working unit to the power unit provides ready means of lifting and locking into fixed position both carriages, so as to enable the machine to proceed rapidly to other points where work is required to be performed.

The ingenious method provided for side-tracking the machine enables it to work efficiently with the least possible loss of time under all conditions of traffic.

The machine has now been in operation on the Bexley Council Tramways for approximately one month. There is still a considerable amount of work to be accomplished, after which a large contract is to be carried out at Bolton.

Two other machines belonging to the same company are also at work in the country, one at Cardiff and the other at Wigan.

The company is an Australian concern, and has already carried out very extensive contracts in Melbourne, Sydney, Brisbane and Adelaide, whilst work has already been completed on the Oldham, Ashton and Hyde, Isle of Thanet, Cardiff, Wigan, and Bexley Tramways, other large contracts already being in hand.

The capacity of the machine when surface grinding is approximately 12,000 lineal ft. of single track per month. For milling work, approximately 9,000 lineal ft. of single track per month.

The work is usually carried out at night, so as not to interrupt traffic.

The machine travels at up to 20 miles per hour when not engaged in remodelling work, and only requires three operators; it will operate on a 4 ft. 8½ in. gauge, but can also be readily adapted for other gauges.

Mr. J. W. Eunsom, the chief engineer of the company, is at present in this country supervising the putting to work of new machines.

GERMAN RULES FOR POCKET-LAMP BATTERIES.

THE standard rules recently prescribed for 3-cell "flash-lamp" batteries by the Verband Deutscher Elektrotechniker, in conjunction with the Union of Pocket-lamp Battery Manufacturers, should be of interest to those British firms who have taken up, or contemplate taking up, this important branch of industry. The rules prescribe that the standard 3-cell battery made up in rounded rectangular form shall have the following overall dimensions *excluding* contact springs:—Length 62 mm. (2.44 in.), breadth 21 mm. (0.827 in.), height 65 mm. (2.56 in.). The variations permitted are ½ mm. (0.02 in.) in length and breadth and 1 mm. (0.039 in.) in height. Contact strips are to be of rust-proof, springy metal and 7 to 8 mm. (0.275 to 0.315 in.) in width; the shorter strip is to be 18 to 20 mm. (0.709 to 0.787 in.) long, and the longer strip 40 to 45 mm. (1.575 to 1.772 in.). The top of the battery must be covered or run-in with a suitable material, and each battery must bear a mark permitting its origin to be traced, as well as the week and year of manufacture. The latter date is to be in plain figures (not code), and both marks must be incapable of easy removal. On delivery from the works the E.M.F. of the battery should be at least 4.5 volts, and should not exceed 4.8 volts. Provided the battery be stored and handled carefully its E.M.F. should not fall below 4.2 volts during the first 14 days after delivery, but it cannot be held to be unsatisfactory if it falls below this value after four weeks, the E.M.F. being measured by a D.C. precision instrument having a resistance of at least 100 ohms per volt of range. The internal resistance of a new battery must be so low that on connecting the terminals through a resistance of 15 ohms the E.M.F. falls by not more than 0.6 volt below the initial value of 4.5 volts. Every battery must be marked with the useful burning hours on continuous discharge and on intermittent discharges; these figures should refer to a temperature of about 20 deg. C. and to the battery as freshly delivered from the maker. When testing continuous discharge the battery is to be connected to a resistance of 15 ohms, and discharge is to be taken as complete when the terminal P.D. has fallen to 1.8 volts. The actual life on continuous discharge (to the nearest ½ hour) may be increased by 40 per cent. to arrive at a value for the life on intermittent discharge.

The prescribed dimensions apply only to the normal arrangement of three cells side by side and with top contacts; they are not intended to hinder or discourage any modification in arrangement of cells or contacts which may appear desirable. On manufacturing grounds, battery cases may be dated ahead by eight days, but not by any longer period, and both trade mark and date of manufacture should be die-stamped. The best method of indicating whether a battery has been used or not is to place a guarantee-strip over the longer contact (and possibly over the other as well), so that the battery cannot be used without tearing away this strip. A notice should be printed on the strip that the battery must be tested (by voltmeter) before the strip is removed and provision must be made, by a hole or otherwise, so that testing is possible. Electromagnetic voltmeters of the watch type are quite unsuitable for testing dry cells, owing to their

inaccuracy and high current consumption. A higher initial E.M.F. than 4.8 volts may easily be attained, but it is of no advantage, because it will soon decrease, and whilst it endures may burn out the lamp filament; an initial E.M.F. higher than 4.9 or even 5 volts is very undesirable. The minimum of 4.5 volts is prescribed for final works tests, and batteries which just pass this test will not yield 4.5 volts when received by the purchaser. If the latter is at a distance he should take care that batteries are received and tested within two weeks from the date of the works test, otherwise it may be impossible to get claims for defective cells admitted by the works within the four weeks specified as the longest period within which a battery may be expected to yield an E.M.F. of 4.2 volts. Batteries should be stored in a cool, dry place, and neglect to do so frees the manufacturer from responsibility for rapid deterioration.

The low pressure drop which accompanies low internal resistance of the battery results in more light being obtained from the lamp and a longer useful life from the battery. Purity and correct mixture of the battery materials are, however, more important than low internal resistance, which is no more than a contributory indication of excellence. The measurement of internal resistance by determination of voltage drop gives sufficiently accurate results, does not injure the battery, and is a test which can easily and quickly be made in practice. The telephone bridge method is doubtless more accurate, but is too tedious where many thousands of cells have to be tested. Formerly reliance was placed on the current developed by a battery on short circuit as an indication of the excellence of the cells; this test should be abolished, because the result is of no value unless a very accurate instrument is used, and even then the very defects of a badly constructed battery may enable it to develop a very high current on short circuit. Also, a short-circuit test, unless completed very quickly, does permanent damage to a battery. As regards the life test, discharge through a constant resistance of 15 ohms is approximately equivalent to running on a 3.5-volt, 0.2-amp. metal lamp, and gives more definite results than would be obtained by actual discharge through a lamp, since the resistance of the latter is not known accurately, and varies with the state of battery discharge. An average life figure for a batch of batteries of the same type, and made from the same lot of materials, may be obtained by taking the mean result of tests on three or five batteries. About one in 1,000 batteries delivered is generally tested for burning hours. The test is made on cells perhaps three days old, and the life then indicated cannot be obtained when the batteries are three or four weeks old. In marking the life on the battery case, it should be given as the hours of continuous burning for a 3.5-volt, 0.2-amp. lamp, since this basis of reference is understood more generally than the meaning of 15 ohms. In actual service pocket-lamp batteries are almost invariably used intermittently, perhaps for a total of five to ten minutes per diem with long periods for recovery. Numerous tests show that under such conditions the total useful life is at least 40 per cent. longer than on continuous discharge, say 3½ hours as compared with 2½ hours.

TRADE STATISTICS OF BRAZIL.

THE following figures show the imports into Brazil of electrical and similar goods during the year 1915. The figures for 1914 have been added for purposes of comparison, and notes of increases or decreases, as the case may be, are given:—

	1914.	1915.	Inc. or dec.
	Dollars.	Dollars.	Dollars.
<i>Electric cable.</i> —			
From United States	80,000	203,000	+
.. Great Britain	127,000	1,000	—
.. Germany	77,000	—	—
.. Other countries	51,000	5,000	—
Total	335,000	209,000	—
<i>Insulators.</i> —			
From United States	32,000	24,000	—
.. Germany	41,000	4,000	—
.. Other countries	17,000	5,000	—
Total	90,000	33,000	—
<i>Electrical machinery.</i> —			
From United States	686,000	461,000	—
.. Germany	272,000	22,000	—
.. Great Britain	421,000	137,000	—
.. France	123,000	29,000	—
.. Other countries	118,000	42,000	—
Total	1,620,000	691,000	—
<i>Electric motors.</i> —			
From United States	99,000	40,000	—
.. Germany	55,000	7,000	—
.. Great Britain	40,000	13,000	—
.. Switzerland	52,000	5,000	—
.. Other countries	7,000	14,000	+
Total	223,000	79,000	—

<i>Summary figures.—</i>	1914. Dollars.	1915. Dollars.	Inc. or dec. Dollars.
From United States	21,000	—	21,000
Great Britain	30,000	—	30,000
Germany	37,000	—	37,000
Other countries	46,000	—	46,000
Total	143,000	—	143,000
<i>Industrial machinery.—</i>			
From United States	158,000	111,000	47,000
Great Britain	398,000	361,000	37,000
Germany	309,000	13,000	296,000
France	206,000	19,000	187,000
Other countries	94,000	47,000	47,000
Total	1,165,000	551,000	614,000
<i>Rails, fish plates, and railway accessories.—</i>			
From United States	922,000	249,000	673,000
Belgium	425,000	—	425,000
France	365,000	—	365,000
Germany	215,000	13,000	202,000
Great Britain	166,000	52,000	114,000
Other countries	123,000	2,000	121,000
Total	2,216,000	316,000	1,900,000
<i>Lighting apparatus.—</i>			
From United States	29,000	32,000	3,000
Germany	74,000	6,000	68,000
Great Britain	39,000	23,000	16,000
Other countries	17,000	11,000	6,000
Total	159,000	72,000	87,000
<i>Other machinery (except agricultural).—</i>			
From United States	909,000	551,000	358,000
Great Britain	1,269,000	371,000	898,000
Germany	782,000	37,000	745,000
France	488,000	123,000	365,000
Belgium	44,000	1,000	43,000
Italy	61,000	21,000	40,000
Switzerland	66,000	37,000	29,000
Holland	533,000	96,000	437,000
Other countries	107,000	92,000	13,000
Total	4,259,000	1,329,000	2,930,000
<i>Telegraph and telephone posts, and bridge and fence material.—</i>			
From United States	62,000	41,000	21,000
Belgium	92,000	—	92,000
Great Britain	337,000	91,000	246,000
Germany	197,000	1,000	196,000
France	39,000	—	39,000
Other countries	17,000	5,000	12,000
Total	744,000	138,000	606,000
<i>Copper wire.—</i>			
From United States	12,000	57,000	45,000
Germany	18,000	—	18,000
Great Britain	13,000	8,000	5,000
Other countries	10,000	3,000	7,000
Total	53,000	68,000	15,000
<i>Iron and steel wire.—</i>			
From United States	70,000	607,000	537,000
Germany	330,000	17,000	373,000
Belgium	16,000	—	16,000
Great Britain	65,000	51,000	14,000
Other countries	68,000	63,000	5,000
Total	609,000	738,000	129,000
<i>Rubber manufactures.—</i>			
From United States	25,000	71,000	46,000
Germany	58,000	3,000	55,000
Great Britain	79,000	67,000	12,000
France	47,000	58,000	11,000
Other countries	47,000	50,000	3,000
Total	256,000	249,000	7,000
<i>Hydraulic pumps and accessories.—</i>			
From United States	51,000	42,000	9,000
Great Britain	63,000	25,000	38,000
Germany	56,000	5,000	51,000
Other countries	46,000	13,000	33,000
Total	216,000	85,000	131,000
<i>Scientific instruments.—</i>			
From United States	61,000	27,000	34,000
Germany	101,000	11,000	90,000
France	50,000	9,000	41,000
Great Britain	27,000	14,000	13,000
Other countries	13,000	17,000	4,000
Total	252,000	78,000	174,000

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED.)

Complete specification for this journal by MESSRS. W. P. THOMPSON & CO.,
Electric Patent Agents, 285, High Holborn, London, W.C., and at
Liverpool, 10, Broad-st.

- 13,564. "Electric water heaters." J. F. BARR. September 25th.
13,565. "Means for carrying electric cables." A. DETRAUX. September 25th.
13,591. "High-tension discharge apparatus." E. WILSON. September 25th.
13,593. "Electric resistance furnaces." J. C. LANDMEYERS. September 25th.
13,617. "Electric fire and stove." H. S. SOUTTER. September 26th.
13,631. "Attachment of magnets to power units of motor cycles." C. T. B. SANGSTER. September 26th.
13,639. "Controllers for electric motors, &c." G. ELLISON. September 26th.
13,661. "Electrical apparatus for transmitting movements at a distance." See also 13,662. See also 13,663. September 26th.
13,664. "Combined electric stoves and toasters." H. A. RICE. September 26th.
13,665. "Ignition mechanism for internal-combustion engines." H. R. VAN DAVENTER. September 26th. (U.S.A., October 28th, 1915.)
13,671. "Dynamo-electric machines." THE BRITISH THOMSON-HOUSTON CO. See also 13,672. September 26th.
13,674. "Electric switches." A. CRAWFORD, W. PRESTON, and W. SANDERSON & CO. September 27th.
13,725. "Combined switch and plug boxes for electric circuits." J. SCOTT. September 27th.
13,727. "Electric heating and cooking apparatus." G. PATE & A. R. WOOD. September 27th.
13,746. "Electric signalling systems." R. LAMBOURNE. September 27th.
13,754. "Electric cooking, &c., apparatus." A. F. BERRY. September 27th.
13,758. "Dynamo electric machinery." M. LATOUR. September 27th. (France, September 7th, 1915.)
13,767. "Electric switches." V. HOPE. September 28th.
13,768. "Electric overhead tramway trolley-pole attachment for preventing flash at breaking points in cable." G. T. THOROLD. September 28th.
13,803. "Electric motor control." THE BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). September 28th.
13,805. "Automobile electrical apparatus for welding, searchlight, &c." P. F. SMITH & MESSRS. TILLYNG-STEVENS, LTD. September 28th.
13,812. "Electro-magnetic engine." E. BACHELET. September 28th.
13,814. "Magnets for lighting automobiles and starting internal-combustion engines." J. BETHEND & E. GIRARDEAU. September 28th. (France, December 20th, 1915.)
13,816. "Systems of distribution." BRITISH WESTINGHOUSE & ELECTRIC MANUFACTURING CO. September 28th. (U.S.A., October 7th, 1915.)
13,820. "Automatic shifting devices for magnets." L. BIGNON. September 28th. (France, October 2nd, 1915.)
13,825. "Portable electric lamps." O. HOPFMAN & C. WOLTER. September 28th. (Germany, September 25th, 1915.)
13,839. "Improving voltage regulation on alternating-current sub-stations, feeders, rotary converters, &c." A. M. TAYLOR. September 29th.
13,840. "Spark plug." A. E. TONKS, MESSRS. E. TONKS & SONS, C. W. TONKS, E. TONKS, and G. A. TONKS. September 29th.
13,854. "Means for ventilating and cooling electric generators and motors." P. F. SMITH & MESSRS. TILLYNG-STEVENS, LTD. September 29th.
13,887. "Apparatus for electrical transmission of rotary motion or signals." P. SCHLOSOWSKY. September 29th.
13,888. "Magnet dynamos." P. C. RUSHEN (Bosch Magneto Co.). September 29th.
13,899. "Spark plug for internal-combustion engine." H. R. WILKS and T. CROSSBEE & SONS. September 30th.
13,905. "Cooling and ventilating system for electric storage batteries in submarines." M. F. HAY. September 30th.
13,942. "Electric train-lighting, &c., systems, and regulation of electric circuits." H. LEITNER. September 30th.
13,943. "Telephones." F. L. CORK. September 30th.

PUBLISHED SPECIFICATIONS.

1915.

- 8,308. ELECTRIC HEATERS AND ELECTRIC HEATING APPARATUS. J. E. C. A. Marks (Landers, Fray & Clark). June 8th.
12,730. BIPOLAR ELECTRODE ELECTROLYSERS. G. G. Hepburn. September 6th.
12,798. INCANDESCENT ELECTRIC LAMPS. L. Simonotti & E. Simonotti. September 7th.
12,810. CONTROLLERS FOR ELECTRIC MOTORS. H. E. Day. September 7th. (September 29th, 1914.)
12,984. APPARATUS FOR DETERMINING THE "CRITICAL" OR "CONVERSION" POINT OF SAMPLES OF IRON OR STEEL BY MEASURING THE ELECTRICAL RESISTANCE OF A TEST PIECE OF SUCH METAL WHILST HEATED TO A HIGH TEMPERATURE. H. J. C. Simson (Saldau). September 10th.
12,999. SEARCHLIGHTS. E. A. Sperry. September 10th. (April 16th, 1915.)
13,093. MEANS FOR TRANSMITTING SIGNALS ELECTRICALLY. G. B. Reeve. September 11th.
13,073. MEANS FOR REGULATING ARC LAMPS. J. Brockie, and Johnson and Phillips, Ltd. September 13th.
13,080. PROJECTOR ARC LAMPS. J. Brockie, and Johnson and Phillips, Ltd. September 13th.
13,216. ELECTRICAL METHODS OF SOUNDING OF CHURCH AND OTHER BELLS. T. Southgate. September 16th.
13,481. ELECTRIC MOTORS. F. A. Heys (Neuland Patents, Ltd.). September 22nd.
13,387. ELECTRIC TRANSFORMERS. C. H. Thordarson. September 24th.
16,550. TELEGRAPH OR TELEPHONE LINE INSULATOR. J. B. Alexander. November 23rd.
17,473. ELECTRO-MAGNETIC RELAYS. C. B. Burdon (Siemens & Halske Akt. Ges.). December 14th.

1916.

- The numbers in brackets are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.
1,246. ELECTRIC CIRCUIT CONTROLLERS. Igran Electric Co. (Cutler-Hammer Manufacturing Co.). January 26th, 1916. [101,362.]
1,821. AUTOMATIC TELEPHONE SYSTEMS. Relay Automatic Telephone Co., Ward, F. M., Bryant, G. M., & T. M. Immy. August 11th, 1915. (Divided application on 11,600/15. Cognate application 1,868/16.) [101,047.]
3,059. HOLDER FOR CARRYING TWO SEPARATE ELECTRIC OR OTHER WIRES OR CABLES. J. E. Grootcutt. March 1st, 1916. [101,372.]

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TRAVELLING SCHOLARSHIPS.

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THE building up of substantial and lasting trade connections is not, in ordinary times, a matter of weeks or months. In war-time, when supplies from some directions are cut off and markets are in need, orders can be obtained practically for the asking if we are in a position to execute them; and it may be that some of these orders given in a hurry, will by reason of satisfactory service, and perhaps by reason of allied sentiment, be followed by others from the same sources after the return of Peace. In normal times, however, and speaking generally, foreign trade connections, save for quite specialised lines of trade, are a plant of slow growth. We survey markets, prepare literature, advertise the goods we make, and, if we are wise, nurse periodically the ground we seek to cultivate; but these are only part of the effort, an important part undoubtedly, but we have to go deeper, for after we have done all these and other things along ordinary commercial lines, we may find that we have not built upon the best or most reliable foundation. The foundation that we must put in very substantially, and which does not lie in one country alone, but in both that in which we manufacture and in that in which we desire to sell, must be made up of as complete a knowledge as we can obtain of the character and the consequent requirements of the people of the market, and of closely cemented relationships and friendships or understandings imparting a complete confidence in the seller on the part of the buyer. This foundation is education. Not education of the ordinary school, college, or university type, but education of specialised types, one kind for the buyer and another for the seller. In the main, it is to be obtained by mutual interchanges of visits; taking a particular case for the purpose of illustration, the entertaining of Russian engineers and business men in England, and the deputation of British engineers and manufacturers to the markets of Russia. Much success has been known to follow organised visits of such kinds, and private parties on their own initiative and at their own expense have also found their efforts to be well rewarded. Not once, nor twice, but many times have we referred to the way in which British and German traders have educated the rising generation of engineers in non-manufacturing, and therefore purchasing, countries, and created an atmosphere and conditions congenial to the growth of trade. This lesson is not likely to be overlooked as we lay our plans for the future. The opening of our works to young foreigners whom we expect to be ultimate buyers is only one half of the matter. What we also need is the opening up of facilities in their countries for our own potential business men to learn most thoroughly, as the result of extended sojourn, observation, and education, and of intimate converse and relationship, the language and character of the people, their country, and their requirements. Those of our readers who took the trouble to read the Government Committee's report on a British Trade Bank will have noticed that one of the most important matters dealt with therein related to the need for encouraging suitable young men to leave these shores and take up residence and business interests in markets where we desire to strengthen the British commercial hold. When we nationally hold that after the war we must aim first at peopling the Mother Country and the Empire,

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we shall not fail to see the necessity for assisting a number of suitable men to go to other countries in the interests of British commerce and industry, and therefore in the interests of the Empire as a whole. It may be that our young men will find it good policy, as German agents have often done, to arrange even their affections in subordination to trade interests, marrying one of the foreigner's daughters, but that we are quite prepared to leave to them—the details we need not enter into. What we must do is to make the opportunities for the young men to go to these potential markets, making it worth their while to do so, because they are the representatives of a Greater British industry. The British electrical and engineering manufacturer knows many ways in which this can be done, but it is our purpose on this occasion to describe briefly the steps that are being taken by another great department of British industry as the result of organisation of its different firms, as the scheme is considered by some to afford an example which might be profitably studied, and perhaps followed, by British electrical and engineering organisations. The Bradford Dyers' Association has offered to give to travelling scholarships to cover the cost of a year's residence in Russia—the gift is valued at £2,000 per annum. The proposal is made in recognition of a great and urgent local and national need, and the only stipulations attached are that candidates for the scholarships must be either connected with, or intend to be connected with, the piece goods trade of Bradford or Manchester, and that they shall have acquired an elementary knowledge of the Russian language. This language difficulty has long been one of our obstacles to Russian trade. Geographically, Germany was in such close proximity to Russia that commercial people intermingled, and a Russian need had only to be known and measures were taken to meet it. The people and their language were known, and a trip into Russia was nothing more than a run into the provincial districts here for an Englishman. Whether those relations are resumed again or not, the goodwill of the Russian people toward their Allies in this terrible war will alter matters in our favour if we can meet the needs of the situation, and we are more likely to meet those needs if we learn the language in order to understand them and fraternise with them either here or on their own soil. The Bradford Dyers' Association was fortunate, in this respect, in securing the co-operation of the Bradford Education Authority so as to give a stimulus to the study of Russian. It is stated that arrangements are now in process for the selection of suitable candidates to proceed to Russia, for the provision of their comfort and accommodation while there, and for their training and supervision. The services of the Russian Embassy and of our own Consuls in Russia have been sympathetically placed at their disposal. Students will go to university cities, such as Petrograd, Moscow, Kharkoff, Kieff, and possibly Odessa; they will attend courses of lectures, with a strong commercial bias, at universities and commercial institutions, and in a hundred ways they will be enabled to acquire an intimate acquaintance with Russia and with the habits and customs of the people, also to investigate Russian industries, securing introductions to business centres, and so forth. Of course, every student has to familiarise himself with the elements of the Russian language before he goes out, and the Educational Authority will assist to that end so that six months' study shall make him sufficiently "fit." Now only the blindest man can fail to see the most excellent possibilities contained in such a scheme; it is conceivable that in the course of time, almost incalculable benefit to British textile industries would result. And if this applies in the case of textiles, why not in electrical manufactures? It seems to us that electrically we are up

against very much the same difficulties—the language and the need for knowledge of the peculiarities of the people and their country. As we hope to have ample electrical manufacturing capacity after the war we need to be far-seeing in our measures, and perhaps another £2,000 a year from the electrical industries, organised, say, from London, or Manchester, or some other big engineering centre, along very similar lines to those adopted in the case of the Bradford Dyers, might prove to be a most profitable investment for the industry in the long run as well as assisting in opening up very favourable relations with our Russian electrical friends during the remaining stages of the war if, as appears likely, it lasts much longer.

The Council of the Lord Kitchener National Memorial Fund is founding a number of commercial scholarships for the sons of deceased and disabled officers and for young men who have served with the Forces, for the purpose of enabling them to gain experience in France, Russia, Italy, Japan, Belgium, Roumania, Portugal, and Serbia. Is it altogether out of the question to prepare one grand national scheme by which the textile, engineering, and electrical trades could co-ordinate their efforts in co-operation with the Kitchener Memorial Council?

Rubber.

THERE has been a little more life in crude rubber within the past fortnight or so, and the market has occasionally shown improvement, though no important advance has to be recorded on balance. The more active demand which has been experienced is chiefly attributed to the misgivings which have been aroused through shipping uncertainties. There has, under the circumstances, been more readiness to cover short contracts outstanding on the part of dealers, but otherwise no eagerness to buy has been seen, consumers being apparently still of opinion that a hand-to-mouth policy is quite in keeping with the heavy stocks now in existence on this side. Stocks, indeed, have grown very considerably the last few months, the total returned at London and Liverpool combined on October 1st being 10,408 tons, which shows an increase of about 4,000 tons and 5,000 tons respectively compared with the same date in the previous two years. There is not much doubt that the accumulation of unsold supplies will proceed further in the present rather indifferent state of the market, for abnormally heavy quantities were shipped from the East in the past month, while the aggregate for the nine months represents 44,302 tons, comparing with 30,657 tons in 1915 and 21,550 tons in 1914. The output of the plantation estates will doubtless continue progressive, although the latest advices from that quarter suggest that operations are now to some extent hindered by labour scarcity, and other adverse causes. The labour problem, at any rate, is causing some apprehension in the Middle East. Therefore, the increase of output in various directions is hardly likely to be as large as originally anticipated, unless the shortcomings referred to can soon be remedied.

The market at about this time last year became extremely sensitive through shipping uncertainties, and delayed arrivals, chiefly because the unsold stocks were comparatively reduced, and the United States were buying freely. At that time a large portion of the rubber arriving here was already sold, and the balance was thus easily taken care of by the additional orders coming on the market for spot rubber. Conditions now are practically reversed. Through the short-sighted policy of the estates in refusing to sell ahead, forward positions have been left rather unprotected, and the result of this policy is that very considerable quantities of the plantation product are arriving unsold. This naturally has a subduing effect upon demand, while manufacturers

already carry fair stocks, and are not keen about increasing their commitments. The prices asked for forward rubber are still considered too high to induce fresh interest. No great reliance can be placed upon America increasing her takings to any important extent until after the Presidential Election, in view of political uncertainty. Meanwhile, however, it may be mentioned that according to the latest advices from that quarter reserve stocks in manufacturers' hands have been eaten into considerably within the last few months, and that the progress of operations at the American mills is quite satisfactory in spite of the recent labour disturbances. Export of rubber goods are in excess of all previous records and manufacturers of tires are doing a very large business, while rubber goods are being introduced as a substitute for leather soles for shoes, &c. There is no doubt that buying power is accumulating for the raw product, which must eventually lead to more active American buying from the East direct or from this side.

ELSEWHERE in this issue we publish an abstract of an address by

Mr. R. A. Chattock to the Birmingham Association of Mechanical Engineers, in which the author, after touching upon various aspects of the engineering industry as affected by the war, on lines with which we are in hearty agreement, took up a subject which for many years has been with him a favourite study—the reform of our methods of generating and distributing electrical energy. In view of the national movement in this direction, and of the fact that he is Chairman of the I.E.E. Committee on Electricity Supply, Mr. Chattock's remarks are particularly interesting and timely.

It will be observed that, with other leading electrical engineers, the author advocates the more complete and efficient utilisation of coal by the one method that is at present open to us—gasification of the crude fuel, and recovery of the products of its distillation which are more valuable in themselves than as sources of heat. Commenting on the enormous amount of coal required to provide sufficient combustible gas by distillation, and the large area that would be occupied by the generating station, Mr. Chattock suggests that some of the boilers should be fired with the coke resulting from the former operation, thus achieving the double object of reducing the amount of coal to be handled, and avoiding the production of excessive quantities of coke "or other form of fuel"—the solid product of the low-temperature distillation of coal being considerably different from what is known as coke. As an alternative, the "coke" might be gasified in producers; this would have the advantages of uniformity in firing the boilers, and avoidance of the difficulties that are met with in burning coke in boiler furnaces, against which must be set the difference between the cost of suitable grates and that of the producers. It is interesting to note that the big gas engine is not so much as mentioned in the address—so completely has the steam turbine established its superiority as a prime mover.

Mr. Chattock includes amongst the benefits derived from the adoption of some such scheme the conservation of our coal supplies, the elimination of smoke from the atmosphere, and the supply of electrical energy at very low prices—all most desirable results. Also, by siting the generating stations at coal mines and transmitting energy electrically, he proposes to relieve the congestion of traffic on the railways, and in order to hasten the change he advocates the adoption of compulsory measures by the Government. To discuss the pros and cons of the last-named course would require more space than we can spare to-day: but with regard to the economy of power supply we may say a few words. It has been fully realised in cer-

tain industries that the cost of power in itself is a mere trifle compared with the total costs of production and marketing, and while we would not underestimate the importance even of "mere trifles," we wish to point out that the *saving of labour*, combined with increased output, resulting from the liberal employment of electric power in industry is of far greater moment, and should be given greater prominence in discussing this subject. The importance of this point was marked before the war; in the future, it will be of still greater significance. In connection with heating operations on the other hand—domestic and industrial—the cost of energy is certainly the paramount consideration, and the same is true of electrochemical work, which is likely to come more extensively into vogue.

The electrical station engineer may view with some concern the prospect so frequently displayed before him—that he will have to add to his many accustomed activities the functions of a gas engineer and chemist. We sincerely trust that opposition to reform will not be based upon this ground. There is no inherent reason why he should shrink from such a fate. In any such large undertaking as Mr. Chattock foreshadows there is bound to be a staff of expert chemists, and the engineer will be concerned mainly with the utilisation of the gas supplied by the coal-consuming department, as at Brighton. But it would be well if electrical engineers who hope to attain eminence in electricity supply would take time by the forelock, and make themselves familiar with this branch of the subject—for the change is bound to come.

American Prosperity.

THE article on the present position of the electrical industry of the United States, which we quote in full from our American namesake in this issue, will be read with interest—not, perhaps, unmixed with envy—by British manufacturers, who, with all their energies absorbed in the gigantic task of maintaining the cause of a free and beneficent civilisation in Europe against the onslaught of a barbarous and Vandal foe, are for the present unable to take due part in the feast of industry spread out before their confrères. "Feast"—it might rather be called an orgy! It must be admitted, however, that no small part of the trans-Atlantic prosperity is due to the manufacture of munitions of war, which, by the force of circumstances, of which the British Navy is the predominant factor, can be supplied only to ourselves and our Allies, and to that extent our neutral friends are supporting the cause of justice and freedom.

Whether that should be the limit of their military activities it is for them to judge—we have our own opinions on the matter. What mainly concerns us is not so much the present as the future, in this connection. The fact that our manufacturers have, in spite of the most adverse and difficult conditions, succeeded in raising their exports for the last two months to a higher monetary value, if not a greater volume, than in the corresponding months before the war, is of good augury. Our workshops are crammed with machinery, much of which should be capable of adaptation to the requirements of trade after the war, and a new spirit has been inculcated into our industrial armies, from which we hope for great results. The big American firms are clearly quite unable to cope with the volume of business that is now offered them, and when peace looms ahead undoubtedly the world's demand will be redoubled, while the establishment of a preferential régime throughout the Allied nations must prove a vital factor in determining the course of trade. We therefore have no fears for the future, provided that no effort is spared to meet the new conditions with the utmost efficiency and determination.

ELECTRICAL TRADE IN INDIA AFTER THE WAR.

By G. R. DRUMMOND, M.I.E.E., M.I.M.E.

THE majority of electrical firms in England at present hardly realise the immense possibilities and importance of electrical progress in India. Up to a very few years before the war very little competition was offered at all by English firms, with the result that many very large orders were placed on the Continent and in America, resulting in foreign firms obtaining a footing in this country, and, in my opinion, it is "up to" British manufacturers to consolidate their present position, and to considerably extend their activities in India—that is, of course, if they wish to compete with foreign firms in this direction. Now I do not wish to imply in the least that what has been mentioned regarding orders being placed abroad was due to weak representation, but to earnestly impress on firms that there appears to be no reason whatever why after the war England should not supply the bulk of electrical goods for India, and that, apart from home orders, their works can be fully employed to cope with this increased business, provided they tackle their Indian export trade in the correct manner. What is the best way to achieve this result? I remember, when I was in London in, I think, 1905, I was talking to the managing director of one of our leading electrical firms, and in the course of our conversation he mentioned that his firm had agents in India, but orders were few and unimportant, and he inquired if, in my opinion, more business would result if direct branches were established and the agency abolished. My reply was emphatically yes, provided you send out the right men and go to work correctly, always remembering the vastness and possibilities of the country. The firm in question took my advice and have done fairly well, but not so well as they might have done, or as I anticipated. Firms operating in India should remember that, generally speaking, business is carried out on completely different lines to those obtaining in England, and that certain points should be carefully observed, of which I will detail what are, in my opinion, the most important:—

Workmanship.—This should be of the *very best always*; in fact, more attention and care should be given by works to orders for India than for home orders. Not, as I am afraid is sometimes the case, machinery pushed through the test house with the remark, "Oh, it's good enough; that machine's for India; we'll not be worried or hear about it, once it's shipped." No; they would possibly not hear much about it, or their firm about repeat orders. Any plant, even if only a little doubtful under test, should be kept back, and, if necessary, scrapped. Firms' reputations have been completely damned for certain classes of work, owing to indifferent workmanship and their test house passing the stuff through as good enough for India. I remember—it was, I think, in 1908—I was inspecting and reporting on an electric scheme in a large Native State, and had been told that the scheme was being changed from D.C. to A.C., and a steam 3,300-volt alternator, with switchboard, had just been installed. I was looking forward to seeing this plant, as it was from old-established English firms with good reputations for D.C. boards and machines, but firms who had up to then manufactured little, if any, A.C. plant. On arrival at the power house with the engineer, some D.C. sets only were in operation, and on my inquiring if the A.C. set could not be started up for my inspection, the engineer replied, "Well, as a matter of fact, we're rather afraid to run it. We have had no luck at all with board or set." On its being uncovered for my inspection, I understood why. Without going into details, I will only say that I recommended the engineer to return the plant to the makers as useless, and on no account to try to operate it. The firms in question possibly heard little about this, for various reasons, but from that date to this I have seen no more of their A.C. plant, nor have I heard of any, being installed in India, and in all probability this has also seriously affected their sale for other electrical material, without the heads of the firms understanding why. This is only one case of

many I could quote from my own experience out here. Firms must understand that jobs in India are some 8,000 miles from their works, and engineers out here cannot 'phone up works to send men to inspect, overhaul, &c., &c., or to rectify any fault that may occur, and if any trouble is experienced with plant no repeat orders to that maker are going home, and such news travels. On the other hand, if the plant is really good, many repeat orders result, and, when new works are in progress, engineers invariably specify plant of which they know examples are running satisfactorily in other parts of the country. Another point is, makers should realise that plant which is excellent for England may not always give satisfaction when installed in India, and that plant which would run well, say, in Bombay, would give trouble if installed in Delhi. Extreme climatic variations must always be taken into consideration, and in certain parts of India the prevalence of dust storms have to be considered. Firms should also bear in mind that in all probability the plant will be entirely operated by cheap Indian labour, and they should design same accordingly. Efficiency for home practice is an important factor, but in many cases engineers in India would prefer reliability at the expense of a little efficiency. One other point is, *firms must standardise more*. Possibly many of my readers will say, "We do standardise." To a certain extent I admit, but they should standardise whenever possible, and work strictly to standards, until, of course, the design changes, and then it should always be possible for a machine to be made—if required—to an old pattern to match machinery already installed. Nothing is more annoying than to receive plant which has been specified to be exactly similar in every respect to a previous order arrive out with different fittings, and to be obliged to stock, say, a different size of brush for same, to say nothing of the break up in the uniformity of the station. In my opinion, firms would do well to have attached to their export department a good reliable engineer with a special knowledge of India, whose duty should be examination and passing of all goods for India.

Representatives.—Representatives should preferably be engineers who have had a good varied home training, with also experience in India. They should have plenty of tact, the full confidence of their firms, and, above all, they must be "pucca sahibs," able to move in society, and eligible for membership to any of our clubs.

During my 18 years' experience in India, I have at different times met a good many representatives of firms, who have called on me at my different stations, and of these I suppose there were few indeed who were really suitable men to represent their firms here in India. It must be remembered that at least 50 per cent. of the business is negotiated with Indians, the majority of whom require very tactful handling. Ninety per cent. of these have not seen England, and, therefore, must judge firms, to a certain extent, by their representatives. I will mention here that no one is quicker to observe whether a man is a "chota sahib" (little man, literally subordinate) or a "bara sahib" (big man, literally officer) than an Indian, and be impressed accordingly, or otherwise.

In India there are observed two classes—i.e., the club man (officer class) and the subordinate, and the distinction is most marked. Representatives must, of course, belong to the former (it would be fatal to the interests of their firms for them to drift into the latter), and it is essential that they should belong to the local club and mix in Society. Possibly my readers will say—"Oh, that's absurd. We want a man to push business, not to go into Society." I can assure them that much more business is secured by the man who has entry into the clubs and Society than the man who, say, grinds hard at office all day and talks about having no time for such frivolities. The ideal representative is the man who combines both work and social life, and it must be obvious to my readers that when orders are being handed out—other things, of course, being equal—it is the man one knows and meets at club who generally secures the work. Some representatives of firms, although eligible, cannot belong to clubs, because their pay does not permit. This is a great error on the part of their firms, who, I take it, are ignorant of the country, or they would not handicap their men before they really get to work.

Living in Presidency towns is expensive. For instance,

in Calcutta a suitable house cannot be had under Rs. 500 a month; servants and living expenses run away with another Rs. 500, and then one has club and other expenses, and last, but not least, if the representative is married, comes the yearly expense of wife and family going away to the hills during the hot-weather months.

The above is not by any means exaggerated. One of the many duties of the representative is, at times, to receive and put up clients who may be down on business, and to entertain them. To do this it is essential for him to have a house in a good locality, and, generally speaking, to look after the client, and treat him as well as if he were in his own home. I wonder how many firms there are who pay their representatives only Rs. 750 or under a month, and are under the impression that they are treating their men well? Apart from the fact that good sound men cannot be had for that pay, their men cannot possibly live as they should do, and as is their duty to their firm.

Some years ago I was asked to install a complete modern electrical equipment for a large theatre in a State for which I was then consultant. I was extremely busy at the time with other schemes, so sent full particulars with drawings to a certain firm which I knew had carried out similar work in India, asking for a detailed estimate for the supply of all the material. After a very long wait and some correspondence, the representative stated he would not send the estimate unless I deposited a sum of money with his firm, which would be forfeited if he did not get the work! Needless to say, I placed the order elsewhere, and intended sending the correspondence to the head of the firm, only I realised that it was more the firm's mistake in sending out such a man than that of the representative, who, no doubt, thought he was doing the correct thing.

Representatives should at least once a year tour India, making personal calls on all clients, and paying visits to all native States and towns where electricity is, or is likely to be, installed. This is essential, and it should not be necessary for the representative, on his return to his centre, to have to work at nights to pull up his arrears of office work accumulated during his absence. How many times have letters been forwarded to clients, stating that the representative was "up to his eyes in work, and could not possibly get away before such and such a date." This is altogether wrong, as the representative should so arrange his office routine as to leave himself free to take a trip anywhere at a moment's notice, without feeling worried at the thought of work piling up for him against his return. He should remember that he is not serving the best interests of his firm by becoming an office fixture.

To conclude, I will add that in the first five years after the war, it is certain some millions sterling will be spent on electrical work in India. Apart from the innumerable smaller schemes pending, two great industrial schemes are to be launched by, or through, the agency of Messrs. Tata, Sons & Co. First of these is a hydro-electric scheme with a capital of 2½ crores of rupees, and the second an extension of Messrs. Tata's steel works, at a cost of 3½ crores of rupees. The activities of Sir Thomas Holland and his Commission will do much to stimulate trade, and altogether the future holds out vast possibilities for electrical enterprise in India. I sincerely trust our English firms will take full advantage of them, and that these few notes will be of some little assistance to them in this direction.

THE PRESENT STATUS OF THE AMERICAN ELECTRICAL INDUSTRY.*

THE vast volume of business now being handled by the Westinghouse Electric & Manufacturing Co. and the General Electric Co. has never been paralleled in the history of these manufacturers. The two companies are taking orders, this year at the rate of \$225,000,000 per annum, which is \$90,000,000, or 65 per cent., in excess of any other year in their corporate existence. According to a statement in the

Wall Street Journal, the Westinghouse Co. will manufacture during the fiscal year to March 31st, 1917, including its shell orders and other munition orders, aside from rifles, between \$50,000,000 and \$100,000,000 of finished products.

Those who have studied the condition of the electrical industry in the United States during recent weeks have been amazed at the sold-out condition of great concerns like the Westinghouse and General Electric. It is understood that in the turbine departments of both these big producers no deliveries of turbines short of 18 months are being promised. In fact, some very large contracts have been taken this week, calling for 15 months' delivery. In other lines Westinghouse is sold ahead at capacity for seven and eight months, and the same statement is true of General Electric. These two companies have orders in hand for 20,000 to 25,000 motors alone.

Because of the immense pressure which incoming orders are exerting, Westinghouse Electric has purchased 500 acres of land on the Delaware River, and will use it as the nucleus of a new manufacturing centre. The physical possibilities in its East Pittsburg location are so clearly exhausted that it was imperative that a new centre be started if the company is to continue to hold its normal proportion of the industry.

Indicative of the prosperity of the manufacturers of electrical equipment and the entire electrical industry, but teeming with the difficulties encountered by manufacturers, were addresses made by G. E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Co., and E. W. Rice, Jun., president of the General Electric Co., before the Association of Edison Illuminating Companies, at its 37th convention at Hot Springs, Va., September 5th/7th. The excerpts from these addresses serve admirably to show the conditions now existing in the manufacturing branch of the industry.

ABSTRACT OF MR. TRIPP'S ADDRESS.

In order to get a comprehensive view of present manufacturing conditions in the electrical industry, it is necessary to review for a moment a little of its past history. When the electrical industry began it was something more than the mere selling of a manufactured product. It was the application of scientific knowledge to practical uses, and required close co-operation between the manufacturer and the pioneers in the public utility field.

The tremendous importance of individual genius was the predominating feature of this period, and manufacturing was largely confined to the development of the particular apparatus which some far-seeing man had invented or developed. As a natural consequence, the same man became an indispensable factor in the application of his conceptions to the public use; and from this condition arose, not electrical manufacturers, as they are now constituted, but organisations standing sponsor for and producing goods according to systems developed by the great chiefs of the electrical science. Through these agencies there sprang up a great number of small installations of street railways and electric light companies, serving the routine local wants of the ordinary citizen in his daily life. This was the first step in the evolution of the industry.

Perhaps the next stage may be described as that in which the various systems were sifted out, not, however, by the predominance of one or the other, but as is usual in such circumstances by a combination of the best points of all of them, until the manufacture of electrical apparatus and the application of it became more or less standardised. That is to say, while invention and research went on, and is still going on, and important improvements were from time to time made, and are being made, it is a fact that the large manufacturer of electrical apparatus can and does produce machinery and apparatus that is adapted to any kind of electrical service.

When the manufacture of electrical apparatus had reached this stage it made possible the new era of central-station development, which resulted in a great expansion of the uses of electricity, the history of which has been a matter of comparatively few years. The isolated electric light plant which had no power business and gave a local individual service which had no great fluctuations, has passed away and has been replaced by huge central-station organisations which sell a great percentage of their output for uses in all lines of industrial activity, and whose business will more and more tend to rise or fall with the general tide of industry.

The demand for large generating units has been greatly increased, due to the more intelligent and energetic conduct of the electrical business under concentrated control, for it is an undoubted fact that scientific management keeps pace with concentration. I believe that the tendency for combination and consolidation of public utilities is bound to go on from a purely economic standpoint, and that this irresistible tendency will present many political problems for solution, but I have referred to them solely for the purpose of enabling you to better understand that the demands from the manufacturer, brought about by the sudden and tremendous impetus given to almost every branch of industry in the United States on account of the European War, was the combined result of these great aggregations and the large use made of them by industrial enterprises. That is to say, manufacturing industries of all kinds, which have been recently taught to use electricity as a power, called for an increase in service, the magnitude of which was as unforeseen as it was abrupt.

* *Electrical Review and Western Electrician*, September 23rd.

The experience of our company will serve to illustrate how sudden and unexpected was the demand made on the manufacturing industries of this country during the latter part of 1915. The war began August 1st, 1914. At that time we had unfilled orders on our books of about \$8,000,000. This was a small amount, and represents about two months theoretical full output of our shops. The outlook was anything but encouraging. On February 28th, 1915, which was the lowest point we reached, we had on our books approximately \$5,600,000 of unfilled orders, a falling off of 30 per cent. Our shops were running at not over 50 per cent. capacity, and the total number of men on our pay roll was about 14,800.

While February, 1913, was the low period, there was not great improvement for several months afterward. In fact, the real upward movement did not begin until November 1st, 1915, at which date we had on our books \$6,900,000 of unfilled orders. In order that you may have these figures more clearly in mind, let me recapitulate. On August 1st, 1914, at the beginning of the war, we had on hand \$7,900,000 orders. On February 28th, 1915, which was our low period, we had on hand \$5,580,000. On October 31st, 1915, or 14 months after the beginning of the war, which marked the real beginning of the avalanche, we had on hand \$8,900,000. From that time on there was no cessation of increases. Notwithstanding we increased our forces from the figure of 14,800 to nearly 30,000, and ran our factories to the fullest possible capacity, we have on hand to-day unfilled orders for electrical goods amounting to considerably over \$30,000,000.

In all these figures I have given I have taken no account whatever of orders for war munitions. I am referring to our regular product, in which, as you have seen, notwithstanding the very large output of our shops during the last eight months, our unfilled orders have increased over the low point of February, 1915, by almost 600 per cent.

I have no figures at hand giving statistics as to the demand for labour upon the munition industry, but I should hazard a guess that 150,000 or 200,000 new jobs would not be excessive; and, as the number of men we have employed on munition work amounts to about 4,500 in Pittsburgh, it is fair to say that our labour conditions would have been just as serious had we never taken a war order. Our greatest task is to find a sufficient supply of the two extremes, viz., the highly skilled and the common labourer. The first is practically unobtainable, and the latter is becoming scarcer, more expensive, and less efficient. It is not difficult to hire enough men, but they will not stay.

Up to this point I have endeavoured to outline some of the conditions under which we are now working, but I should like to add something from the financial and profit side, and to say at the outset that, under normal conditions now and in the future, so far as I can foresee, an electrical manufacturer will not be able to earn any more than a fair return upon the actual cash invested in the business; that is to say, no cash returns are to be expected upon patent rights, goodwill, and other intangibles of that nature. It may be possible for a concern to do it for a few years, but it will be because an insufficient amount is being expended in research and development work, and that policy carried on long enough will eventually put any electrical manufacturer out of business. We expended last year in research and development over \$1,000,000, and that amount, of course, comes bodily out of net earnings, because it is an expenditure that cannot bear immediate fruit, and it would only be warranted on the expectation that the general law of averages over a period of years would in a thousand ways add that and more to the money value of the company's business.

The profits in the business are undoubtedly close. I think our shops are operated with reasonable efficiency, and I think our sales department gets as high a price for the product as possible, but until last year, which included war profits, there has never been a year in the last ten years that the Westinghouse Electric & Manufacturing Co. made as high as 15 per cent. on the selling prices of its output. The figures have ranged from 8 per cent. minimum to 14 per cent., with an average of, say, 12.5 per cent.

This is a close operation, and requires that, for safety, a manufacturing company should turn its capital over once a year, and where it has not yet reached that desirable stage it is undoubtedly wise policy to constantly increase its reserves until the goal has been attained, and the Westinghouse Co. has pursued, and will pursue, that general policy so far as it is able to do it.

ABSTRACT OF MR. RICE'S ADDRESS.

The situation in regard to general manufacturing conditions is, from a production standpoint, extremely unsatisfactory. Stocks in the hands of manufacturers and dealers in metals and machinery, which were allowed to become depleted, owing to the abnormal reduction in business, were quickly exhausted upon its revival. All manufacturers and dealers in such materials and appliances soon became overwhelmed with orders, and consequently there has been for the past year, and still continues to be, the greatest difficulty in obtaining raw materials and equipment, particularly those of a special nature. The demand for copper and brass materials, iron and steel, sheet steel, castings, forgings, &c., has for some time greatly exceeded the capacity of the producing concerns in this country. Promises made by producers of raw materials and machinery and tools, of every descrip-

tion, have been found, by sad experience, to be extremely unreliable, and this naturally interferes with our schedules of manufacture of finished goods. There is little, if any, evidence of a change in the situation in the immediate future, and we anticipate that difficulties will continue to be experienced in obtaining raw materials. As a result of over-sold conditions prices have been advanced to unprecedented figures.

The increase in prices of raw materials and machinery has not been permitted to directly affect production unfavorably, as these prices have been met. The fundamental difficulty which has constantly interfered with production schedules has been the inability to get machinery and materials, either on time or in sufficient quantities to keep our factories operating in an efficient manner. In some instances materials and machinery which heretofore have been employed have been unobtainable, and new materials, machinery, and methods have been substituted, all of which has involved delay in production. Even after we had succeeded in purchasing our raw materials, and shipment had actually taken place at the point of manufacture, there was no assurance that the material would arrive on time. The railroads, as is well known, became so congested that deliveries were slow and uncertain, and complete embargoes were frequently placed upon the delivery of important materials, and always, it would seem, at the most unfortunate time for ourselves and our customers.

The manufacturer, however, needs something more than buildings, machinery, and raw materials in order to fill the orders of his customers. He must have labour of good quality and of reasonable and reliable supply, and, manifestly, it is impossible to cope with the increased volume of business without an increase in the efficiency of labour, or an increase in quantity. In spite of all our efforts the labour situation for the last year has been, and still remains, in a very unsatisfactory condition, especially with reference to high-grade skilled employes and low-grade common labourers. There does not seem to be a sufficiency of either class to meet the demands of production in this country. As is well known, the scale of wages of such employes is abnormally high, which condition has been intensified by competition among the manufacturers themselves.

The increase in the price of labour would not in itself affect production adversely; it might, in fact, under proper conditions, lead to a stimulation and improvement of production. However, unfortunately, there is every evidence that the efficiency has, temporarily at least, declined, and the output per man is lower than it has been heretofore at a time when it is to the interest of all men engaged in the industry, as well as the employers, to obtain the highest possible output.

The large contracts which have been taken for war munitions have unquestionably affected the general manufacturing situation. They have created a demand for enormous quantities of brass, copper, and steel, and are largely responsible for the condition in which the producers of such materials find themselves, viz., almost complete inability to fill orders.

As to what extent, if any, the manufacture of munitions by our company has interfered or may interfere with deliveries of our regular products, I frankly admit at once that such contracts as we have taken for munitions have interfered, and will, until completed, interfere to a relatively limited extent with our regular business. I may further confess that if we had anticipated the prompt revival of business, to say nothing of the phenomenal increases in our regular business, we would never have undertaken the manufacture of any munitions.

At this time it is difficult to express a definite opinion as to the deliveries on 1917 contracts. We have taken large contracts for delivery in 1917, and in some cases even for 1918. We are contracting for important materials as far in advance as seems to be necessary, in order to ensure deliveries. In order to be assured of a supply it seems to be necessary to place orders for some materials well into 1917. In such cases we have not hesitated to take the risk.

The great increase in the cost of raw materials and labour, as well as other items of expense, have made it necessary for us to increase our prices. We have not, however, advanced our prices more than necessary to cover increased cost of manufacture. In some classes of apparatus, through the skill of our engineers in re-designing, without sacrifice of quality, we have effected economies off-setting, in part, at least, the normal increase cost, and in such instances our prices have not been increased to the extent that otherwise would have been necessary.

As to future prices, we are so completely dependent upon the prices which we must pay for raw materials and labour that it is impossible for us to express an opinion which would be of special value. It would almost seem that the high-water mark, with respect to prices of raw materials and labour, has been reached, and, if so, with a continuance of such conditions, future prices of our materials would naturally remain substantially unchanged. Of course, upon any extended reaction in business, which some authorities assure us will take place upon the cessation of hostilities, prices would naturally decline.

It has been suggested that the large profits on munition contracts have established a precedent which may have a bearing upon the electrical business. I do not share in this view, as the electrical business is highly competitive, and in normal times the volume of demand is less than the combined facilities of all the manufacturers.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Sanders Fuseboards.

MESSES. WM. SANDERS & Co., of Falcon Electrical Works, Wokingham, are introducing a new skeleton type of fuseboard, the construction of which does away with the usual china or slate base. The contacts are supported direct by bus-bars and insulated bars which carry the terminal contacts; the contacts are clamped direct to the bus-bars by the firm's patent clip system, the terminal contacts being mounted on a bar insulated with moulded mica.

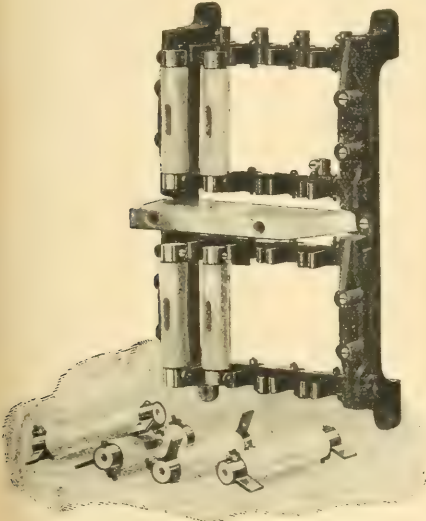


FIG. 1.—ARRANGEMENT OF SANDERS FUSES AND TERMINALS.

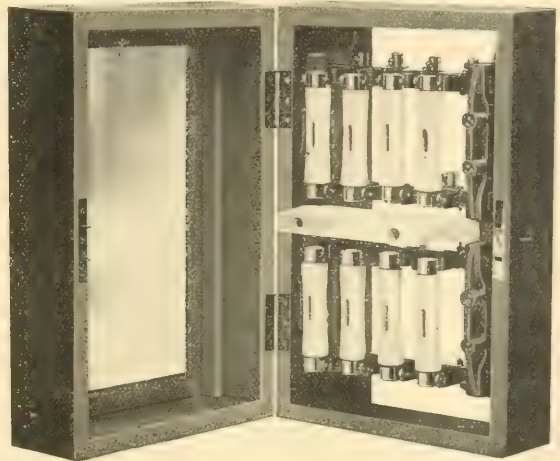


FIG. 2.—SANDERS FUSEBOARD AND CASE.

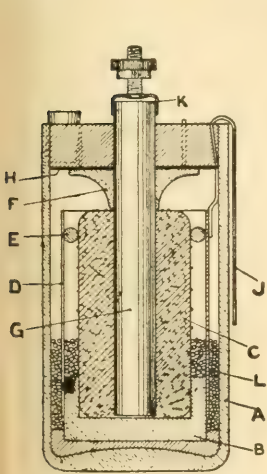


FIG. 3.—EDISON SWAN H_2O CELL.

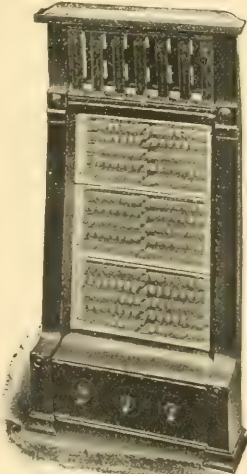


FIG. 4.—CARRON ELECTRIC FIRE.

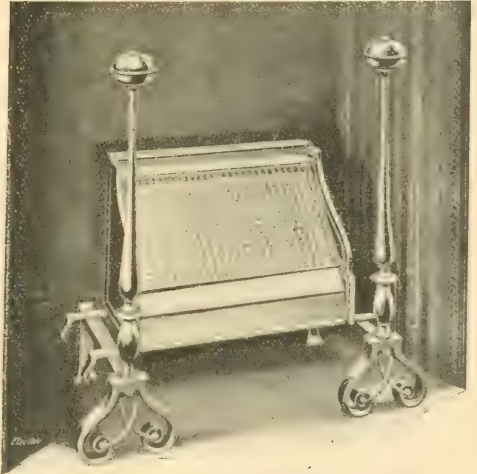


FIG. 5.—CARRON DOG FIRE WITH ELECTRIC HEATERS.

The bars—terminal and bus—are supported at their ends by a rigid iron frame, being insulated from the latter; the main terminals (on the patent clip system) can be clamped anywhere on the busbar between the contacts. Figs. 1 and 2 show the skeleton construction of the fuse frame and the latter fixed in a case.

It will be noted that the panel can be wired up without dismantling and that the cables can be run up and down direct to the terminals without any bend. The live parts are all mica insulated, and the construction is claimed to be practically unbreakable and therefore ideal for transit.

Ediswan H_2O Cells.

THE EDISON SWAN ELECTRIC CO., LTD., of Ponder's End, has brought out a new and improved type of its " H_2O " cell, which is a small and compact cell turned out dry and made active by the addition of water only. Fig. 3 is a cross-section of the cell, which

is provided with a clear glass container, A; a porcelain base B, fixed in position with melted bitumen, forms a support for the sack C, and for the zinc cylinder D, keeping them always the correct distance apart, yet so close together that the internal resistance is very low. A rubber ring E, is a further safeguard against accidental contact. Above the sack a porcelain rim F, slipped over the carbon rod G, and supporting a waxed cardboard washer H, on which the sealing compound is poured. A fibre tube passing through the compound and closed with a cork, enables the cell to be filled with water and a small glass tube provides an outlet for the gases generated when the cell is in use. A lead connection strip J is soldered to the zinc cylinder, and a brass cap K forced on the carbon rod, carries the screw terminal. Ammonium chloride crystals L are placed in the cell at the time of manufacture. Provision can be made on the label for recording the visits of inspectors, and the cells, when worn out, can be recharged by the makers.

Carron Electric Fires.

Amongst the various designs of electric stoves, fires, &c., contained in the recently issued pamphlet E.F. 4, of CARRON CO., may be mentioned a series of fire interiors specially designed to take the place of the ordinary coal fire grate, but which do not require building in. All these fires are fitted with three or four standard patent Carron radiant electric fire bars, each of 1 KW. capacity and controlled by a separate switch. The design is such as to heat the air which circulates through the fire; the stoves can be supplied in art black, armour bright or electro-brass or bronze finish, and be fitted with trivets. Several patterns of independent electric fires are also listed, of which fig. 4 represents a typical design, with three heating elements separately controlled and giving a total loading of 3,000 watts; smaller 2,000-watt fires are also made. The elements are all interchangeable and guaranteed for two years.

THE BRITISH ASSOCIATION.—VII.

Standardisation and the Engineering Industries.

Is a paper read before Section G by Mr. C. LE MAISTRE, General Secretary of the Engineering Standards Committee, the assistance rendered by standardisation to the engineering industries was discussed. The author, after referring to the necessity for the adoption of order and system in methods of production, and the consequent movement towards co-ordination and collective effort in place of our former individualistic methods, pointed out the importance of continuous progress and of avoiding any tendency towards crystallisation of design by constant revision of the standards. "Satisfactory results have been arrived at not by one section of the community imposing its opinions on the other, but rather as the result of co-operative action, mutual concession and ultimate agreement between all the interests concerned. The adoption of standards agreed on in this way undoubtedly promotes uniformity of practice, avoidance of waste, elimination of harsh and unnecessary conditions, reduction of manufacturing costs, and last, but by no means least, engenders a feeling of mutual confidence between user and producer such as could not be secured by isolated action on the part of either."

Mr. le Maistre outlined the growth of the Engineering Standards Committee from the inception of the movement by Sir John Wolfe Barry in 1897, to the present organisation of 64 committees and sub-committees, and numerous panels, including in all over 500 members. He paid a tribute to the work of his predecessor, Mr. Leslie Robertson, to whom the success of the Committee was largely due.

As stated in the paper, not only are all parties concerned with any particular subject consulted before a decision is made, but also in some cases experimental investigations are carried out at the instance of the Committee by the National Physical Laboratory.

The British standard specifications, which are confined to the main technical clauses necessary for the purchase of the product to which the specification relates, are being increasingly adopted throughout the country, in home and export trade in general, and are also being largely substituted for the various and differing Government and municipal specifications formerly employed. They are proving of increasing value to the Crown Agents for the Colonies and the self-governing Dominions, and are, in large numbers, being sent abroad for use in the supply of engineering material required.

One of the first objects in the formation of the Committee was to simplify the rolling of steel sections for engineering structures and rails as well as shipbuilding material, so as to save unnecessary cutting of a variety of rolls for no good reason, and also to facilitate the making to stock during slack times. That the work of the Committee in this direction has been amply rewarded is shown by the fact that the number of rolls in use by British manufacturers has been largely reduced. As an instance, whereas there were formerly 70 sections of tramway rails, there are now only five. The same is true of all ordinary merchantable sections, such as angles, tees, and channels and rolled joists. The percentage of British standard tramway rails to the total tonnage rolled during the year ending March, 1915, was 75 per cent., which is an indication that the number of standards recommended is adequate to meet all ordinary requirements. A considerable reduction has similarly been effected in regard to railway rails. The railway companies, Government Departments, the London County Council, and other important bodies both at home and abroad, have adopted many of the Committee's standards.

Turning to the electrical side of the Committee's activities, a large amount of preparatory work of importance has been successfully carried through during the past two years. The most important electrical work completed is that of the Standardisation Rules for Electrical Machinery, in the preparation of which the Committee has received the cordial co-operation of the British manufacturers through their official organisation.

The conditions of the electrical industry in this country, says Mr. le Maistre, are very different from those existing either in Germany or America. In the United States two large corporations deal with practically the whole of the business, whereas here there are some 40 or 50 firms more or less in competition with one another. However, conferences held both in London and in New York with the Standards Committee of the American Institute of Electrical Engineers have resulted in the establishment of a thoroughly practical basis for the comparison of tenders for electrical machinery made

is the No. 263 dog grate shown in illustration, which is also fitted with ton standard grates, which are remote controlled. The grates are made of cast iron, and can be supplied in old brass or in iron, steel, and back iron. The company can supply any type of dog grates, designed to suit any particular type of electric heating.

Currents supply a most little stove of 1,500 watts loading, specially designed for medium voltage, A.C. circuits in crane cabins and in another type of lesser loading (800 watts) for heating workshops, trains, cars and in

The "Wilkinson" Brake.

A recent Congress of the Tramways and Light Railways Association on June 20th last, reference was made to a new brake which has been introduced by Mr. R. H. Wilkinson, general manager of the Hammersmith Corporation Tramways. This brake is a band brake attached to the extended armature shaft, actuated through levers from the usual platform brake spindle.

The brake drum, which is of cast-iron and keyed on to the motor shaft, is of open section, the arms creating a draught which assists greatly in keeping the drum cool, also reducing to a

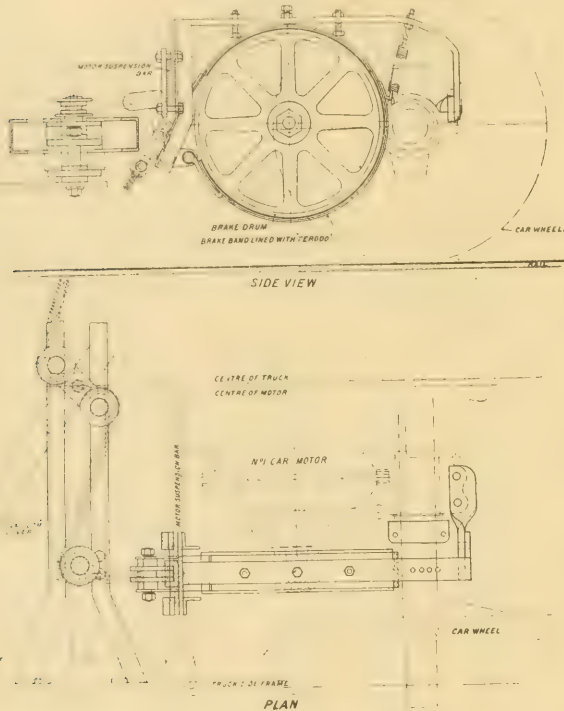


FIG. 6.—THE WILKINSON TRAMWAY BAND BRAKE.

minimum the mass of the drum wheel to facilitate rapid cooling. The brake band is of mild steel lined with "ferrod," and is in one length, attached at the ends to a bell crank lever by means of riveted lugs, one end being fitted with an adjusting screw.

The band and levers are supported by an angle iron and are attached to the motor suspension bar, and to the motor shaft at the axle bearing. A pull-off spring, and adjusting screws for regulating the clearance between drum and band, are also shown in the drawing.

The force applied to the brake-band levers is equalised by a differentiating chain gear. A chain passes freely through two fixed pulleys attached to a cross frame, and two pulleys attached to a short lever which is fixed to the main "pull" lever as shown, and moves with it. The "pull" lever is placed on the under side of the cross frame, owing to lack of clearance above, and is connected by a gudgeon to the short "pulley" lever situated above the frame. The ends of the "pull" lever are connected up to the motor brake spindle in the usual way, a hand wheel being used on the motor to operate the lever.

The brake is quickly applied, there being practically no slack to take up, as with wheel brakes. Braking through the gears, it is similar in action to the electric brake, and has proved very efficient.

We are indebted to the *Journal of the Tramways and Light Railways Association* for our particulars and illustration.

in the United States of America or Great Britain, the rules of both countries being now in agreement on all essential points.

Much also has been accomplished in one of the most difficult of tasks, the standardisation of small electric fittings with due regard to liberty in design. This work, in which again the masters' association has been most helpful, has occupied a great deal of time, and the difficulties and prejudices to be overcome have been great. Ordinary household wall plugs and sockets have at last been standardised as regards interchangeability. A specification to secure interchangeability between any charging plug and any socket of the type recommended by the Electric Vehicle Committee, should be of material assistance in promoting the use of electric wagons and runabouts. A specification for electric supply meters has recently been evolved after much labour, and although some modifications may still be required, it is hoped that it may eventually prove satisfactory to both producer and purchaser alike.

A system of British standard graphical symbols for use in electrical engineering plans is being drawn up, and in this work the Committee has the co-operation of the American and Canadian Electrotechnical Committees.

The ramifications of the Committee are extremely widespread, and the commerce of the world being largely international, it is natural that the Committee should be forced to envisage co-operating internationally. The Sectional Electrical Committee, with a different chairman, is, *ipso facto*, the British Committee of the International Electrotechnical Commission, which has branch committees in 15 to 20 different countries.

The problem of the rating of electrical machinery is, possibly, more intricate than the standardisation of any simple pieces of mechanism, electrical or otherwise. The conductivity of the copper, the permeability of the iron, the mechanical strength of the materials, can be estimated with sufficient accuracy from the results of definite and easily carried out tests on samples. Owing to their inherent properties, the insulating materials employed at present come into an entirely different category. They are governed by no well-defined laws, as in the case of the copper and iron, their properties are variable and alter largely for very small changes in the conditions of manufacture as well as those under which they are employed in the completed machine. One of the important problems, therefore, is the settling of the limits which it is considered necessary to impose in order to ensure that the principal causes of destruction of the insulating materials, the heating combined with the time element, shall be kept well within safe limits.

A clear distinction exists also between an "international standard of quality" and an "international rating." The international acceptance of the former has already been brought about by the adoption, by the I.E.C. at its Berlin meeting in September, 1913, of certain limits of observable temperature applying to the materials in general use to-day. But these limits do not offer a means of comparing directly machines from various sources, since they would not necessarily have the same temperature rise. The fact, however, that American and British electrical engineers are at one on this point of immense commercial importance, will doubtless have a great influence on the electrical industry of the world.

Every effort must be made to ensure that the British standard specifications are readily available to foreign purchasers as well as to those in the British Empire. A few of the specifications have already been translated into French, and it is hoped that satisfactory arrangements may be made to translate them all into French as well as Spanish. In regard to Russian, the question is somewhat complicated, but in this case also the matter is being given the most careful consideration.

The work which has been effected by the Committee should very materially assist in keeping the trade of our great Colonial Empire in the hands of British manufacturers. As regards the immediate future, so pregnant with vital issues to our trade, both home and export, the influential position of the Engineering Standards Committee as the central body, with its unique expert knowledge of standardisation, holds vast possibilities for good to the industry.

Some Characteristic Curves of a Poulsen-Arc Generator.

By N. W. McLACHLAN, B.Sc. Eng., A.M.I.E.E.

(Section G. Abstract.)

With a carbon-copper arc burning in hydrogen, without a magnetic blast, having a condenser (the capacity not exceeding a certain limit) and a variable inductance shunted across its terminals, there is a certain inductance and, therefore, frequency, for which the shunt current is a maximum. The present investigation was undertaken to determine whether this condition is applicable in the case of a Poulsen-arc generator: (1) When energy is absorbed in the shunt circuit by a variable non-inductive resistance; (2) when the energy absorbed in the shunt circuit is as small as possible. In both these cases there is a loss in the Moscicki condensers, this being unavoidable, unless air condensers are used.

Frequencies between 1.3×10^4 and 8×10^4 cycles per sec. were employed, the range of frequency in any experiment

depending on the magnitude of the capacity. The resistance used varied from 70 ohms to 6 ohms, and the capacity from 0.0009 mfd. to 0.009 mfd.

The current in the shunt circuit was analysed; for the various capacities tested the most prominent harmonic was the second, other harmonics being comparatively small. With a capacity of 0.0009 mfd. the R.M.S. values of the second and third harmonics were, respectively, 30 per cent. and 9 per cent. that of the fundamental when the frequency was 3×10^4 cycles per sec.

Full details of the experiments were given in the paper, and the author arrived at the following conclusions:—

1. With fixed capacity and frequency there is a certain resistance giving maximum power absorbed in the shunt circuit. There is also a certain resistance for which the efficiency of the arc is a maximum; but the resistance corresponding to maximum power is smaller than that corresponding to maximum efficiency.

2. With fixed capacity and fixed resistance in the shunt circuit there is a certain inductance, and therefore frequency, for which the power obtained from oscillations of fundamental frequency is a maximum.

3. With given resistance and frequency, the power obtainable in the shunt circuit (both total power and that due to oscillations of fundamental frequency) and the efficiency of the arc increase with the capacity; but with larger capacities (of the order of 0.00368 mfd. and upwards) the burning, especially with small inductances, is apt to be irregular and noisy—i.e., when the ratio L/C is small.

4. When the power absorbed in the shunt circuit is very small, the capacity being fixed and not exceeding a certain limit, there is a certain inductance, and therefore frequency, for which the shunt current is a maximum. For capacities beyond a certain limit there does not appear to be any definite maximum value.

5. A diminution in the strength of the magnetic blast does not cause any appreciable alteration in the maximum power and maximum efficiency. The maximum power occurs at a lower frequency, and more power is obtainable at lower frequencies than with a stronger blast.

6. A diminution in the strength of the magnetic blast does not cause any appreciable alteration in the fundamental frequency of the oscillations in the shunt circuit; but there is a tendency for the second harmonic to increase with capacities of 0.00368 mfd. and upwards.

7. The most prominent harmonic in the shunt circuit is the second, thereby showing the existence of an asymmetrical current wave. This harmonic for any given capacity increases with decrease in inductance, and therefore increase in frequency. For a given frequency the second harmonic increases with the capacity.

8. The insertion of resistance in the shunt circuit causes the burning to be less regular than it is without resistance. The irregularity of the burning increases with increase in the resistance.

In order to ascertain whether the loss in the Moscicki condensers had any considerable effect on the power obtained in the shunt circuit, an air condenser was arranged to have the same capacity at high frequencies as one of the Moscicki condensers. It was found that the loss in the Moscicki condenser was sufficient to cause a diminution in the power expended in the shunt circuit in some cases exceeding 15 per cent.; but this did not invalidate any of the conclusions given above. The capacity of the Moscicki condenser at high frequencies was found to be 21.5 per cent. less than the capacity found by ballistic experiments.

Pressure Oil Film Lubrication.

By H. T. NEWBIGIN, A.M.I.C.E.

(Section G. Abstract.)

WITHOUT lubrication a bearing will not run without excessive wear, and without artificial cooling no bearing with oil lubrication will run continuously if the temperature rises above 150 deg. F., because at about this temperature most oils begin to carbonise. The efficiency of a bearing must therefore be such that the temperature due to the heat generated by its friction, minus that dissipated by radiation and conduction, does not exceed this figure.

The action of a lubricant is twofold; it first of all alters the nature of the rubbing surfaces, thereby reducing friction (and this is the commonly accepted justification for its use), but under favourable conditions it goes much further than this and automatically generates a high-pressure oil film between the surfaces, entirely eliminating metallic contact and thereby enormously reducing the friction. This is what is now called "pressure oil film lubrication." It occurs to a limited extent in most journal bearings, but does not occur in ordinary collar thrust bearings.

The phenomenon of pressure oil film lubrication was first noticed by the late Mr. Beauchamp Tower. Following on Mr. Tower's experiments, the late Prof. Osborne Reynolds, F.R.S., showed that the friction under the circumstances was merely that due to the viscous flow of the oil. From the practical point of view the most important things that he showed

First, that in order to obtain a pressure oil film between lubricated surfaces the surfaces must have a slight inclination

to each other, with the opening at which the oil enters greater than that at which it leaves. Or, in other words, that the oil film must be wedge-shaped.

Secondly, that in the case of a journal bearing the wedge form of the oil film occurs naturally, due to a slight shifting of the centre of the shaft in relation to the centre of the brass.

Thirdly, that such a wedge-shaped oil film cannot occur in a collar-thrust bearing; hence their inefficiency and low carrying capacity.

It was left to an Australian engineer and mathematician, Mr. A. G. M. Michell, of Melbourne, not only to complete Reynolds's theory, but also to show how its teaching can be applied in practice. On the assumption that the thickness of the oil film at the entering edge is twice as great as at the leaving edge, he showed how lines of equal pressure within the film can be plotted and how the centre of resultant pressure can be determined for plane rectangular surfaces of varying proportional cross dimensions. He also demonstrated practically that a rectangular block pivoted at its point of resultant pressure will automatically assume an angle to an opposing lubricated surface, depending on the speed of rubbing, viscosity of the oil and pressure. On this principle he founded his now well-known thrust bearing.

The result of Mr. Michell's work has been to enable lubricated thrust and journal bearings to be designed with the principles of oil film lubrication as a basis, in the same way as ball and roller bearings are designed with the ball or roller as a unit, and as distinguished from the mere application of oil to the primitive forms of these bearings. The essential feature of the Michell bearings is the subdivision of the stationary surface into a number of blocks or pads, each pivoted at its back, and so free to assume a slight angle with its contacting surface. Bearings designed on this principle differ radically from the primitive forms of journal and thrust bearings, but the results obtained in practice have fully justified the change.

Taking the case of the thrust bearing first, the Michell thrust bearing differs from the older type in having only one collar, the multiplicity of collars in the older type having been necessitated by the low carrying capacity of parallel rubbing surfaces, as distinguished from the high carrying capacity of those in which the fixed surface is subdivided and made free to assume the angle to the opposing collar necessary for the formation of oil pressure within the film.

The Michell thrust bearing has a coefficient of friction of about 0.0015 as against 0.03, and carries 200-300 lb. per sq. in. with a much greater factor of safety than the primitive form has at 50 lb.

The subdivision of the fixed surfaces into a number of segmental tipping blocks or pads is the essential feature of all thrust bearings made on this principle, but there are many variations in the design of the housing and method of carrying the tipping blocks, depending on the particular use to which the bearing is to be put.

In the case of the thrust bearings in steam turbines the blocks are symmetrically disposed around the faces of the collar, and each series is mounted on a ring partly spherical on one face, the convex surfaces of which are outward and rest on correspondingly spherical seats for the purpose of automatically distributing the load among the blocks. The blocks are mounted on the faces of the rings next the two sides of the collar against which they pivot, either along radial lines or on rounded pins.

This type is entirely enclosed, and is supplied with an oil circulation by means of an independent pump. The oil passes through an oil cooler on its course, thereby removing the heat generated by friction from the actual surface of its origin. The mean rubbing speed sometimes exceeds 100 ft. per sec. Slow-speed bearings are made on the same principle, with grease lubrication.

Upwards of 800 Michell thrust bearings are now running in this country alone, in sizes varying from 1 to 15 in. dia. of shaft, and larger sizes are in course of construction. The use of them is rapidly becoming standard practice in steam turbine work. The same principle is now being applied to journal bearings.

In lubricated journal bearings of the primitive type the phenomenon of pressure oil film lubrication is much less marked in the case of bearings of large diameters, probably owing to the greater oil clearance that is necessary in large sizes and to the extreme thinness of the oil film. For example, a journal bearing of 2 or 3 in. in diameter will run satisfactorily under a pressure of 300 to 400 lb. pressure per sq. in., but it is not found advisable to load large bearings above 100 lb., even with a forced oil circulation.

The pressure oil film only occurs along a narrow strip in the primitive type, and the remaining surface merely forms a brake on the rotation of the shaft, so that the designer is again restricted and can only reduce the pressure to the limit found safe in practice by increasing the length of the bearing. But by subdividing the circumferential surface into a number of segments, each of which is pivoted at its back, and thereby free to form an independent pressure oil film between its rubbing surface and the shaft, the number of the pressure oil films can be increased, so that the full projected surface of the bearing becomes effective for carrying load, and the brake surface is eliminated. The friction is thus reduced, the load carrying capacity increased, and the bearing shortened.

A series of tests has recently been run on a Michell journal bearing by Messrs. Cammell, Laird & Co., Ltd., Birkenhead. The bearing surface is divided into 12 segments, each of which is pivoted on a rib at its back, so that it is free to lift at its leading edge to allow the necessary wedge-shaped oil film to form. The faces of the segments or blocks are lined with white metal, each surface being 2 in. square, giving 48 sq. in. of rubbing surface, the equivalent projected area of each half of the bearing being 16½ sq. in.

In addition to the segments being free to tilt, the seat on which they rest is partly spherical, thereby making the bearing also a swivelling one. A circulation of oil was passed through the bearing; each run was continued until the oil temperature ceased to rise. The ingoing and outgoing temperatures of the oil were also recorded, together with the weight of the oil passing, and the R.P.M.

The following are the results observed, together with the friction calculated from the heat taken up by the oil. The

TEST OF EXPERIMENTAL "MICHELL" JOURNAL BEARING.
MAY, 1916.

Duration of test.	Bearing pressure.	Revs. per min.	Surface speed.	Oil supply.		Friction h.p. from heat to oil.	Coefficient of friction.
				Rise of temp. F.	Flow of oil.		
[Mins.]	Lb. per sq. in.		Ft., min.	Deg.	Lb. min.		
105	145	620	1,950	20	14.8	2.8	0.0099
15	520	605	1,900	16	19.0	2.9	0.0029
30	900	620	1,950	25	22.7	5.4	0.0031
60	145	1,320	4,140	22	26.4	5.5	0.0091
60	520	1,303	4,100	35	33.0	10.9	0.0051
30	900	1,320	4,140	41	33.0	12.7	0.0034

friction is that for the two halves of the bearing pressed together. To get the coefficient of friction these figures require to be divided by twice the load.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

To Go- or Not to Go?

Referring to the recent correspondence on station engineering as a profession, I am, sure I do not agree with some of your correspondents' views. "East Coast" regards all electrical plant-running as child's play, his sole reason being that machinery is now so standardised and perfected automatically that any unskilled labourer can operate it. May I ask, has "East Coast" ever had anything to do with the operation of generating station or sub-station gear, especially some of the older systems? The reason I ask is that I have usually found that the men who decry such work as "easy" and "unskilled," are the first to do damage when they do get the chance of operating a little on their own. I have in mind a very recent instance.

Again, another correspondent says he cannot expect to find much technical ability in a switchboard attendant—"a man who inspects his bearings every hour, and occasionally replaces a burnt-out lamp." No doubt, this gentleman is suffering from the same delusion as "North-East Coast," unless the switchboard he was on (if any) was one of those volt-pushing and "let-the-shield-engineer-do-it" affairs on which we find women feeling so proud of themselves. It is true we do find many of the so-called practical men about—men who close a switch because someone else told them it was right to do so; but let some of them be put in charge of a type of plant with which they are unfamiliar, and they will soon be all at sea.

Very true, there is, unfortunately, nothing much in station work as a permanent profession; but why run it down as useless, merely because it is no good financially? For my part, I admire the "young man who goes from job to job trying to pick up all he can." How can he get his experience otherwise?

My opinion is that a man who has had a few years about the stations has learned discipline, self-denial, patience, alertness, nerve and resourcefulness—not to mention many technical points other beginners might miss; and even if he has had to do with a meagre wage, he has a better electrical knowledge with which to get a good job than some of the other so-called electrical engineers and electricians.

D. F. B.

Linking-up Electricity Works.

In the memorandum published by the Joint Committee appointed by the I.M.E.A. and the I.A.E.P.C. to consider the question of the linking-up of electricity supply undertakings, Appendix B contains a diagram showing the average working day load curves of A, a power station having a maximum load of 3,000 kW., and B, a power station having a maximum load of 20,000 kW.

The curves showing the distribution of load after linking-up these works are not what would be obtained in actual practice; A

is shown as taking up 2,800 kW. at 1 p.m., and dropping this again at 9 p.m., and B as dropping this load at 1 p.m. (2,800 kW. sudden extra drop in the dinner-hour "valley"), and then on a rapidly falling curve doubling its load at 9 p.m.

In actual working A would pick up about 500 kW. at 1 p.m., and gradually work up to 2,800 kW. by 2 o'clock; this would materially assist B by making the after-dinner "load-climb" rise at an easy angle. In a large station this after-dinner climb is one of the most trying periods in the day's running. Then at 8 p.m. A would commence to regulate its supply off with the falling load until it could shut down at 9 p.m., the load on B remaining stationary between 8 p.m. and 9 p.m. instead of, as shown in diagram, falling from 7,000 to 3,000 kW., and rising again to 5,800 kW.

J. Y. M.

LEGAL.

P.O. TUBE RAILWAY AND COMPRESSED AIR.

At the Surveyors' Institution, Westminster, on Monday, Mr. Alexander Ross, as Arbitrator, heard a case in which the parties were the Great Eastern Railway Co. and the Postmaster-General, which raised an important point as to the use of compressed air in a portion of a tube railway which will run under the hotel and part of the general offices at Liverpool Street Station, and which is being constructed from Paddington to Whitechapel, on behalf of the Post Office, for the carrying of mails. The Great Eastern Railway contended that compressed air was necessary as an additional safeguard. On behalf of the Postmaster-General, it was submitted that compressed air was quite unnecessary.

Mr. G. M. Freeman, K.C., appeared for the Great Eastern Railway, while Mr. A. F. Walter, K.C., and Mr. Rowland Burrows represented the Postmaster-General.

In opening, Mr. FREEMAN said the Railway Co. desired the use of compressed air as an additional safeguard by reason of the peculiar nature and character of the property concerned. It was peculiar because of its enormous public importance and its physical construction. Enormous pressures were brought to bear upon the supporting columns, and at one end the whole was carried on one continuous girder, so that if anything happened the consequences might be disastrous. Not only would there be tremendous pecuniary loss, but also great public inconvenience, and possibly danger.

The first witness was Mr. BASIL MOTT, who said that, in his opinion, this was exactly one of the cases where compressed air ought to be used. If a movement began in one of the pillars, it might be a very difficult matter to check.

In cross-examination, Mr. MOTT, replying to a suggestion that the clay at the spot in question was extremely hard, and some of the finest clay to be found, said, in his opinion, it was exceedingly difficult for anybody looking at clay to say whether it was liable to give movement or not. The clay was not exceptionally good under Liverpool Street Station; in fact, he thought it was of a bad character, and he had used compressed air there himself. He had carried out tunnels in close proximity to Liverpool Street and had had movement. Then he had put on compressed air and the movement had ceased. He had come into "pockets" in the London clay at a depth of 40 ft.

MR. HORACE WILMER, chief engineer of the Great Eastern Railway, said the portion in regard to which the use of compressed air was desired was 462 ft.—about one-third of the whole interference with the company's property. The height of the hotel was about 100 ft. above rail level, and the height of the offices was about 95 ft. above rail level. If the tube did any damage the Postmaster-General was responsible, but in Witness's opinion this was a case in which the railway company ought not to be exposed to any sort of risk. No compensation would pay them for the driving away of passengers and general dislocation of business.

In cross-examination, the WITNESS said he understood that the Postmaster-General's view was to save a few thousands and damn the consequences. The buildings in question cost the railway company nearly half-a-million. At one point on the spot in question the weight was 43 tons to the sq. ft. The Central London Railway under Liverpool Street Station was carried out with compressed air.

MR. C. L. MORGAN, chief engineer of the London and Brighton Railway, said, in his view, the tube under the area in question should be constructed with compressed air. The total load of the buildings was 10,000 tons. It was well known that the work could be carried out much more safely with compressed air than without it. Blue clay gave as soon as the air got to it.

This was the case for the Great Eastern Railway.

On behalf of the Postmaster-General, Mr. DALRYMPLE HAY, the engineer of the work, said the railway at present had reached a point between Blomfield Street and New Broad Street—a distance of about 400 ft. from the southern face of the hotel. He produced samples of clay taken that morning on the Whitechapel side and the Finsbury side. Having had to do with some 45 to 46 miles of tube railways, he thought he could say these were very hard samples of clay. They were constructing tunnels varying from 7 ft. to 29 ft. diam. They had used compressed air on no part of the railway where the tunnels had been wholly in the London clay. They had used compressed air in the neighbourhood of Mount Pleasant, where the material was the worst he had ever seen—what was called redeposited clay. They had successfully gone under King Edward's Buildings, and the proposed work was child's play com-

pared to this. In his view, compressed air would not serve any useful purpose.

In cross-examination by Mr. FREEMAN, Mr. HAY said a firm of contractors had estimated the cost of compressed air at £10,000 to £12,000. He did not see why the public should spend £12,000 when it was not necessary.

Evidence was also given on behalf of the Postmaster-General by Mr. J. D. Middleton, chairman and managing director of Messrs. Walter Scott & Middleton, contractors for public works, and Mr. Elliott Cooper, and, on the termination of the inquiry, the Arbitrator arranged to visit the station and the workings.

The Arbitrator will announce his decision in due course.

WORKMEN'S COMPENSATION CASES.

At the Westminster County Court, when a wireman sought compensation on the ground that he could not do his work, it was stated by Major Malcolm Nicholls, a consultant to St. Bartholomew's Hospital, that the man had only lost the ring finger of the left hand. He could certainly do work; indeed, men like him were needed for hospital work, and they could not be found. He could get him employment at once at from 30s. to 35s. per week. According to the *Daily Telegraph*, Major Nicholls said that he had seen men who had lost three fingers working well in hospital. "We cannot get the men, and, if we are to win the war, everybody must help. The loss of a finger will not prevent a man doing some work. Men have gone back to the Front after losing even two fingers or an eye."

In the Supreme Court (Appellate Division), (Cape Town, on September 12th, judgment was given in a case in which the dependents of a workman named Schurmann claimed £500. Schurmann was an employé of the Victoria Falls and Transvaal Power Co., Ltd., and his death occurred while he was working in a live chamber at Rosherville power station, last April. The company repudiated liability, on the ground that the accident was attributable to deceased's own serious and wilful misconduct.

The CHIEF JUSTICE, in a very lengthy judgment, came to the conclusion that the accident was attributable to the serious and wilful misconduct which had been brought home to the deceased. His injuries were sustained through his entering and working in the live chamber in contravention of the regulations. In giving judgment for the company, the Chief Justice said the company, having been vindicated, might well award suitable compensation; but he could not allow his strong sympathy for the dependents to lead him to strain the law in their favour.

WHEATSTONE-MORSE TRANSLATING MACHINE.—PETITION FOR PROLONGATION OF PATENT.

The petition of F. G. Creed, Wm. A. Coulson, and Creed, Bille and Co., Ltd., Telegraph Works, East Croydon, electrical engineers, the beneficial owners of a patent granted to Messrs. Creed and Coulson, was mentioned to Mr. Justice Sargent, in the Chancery Division, on Tuesday, on an application to fix Wednesday, November 1st, for the hearing of the petition. The invention for which the letters patent were granted consisted of "improvements in or relating to means or apparatus for operating or controlling type-writing and type-setting mechanism by means of perforating tape." The object of the invention was to reproduce telegraphic messages in ordinary readable printed characters, and the system of telegraphy to which the invention was applicable had long been known as the Wheatstone-Morse system. Mr. AUSTEN CARTNELL, for the Board of Trade, said the proposed date would suit all parties, and his Lordship acceded to the application.

WAR ITEMS.

Technical Instruction of Women Workers.—The Higher Education Committee for Wimbledon and District has decided to utilise its new engineering department at the Technical Institute solely for the instruction of women for munitions work.—*Times*.

Employment of Women in Electricity Works.—The Marylebone Electricity Committee reports that for some time past it has engaged women to carry out the following duties:—Junior engine drivers, volt regulators, storekeepers, clerks, lamp-lighters, meter testers, prepayment meter collectors, and maintenance attendants.

Tramways as Certified Undertakings.—The Ministry of Munitions has placed the Colchester Corporation tramway undertaking under the head of certified undertakings.

The Ministry has also issued a certificate that the supply of tramway facilities by the L.C.C. tramway department is of importance for the purpose of carrying on munitions work. The effect of such a certificate is that the undertaking will be subject to the provisions of Part I of the Munitions of War Act, 1915, which prohibits strikes and lock-outs, and the provisions as to leaving certificates will apply to employé in the tramway department. Under Section 4 of the Munitions of War Act, 1915, the Minister of Munitions may declare certified undertakings to be controlled establishments. The Minister has stated, however, that, as at present advised, he does not propose to take this course in the case of the Council's tramways.

had been passed for labour abroad. He was directed to go before the Medical Board in London.

Exemption given to a lighting fitter at Lydbrook Electric Cable Works was appealed against by the Military at the Gloucestershire Appeal Court. It was stated that the company employed 250 persons, including 175 women, and were engaged making field telephone wires. The cable made was for important purposes, and the man appealed against had been at the works for eight years, and was well skilled in all branches of the manufacturing work. If he was taken the night shift would be stopped, and this would considerably delay the output of the heavy cable so urgently needed. The Chairman (Mr. F. A. Hyett) said he thought the case was one where the Military should supply a suitable substitute, and time would be allowed for this to be done.

Eastbourne Tribunal has given conditional exemption to two leading stokers at the Corporation electricity works, and eight weeks' exemption to the personal assistant to the electrical engineer (Mr. J. K. Brydges), the latter being advised in the meantime to obtain a lady assistant.

The Clerk to the Aldershot U.D.C. appealed, on October 3rd, for the retention of Mr. S. Alder (34), engineer in charge of the electric power station at the sewage works, passed in Class B1 after rejection on attestation. It was stated that he was an expert engineer and fitter, and was in charge of the electric pumping plant, &c. The station was working day and night, and it was essential that Mr. Alder should be retained in the interests of public health. Two months were conceded.

At Aldershot, on October 3rd, the Aldershot and District Traction Co. appealed for two drivers, who were ordered to be called up in a month; another driver, appeal dismissed; two other drivers, put back for medical examinations; a foreman coachbuilder, given three months; a driver, given a final month; and two other employees, who were refused time.

An electrician (33), in business at East Street, Prittlewell, appealing for further exemption, stated that his partner and six men had joined up. He himself had very bad health, and for 10 or 12 years had been strictly dieted. Col. Newitt said that garrison duty abroad would suit the applicant. The Tribunal gave until January 1st, with a further medical examination before that date.

At Hastings, further exemption was sought by Mr. R. H. Pattenden (36), electrical engineer. A firm for whom appellant does all their electrical work supported the claim. Appellant, who is passed for garrison duty abroad, was given conditional exemption, without time limit, on joining the Volunteers.

At Southend-on-Sea, the Corporation applied for exemption for a tramcar driver (30), who had been on the staff for nine years, and an inspector (33), with 11 years' service. Both were exempted as being in certified occupations, and ordered to drill twice weekly.

Ilfracombe Tribunal have given certificates of conditional exemption to Mr. H. J. Stewart (33), resident engineer and manager of the Electric Light & Power Co., and A. J. Rudd, a member of the staff, both being held to be in certified occupations.

At a sitting of the Broadstairs Tribunal, on October 10th, the Isle of Thanet Electric Tramways and Lighting Co., Ltd., applied for 15 employees, the manager and secretary, Mr. Forde, stating that before the war there were 270 employees, and now, with females and boys, there were only 119. Those applied for were two inspectors and drivers, a storekeeper, a steam-engine driver, seven drivers, and four men in charge of sub-stations. Asked if women could not act as drivers, Mr. Forde said he believed the Board of Trade would not sanction such a proposal for their system. If the Military could provide substitutes he would withdraw the appeal. Four drivers were given conditional exemption, one three months, and the other two were refused; the inspectors were conditionally exempted; the storekeeper was allowed six months, one sub-station man was conditionally exempted, and the other three allowed three months each; and conditional exemption was conceded to the steam-engine driver.

At Oxford, Messrs. W. Lucy & Co., manufacturing electrical engineers, appealed for David G. French (19), brass fitter and finisher. The case had been put back for a badge to be applied for, and the firm's manager (Mr. Magin) said that the Ministry of Munitions had badged the man. Captain Fox remarked that the Tribunal would find that French would be called up, although badged. The Town Clerk explained that men for munitions were equally as important as men for the Army, and the badge was dated September 12th. Mr. Magin pointed out that French was only passed for home labour. The Tribunal decided that they had no jurisdiction in the case.

The Lancashire Electric Power Co. appealed, at Swinton, for the retention of an overhead linesman, aged 21. The company's representative said that 11 out of 15 overhead linesmen had enlisted, and if any more were taken he did not know what they would do. Exemption was refused.

An electrical engineer, aged 38, appealing at Eastbourne, said that his only assistant was a boy of 13. His solicitor mentioned that at Enfield six months were given to the owners of one-man businesses, but the Chairman said that they were not bound by what other Tribunals did. Appellant was given until December 31st, with no further appeal without leave.

At Reigate, exemption was claimed for Chas. Morgan (29), shift engineer at the Corporation electricity works. Mr. W. S. Ross, electrical engineer, said they now had only three shift engineers, and they had not had a single reply to advertisements for a man to take the place of Morgan. Temporary exemption until January 1st was granted.

At the Atherton (Lancs.) Tribunal, a mill electrician was granted temporary exemption on condition that he joined the local V.T.C. He explained that he was working late each night and could not attend drills very regularly. He was instructed to attend at least once a week.

At Dewsbury, on Oct. 11th, an electrical engineer, whose partner is in the Flying Corps, was given conditional exemption.

At Sheffield, on Monday, exemption until March 31st was granted to H. J. Burdett (40), electrical engineer, appealed for by Messrs. W. Johnson & Co.

At Bath, on Monday, A. C. Brackstone (39), electric fitter with Messrs. R. Kendall & Sons, passed for C.3, was conditionally exempted subject to his joining the Volunteers.

The Aysgarth (Yorks.) Tribunal granted conditional exemption to the manager of the electrical generating station at the Hawes Wensleydale Dairy so long as he remains in his present occupation.

BUSINESS NOTES.

The Australian Market.—The electrical position of affairs in Australia as it appears to American eyes is explained in the following extracts from a recent report by U.S. Consul W. C. Magelssen at Melbourne.

"While the motor field presents the most apparent attractions at the present time, it is also typical of other industrial lines. Victoria is now in process of electrifying her metropolitan railway system, is considering, in common with the other States, a scheme for the bulk handling of grain on the State-owned railways, and is rapidly developing a system of electric tramways in all the suburban towns of Melbourne, and the principal country towns. In addition, electrical machinery and equipment are required for the lighting of provincial towns, and contracts are pending for the extension of irrigation works, the locking of the river Murray, Australia's longest river, which is the boundary between Victoria and New South Wales, and water conservation works in various parts of the country, requiring concrete-making machinery and steel rods for the construction of dams and conduits.

"Although the whole value of the Commonwealth's imports from Germany in the year before the war did not greatly exceed \$34,065,500, great inconvenience has been caused by the cessation of imports from Germany. The chief trouble has been experienced in the electrical and engineering trade. Lately steel production was begun at Newcastle, New South Wales, where the Broken Hill Mining Co. has established modern smelting works, getting the necessary ore largely from the Iron Knob, near the headwaters of Spencer's Gulf in South Australia; but prior to the war the whole output of this concern was practically bespoken for various railroad extensions under the States' Governments, and for the great trans-Continental line now being constructed by the Commonwealth Government through the States of South and Western Australia, to link up the two sides of the continent.

"This leaves Victoria once more dependent on the outside world for supplies of railroad and constructional steel, and for all classes of machinery, implements, tools of trade, &c., except such as are manufactured in Melbourne from imported metal. In the manufacture of electrical goods the State had not made much progress before the war began, and great dependence was placed on German firms to keep the workshops supplied with the goods necessary for the extension and maintenance of electrical plants of all kinds.

"The railroad electrification scheme, which is expected to cost approximately \$29,199,000 complete, has been mainly entrusted to British engineers to execute, but the war work in England has left them in no better position as to supplies than it has left others, and as a result, the enterprise has been retarded, and there is at time of writing no definite conception as to when it may be finished. Lack of material is the reason for the delays. Bent on a policy of economy, the Government has taken the opportunity to stop temporarily some of the regrading and other work associated with the electrification scheme, but inability to get supplies is the root cause of the reduction of energy in this important public enterprise. Since the energies of Europe are concentrated upon the war, and will be afterwards directed upon the rebuilding of shattered towns and industries, the Victorian electrification scheme is likely to drag, unless the required equipment can be brought from America.

"As all public services in Victoria are in the hands of the Government or the Municipal Councils, the initiation of new works rests with them, and not with private corporations. A notable exception existed in the Melbourne Tramway Co., which has been allowed to the end of its 30 years' lease of the central metropolitan roads. Its system of cable cars, now out of date, radiates from the centre of the city to all the suburbs. The lease is falling into the hands of a public trust, which will carry it on as at present until the war is over, and then adopt electric traction. Linking the outer suburbs is a ring of municipally-owned electric trams, and these will be joined with the central cable tracks, and the whole will be controlled by the Public Trust.

The main supply is from where the roads were originally chartered with a string of property represented on the trust and on their end they expect the future funds will be raised for the electrification of the main system and the extension of the outer suburban routes already operated by electric power.

In other directions municipal control is now being strengthened. With a population of 650,000 inhabitants, Melbourne is divided under the control of 24 Councils, but the central City Council is now proceeding to absorb the inner suburbs piecemeal. Controlling the greater part of the tram lines, and having its own electric plant, the central body has the power of large expenditure on municipal services. No important contracts are offering at present, but works in view will entail importation of electrical and railway equipment.

British Manufacturers and Australian Tariffs on Electrical Goods.—A deputation from the Australian Association of British Manufacturers and their representatives waited upon the Minister of Customs at Melbourne in August respecting tariff matters. According to the *Melbourne Age*, Mr. M. C. Contes, president of the Association, submitted a number of requests and suggestions for increased preference to Britain. On electrical goods he asked for an all round preference of at least 10 per cent., and suggested that all foreign invoices should be loaded 25 per cent. for duty purposes, and then preference of 10 per cent. given on British goods. With regard to metal-filament lamps he suggested that the duty should be based on watts, high-wattage lamps to be counted as two, three or more lamps, according to power. The present preference of 10 per cent. on lampware, brass tubing and gas manifolds, and 5 per cent. on electric globes, brassware and oil engines, was considered insufficient.

Mr. J. K. Merritt, M.L.C., said it was necessary, after winning the war, that an effort should be made to build up the trade and industries of the Empire. Whilst British manufacturers were engaged in making munitions, the Americans and Japanese were capturing the markets. They were not to be blamed, of course, but their activity was creating greater difficulties for the future from the British manufacturing standpoint. American manufacturers were dumping goods in Australia at cheaper rates than those prevailing for the same articles in America.

The Minister, in reply, said that the first duty of the Government and the Parliament was to see that Australian industries were effectively protected. Although the first duty of the Government was to watch over Australian duties, it would not lose sight of its second duty towards the Empire. As a result of the war the Empire had been drawn much closer together, and the need for Imperial preference would not be lost sight. Regarding the need of blocking enemy goods, his experience was that it was almost impossible to sell enemy goods at the present time. Enemy goods condemned by the Prize Court had come into possession of the Customs Department, and they had to be sold in accordance with the Act, but he was afraid that they would realise a very poor price. People would not buy goods when they knew that they were of enemy origin.

National Insurance Act. CORRECTION. In the article by Mr. J. H. Stansfield, which appeared on p. 369 of our issue of October 6th, No. 1,785 decision should have appeared in the preceding section dealing with classes of employment for which contributions are payable.

Catalogues and Lists.—THE PATERSON ENGINEERING CO., LTD., Windsor House, Kingsway, London, W.C.—1916 edition of the Paterson Red Book on water purification for industrial purposes. The book deals with the following matters: Sources of water supply; rapid filtration; water softening; and oil elimination. An abridged list of users is given. Some excellent pictures in half-tone and in colour show the Paterson filters, softeners, &c. The Government has requisitioned the company's premises, India House, Kingsway. Its temporary address is, therefore, Windsor House, as above. Copies of the catalogue can be obtained by all interested in these appliances.

INTERNATIONAL TIME RECORDING CO., LTD., 57, City Road, London, E.C.—Folder pamphlet, giving illustrated particulars and prices of their various models of time recorders.

BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., Trafford Park—Instruction Book No. 5390 (62 pages), relating to the installation and operation of the British Westinghouse rotary converters.

Dissolutions and Liquidations.—RESISTO ELECTRICAL MANUFACTURING CO., LTD.—This company is winding up voluntarily, with Mr. De Westley Layton, 167, Fenchurch Street, E.C., as liquidator. A meeting of creditors is called for October 20th.

DERBY ELECTRICAL CO., LTD.—A meeting is to be held at the offices, Woods Lane, Derby, on November 18th, to hear an account of the winding up from Mr. J. Perry Jones, the liquidator.

CHAS. H. BLUM (an enemy subject).—Creditors of this business must send particulars of their claims to the controller, Mr. J. W. Barrett, 19A, Coleman Street, E.C., by November 16th, certain.

CHARLES COOPER, plumbers and electrical engineers, 2, King Street, Stratford, Manchester.—Messrs. H. & P. Cooper have dissolved partnership. Mr. H. Cooper attends to debts, &c.

SWEDISH CABLE CONSTRUCTION CO., LTD. Creditors must send particulars of their claims, &c., to the controller, Mr. J. H. Stephens, 6, Clement's Lane, Lombard Street, E.C., by November 15th.

Trade Announcements.—MESSRS. JAMES SCOTT, LTD., electrical and mechanical engineers, of Bootle, have opened branches at 317, Victoria Dock Road, London, E., and 27, West Bank Street, Cardiff, under the management of their Mr. E. J.

Rimmer and Mr. T. W. Plunkett respectively, who have had lengthy experience in electrical work aboard ships. The firm will keep a large stock of electrical ships' requirements.

MR. L. DARLEY, of Messrs. Hopkins & Darley, electrical engineers, St. Alban's Road, Watford, having left for military service, announces that the business will be continued under the management of his wife.

LIGHTING AND POWER NOTES.

Australia. The Queensland Government has approved of an irrigation scheme for Inkerman, near Bowen, at a cost of £131,000. The estimates for the scheme are:—Preliminary work, £16,500; lifting appliances, £30,000; power station, £39,800; distributing network, £38,100.

Tumut (N.S.W.) has decided to install an electric supply plant.—*Commonwealth Engineer.*

The Albury electric lighting scheme, designed by Mr. W. Corin, chief engineer of the N.S.W. Public Works Department, is nearly completed. Electricity will be generated at 3,000 volts, three-phase, and stepped down to supply a 415-240-volt, four-wire distribution system. The distributing cables total about 80 miles, and are of aluminium, and street lights will be controlled by automatic time-switches. The original estimate of cost of the scheme was £11,000, but, owing to war conditions, it is estimated that the cost will be about £20,000.

Barnsley.—In connection with the proposed supply of electricity to houses in Mount Vernon Road, the Electricity and Lighting Committee has recommended that negotiations be opened with the Electrical Distribution of Yorkshire, Ltd., for its sanction to the issue of a Fringe Order under Section 6 of the Electric Lighting Act, 1909, or alternatively for the supply of electricity in bulk at the borough boundary on suitable terms.

Birmingham.—COOLING TOWER PLANT.—The Electricity Supply Committee reports that it has not been found possible to place the cooling towers for the Nechells temporary generating station on the site originally proposed, and they are to be erected on a portion of the land intended for the permanent station. The total extra cost is estimated at:—(a) Cooling pond and tower foundations, extra, £150; (b) alterations to railway sidings, £550; (c) pipe line, valves and supports, including supporting bridge across the River Rea, £6,830. The Committee recommends that the alteration be approved, and that application be made to the L.G.B. for sanction to the necessary loan.

Bradford. PROGRESS REPORT. In a report on the work of the electricity undertaking during the municipal year ending this month, the Electricity Committee mentions that the total output for the year was 33,905,136 units, an increase of 5,161,418 units on the preceding 12 months, being the highest increase so far recorded. Bulk supply accounted for 3,157,521 units and motive power and heating 1,887,661 units of this increase. Private and public lighting and night supply to the tramways fell off, but these decreases were practically counterbalanced by additional day supply to the tramways. The income for the period was £167,177, an increase of £19,438; but, due to increased expenditure and additional capital charges, the net profit was £15,988, or some £3,000 less than in the previous year. Out of this, £7,500 was placed to rate relief, the remainder being applied to depreciation. Early this year it was considered necessary to extend the steam and electrical plant at Valley Road, at a cost of, roughly, £50,000 in each case: only the extension to the boiler and cooling plant was approved, and a subsequent application for sanction to the raising of £100,000 for additional generating plant and transmission extensions were also refused by the L.G.B. During the year a 5,000-KW. turbo-alternator has been put to work, also two 1,500-KW. rotary converters, while an older rotary has been replaced by a modern 1,500-KW. set.

The boiler house and cooling tower extension is progressing, and although it will not be complete for three months, it is hoped to use one boiler during the coming heavy-load periods. The Thornbury sub-station has been extended in connection with the supply to the Yorkshire Power Co.

In order to relieve the congestion at the works caused by horse-drawn vehicles delivering coal, the coal in some weeks amounting to 50 per cent. above that required in the corresponding period last year, two 5-ton electric tipping wagons are being procured: for ash disposal a 3½-ton electric tipping wagon is also in use. Ten additional transformer chambers have been equipped, making a total of 45; 65 transformers of 10,000 K.V.A. are in use in them. A total of 67 miles of underground and 3 miles of overhead E.H.T. transmission is in use. Seven new bulk agreements and three renewed agreements represent a total of 6,851 KW., mostly new business obtained: the half-year to September 30th showed an increase of 5,000,000 units sold on the corresponding period of 1915, being equal to the increase of the whole of the previous year, and it is anticipated that the rate of increase will be maintained.

Bury.—LOAN SANCTION.—The L.G.B. has sanctioned the borrowing of £600 for the cable required to give a supply of current to a local works.

Canada.—The fifth annual report on the working of the Toronto hydro-electric system (for the year 1915) shows a gross income of \$1,629,187, while working expenses amounted to \$979,208.

leaving a gross surplus of \$640,978; deducting interest and sinking fund and depreciation payments amounting to \$624,067, and sundry other charges amounting to \$13,773, there remained a balance for the year of \$3,137. The surplus shows a large reduction compared with 1914, which is accounted for by the considerable reduction in the scale of charges which took place in January, 1915, under the advice of the Ontario Hydro-electric Power Commission, from whom energy is purchased in bulk. The consumers numbered 38,834, as against 31,500 in 1914; the meters in use were 39,284, as against 33,976; the street lanterns numbered 43,411, as compared with 40,596.

During the year, 109,501,981 units were sold, as compared with 82,927,015 units during 1914, the connected load amounting to 111,413 H.P. and the peak load to 40,180 H.P. The average price obtained for K.W.-hours sold for the year shows a reduction of over 17 per cent. During the year, two sub-stations have been constructed, one of them having a branch store attached where accounts can be paid and the latest appliances can be obtained. New mains have been laid, bisecting the existing ring mains from which the whole supply in the city radiates. Half-watt public lighting has been introduced into Toronto Street and part of Richmond Street; this type of lighting was offered to the city in 1915, but the alternative—a reduction of the rate with the old type of lighting—was accepted by the Council. Roughly, the output sold has increased by an average of 25 million units a year for the last four years.

The report contains a declaration by the Commissioners of their financial policy, which is interesting; the Commissioners set aside each year, (1) interest on debentures; (2) sinking fund sufficient to pay off debentures at maturity; (3) depreciation—such sum as will amount at the end of the lifetime of the plant of an amount sufficient to replace same. This indication of policy is, it is stated, made because a proposal by the Finance Commissioners of the city, in future to issue debentures limited in term to the life of the asset for the purchase of which they are issued, has led to an impression that a depreciation fund can therefore be dispensed with. The Commissioners regard their allocation to depreciation as an obligation of sound policy and finance, designed, *inter alia*, to prevent the accumulation of city indebtedness for hydro-electric construction to such a level as might injuriously affect the credit of the city.

This view of the matter is not exactly that held in this country, where the same subject was discussed at great length some years ago, and it was for the most part agreed that posterity could fairly be allowed to undertake its own financial obligations, especially if a prosperous business were handed over to it.

Chesterfield.—The L.G.B. has intimated that it is prepared to sanction the borrowing of £20,600 for the extensions at the electricity works, when certain particulars have been furnished regarding the proposed turbine plant, and the work being put in hand at once.

Continental.—**NORWAY.**—The Christiania municipal electricity installation completed the twenty-fifth year of its existence in August. The city draws its electric supply from four waterfalls, which it has successively acquired and partly developed, the aggregate output of which is reckoned at 59,200 KW. delivered in the city. The progress of the undertaking has been steadily upward, the first year's actual working (1893) showing current delivered to 9,930 glow lamps and 21 motors, compares with, to-day, 470,861 glow lamps, 1,965 arc lamps and 5,140 motors of private consumers, and 628 glow lamps and 217 arc lamps for public lighting. Receipts in 1893 totalled 160,000 kroner, and working surplus 42,000 kroner, against 3,750,000 kroner, and a working surplus of 1,340,000 kroner at last account. Lately an agreement has been come to with the Government for the joint development of the municipality's waterfall of Solbergfos and the State's waterfall of Morkefos, the chairman of the Committee being electrical engineer Thorne, one of the municipality's representatives.

A hydro-electric station is under construction at the Mesna Falls, near Lillehammer, to supply an additional 1,000 H.P. to the cartridge and powder factory situated at the Ranfos. The contributory communes of Gjøvik, Faaberg, &c., are to be supplied from the same source.

It is stated that a Franco-American syndicate is arranging to establish a large electrotechnical establishment in Telemarken. The water power required will be at least 100,000 H.P. It was at first intended to acquire a site in Swedish Norrland, but the unfavourable political situation in the Gulf of Bothnia disposed of the idea.

The municipal authorities of Stavanger have decided to obtain a loan of 6,000,000 kroner for the electric development of the waterfall of Dargelos.

SPAIN.—La Sociedad Eléctrica de Mora la Nueva is the name of a new company which has lately been formed to establish a small central electric lighting station in the town of Mora la Nueva, in the Province of Saragossa.

A concession has recently been granted for the establishment of a plant to utilise the water power of the Rivers Lobaras and Landro in the generation of electrical energy for lighting and power purposes in the Ferreira district of the Province of Lugo.

The Sociedad Minera y Metalúrgica de Penarroya intends to establish two generating stations, one at Puertoblanco of 20,000 H.P. capacity, and the other at Belmes of 12,000 H.P., using low-grade coal as fuel. The equipment will be that of the old Sociedad de Gasificación Industrial, now defunct. The current generated will be partly utilised for the Society's own railways, and partly sold to other industries. —*Industria e Invenientes.*

ITALY.—La Società Consorzio per Elettrotrazione is the name of a new undertaking which has recently been organised in Milan with a capital of £60,000, to develop projects for the establish-

ment of electric power stations in the country, more especially in connection with the supply of power for railway operation.

Ealing.—**DAYLIGHT SAVING.**—A decrease in sales of energy by the electricity undertaking of 22.4 per cent. is traced to the operation of the Daylight Saving Act.

Hereford.—**PLANT EXTENSIONS.**—The T.C. has been authorised to carry out extensions estimated to cost £2,310 for buildings, £1,700 for a railway siding, £16,307 for machinery, switchgear, &c., and £3,213 for mains, for the electricity undertaking; as this is £5,530 in excess of the sum applied for last June, the L.G.B. is to be asked to sanction the surplus.

Horsham.—Offers are to be invited for the maintenance of the storage battery at the electricity works for a further period of 10 years from the expiration of the existing contracts with the Tudor Accumulator Co.

Liverpool.—**PROPOSED EXTENSIONS.**—The question of enlarging the city generating station will shortly be considered by the City Council.

London.—**BETHNAL GREEN.**—The B. of G. has received a report from the chief engineer on the possibility of running the laundry plant (at present hand-operated) by electric power or gas, owing to the shortage of labour. He estimates the cost of motor-driven plant at £200 and of gas-driven plant at £227, and an annual saving on the working of £85 if electricity was adopted as a motive power and £41 if gas was used, as compared with the costs at the present time.

The Committee recommends that subject to the sanction of the L.G.B., steps be taken to run the plant by electricity.

MARYLEBONE.—The general manager's report on the working of the electricity department for the June quarter shows that 3,177,038 units were sold, representing a net increase of 3.57 per cent. over June, 1915. The net revenue from the sale of electricity and meter rentals amounted to £31,948, being an increase over last June of £1,605; improvements in sundry revenue bring the increase up to £2,480. The total expenditure for the quarter amounted to £17,381, an increase as compared with the June quarter, 1915, of £408. The total average costs per unit sold were 1.305d., as against 1.318d. for the previous June quarter. The result of the quarter's working shows a net improvement in the balance available for capital charges of £2,072, making a total of £17,945.

The Electricity Committee reports that after about three years' running of the two Oerlikon turbine sets (described in our issue of December 5th, 1913) these turbines have been opened up for examination; No. 11 was found to be in good condition, and the low-pressure wheels of No. 10 were found to be slightly corroded. During the three years these machines have run 27,009 hours out of a possible 50,352 hours, and have generated 56,032,684 units, or 84.06 per cent. of the total units generated. They have cost for repairs £45 and for oil £136, very low figures, amounting to .00078d. per unit generated.

The Electricity Committee recommends that, owing to exceptional circumstances prevailing, an increase of wages varying from 1s. to 3s. per week be made to all male employees of the electricity supply department other than the clerical staff.

HACKNEY.—The Electricity Committee recommends the granting of an additional bonus of 3s. (making 5s. in all) to the men employed in the electricity undertaking and refuse destructor works, the total wages, including war bonus, not to exceed 45s. per week.

Linking-up Scheme.—The Committee also recommends that, subject to the North Metropolitan Electric Power Supply Co. agreeing to the terms and conditions of an agreement to be approved by the Electricity Committee, on behalf of the Council, and subject to the approval of the B. of T. and the L.C.C., the necessary steps be taken to proceed with the linking-up of the two undertakings, at an estimated cost of £6,500.

Revision of Charges.—The Electricity Committee further recommends the following additions to the present scale of charges for electricity for lighting and power, as from the reading of the meters for the December quarter, a fixed minimum charge of 7s. 6d. per quarter for lighting, and 10s. per quarter for power; a percentage increase for electricity for lighting from 17½ per cent., less 2½ per cent. to 20 per cent., less 5 per cent. for prompt payment, and for power a percentage increase of 30 per cent. above normal rates, less 5 per cent., in lieu of 17½ per cent., less 2½ per cent.

The Committee recommends that, in view of the high cost of fuel and the difficulty of obtaining labour, the official test of the 5,000-KW. turbo-alternator be carried out on the town load, instead of an artificial load, the contractors being willing to make a deduction of £120 if the test is so carried out.

An explosion and fire occurred at the Smithfield Markets Electric Supply Co.'s premises on the 11th inst., which resulted in both light and power being cut off in the market and cold storage. The *Meat Trades' Journal* comments on the absurdity of depending on a single source of electric supply, but probably the movement in favour of linking-up electricity undertakings will remedy this in the near future.

Luddenden Foot.—**PROVISIONAL ORDER.**—The Yorkshire Electric Power Co. has notified the U.D.C. that, as the B. of T. is now prepared to consider the granting of provisional orders for public works, the company proposes to proceed with its original scheme of applying for a lighting order for the district.

Nuneaton.—The T.C. has decided to extend the mains, at an estimated cost of £500, which will be met out of the proceeds of the sale of a generator; the present revenue from the extension will be about a £100 a year. From October 15th the charge for current for power is to be increased by 10 per cent.

Radcliffe. **BULK SUPPLY.** The U.D.C. has notified the Brix Corporation that it intends to exercise its option at once on the agreement in respect to the supply of electricity in bulk for a period of five years.

Redruth. **POWER LIGHTING.** The Lighting Committee has decided that a further concession of £92 has been obtained from the electric supply company in consequence of reduced light losses, £171 in all. The total contract was for £552 per annum.

Salford. **DAYLIGHT SAVING.** The electricity department estimates that the Summer Time Act has led to a reduction of £2,500 in the value of the current consumed for lighting purposes. This represents a saving of 1,100 tons of coal. With coal at 17s. 8d. a ton, the estimated net loss to the department is about £1,500, but the increase in the demand for power more than counterbalances the loss of revenue due to daylight saving.

Southend-on-Sea. It has been agreed to allocate £6,000 from the electricity undertaking for the relief of the rates.

Stafford. **PRICE INCREASE.** The T.C. has decided to increase the price of energy for lighting to 7½d. per unit, less 5 per cent. for prompt payment of accounts, as from October 1st last.

Sunderland. **PROPOSED LOAN.** The T.C. has decided to apply to the L.G.B. for sanction to the borrowing of £45,216 for plant extensions at the electricity works. It is proposed to add a 7,500-kw. turbine unit, bringing the plant capacity up to 14,200 kw.

Tasmania. **HYDRO-ELECTRIC DEVELOPMENTS.**—In view of the increased demands which it is expected will be made by metallurgical undertakings upon the Government Hydro-Electric Department for power, it is understood that steps are being taken to obtain data respecting Lake St. Clair, situated some 25 miles westerly from the Great Lake. Lake St. Clair, it is stated, has a surface area of about 80 miles, and varies in depth to 600 ft. If anticipations are realised, a fall of approximately 1,000 ft. will be obtainable when this supply is harnessed. The general programme of the Tasmanian Government in connection with hydro-electric power for industrial purposes has been outlined in Ministerial statements already published. Unofficial estimates have been made giving the present nominal capacity from the existing works at the Great Lake as equal to some 10,000 h.p., and the approximate total which may ultimately be developed as up to 100,000 h.p. *British Australasian.*

The *Commonwealth Engineer* recently published a letter from Mr. J. H. Butters, chief engineer of the Hydro-Electric Department, which, amongst other things, stated that the department has so far entered into the following contracts only—3,500, rising to 10,000 h.p., to the Metallurgical Co.; 30,000 h.p., to the Amalgamated Zinc Co.; and 2,000 h.p., plus normal development, to Hobart and suburbs. The Government has made no contract with the Mount Lyell Co., but has under consideration the supply of up to 50,000 h.p. to it, not from the Great Lake scheme, but from other sources. Data collected in connection with the Great Lake dam shows that the figure of 35,000 h.p. (all day and night) is conservative and 50,000 h.p. continuously could be obtained, or, with subsidiary power, 55,000 h.p.

Wakefield. **LOAN SANCTION.** The L.G.B. has sanctioned the borrowing of £3,000 for the provision of an economiser at the electricity works.

Watford. **NO LINKING-I.P.** The Electricity Committee is of opinion that no advantage would be gained by way of linking-up, and that it should take no part in the conference being called to consider the matter.

Winchester.—The T.C. has sent out circulars to small consumers of current, inviting them to increase their consumption to the value of £2 6s. 8d. per annum, so as to avoid the necessity of enforcing the minimum charge which the Corporation is entitled to make.

TRAMWAY and RAILWAY NOTES.

Australia. The financial statement of the Adelaide Municipal Tramways Trust for the half-year ended July 31st last, for which we are indebted to Mr. W. G. T. Goodman, the chief engineer, shows that there was a gross balance after meeting working expenditure on the Adelaide and Port Adelaide systems of £63,409, which, with the balance of £3,164 brought forward, made a total of £66,573 for appropriation. From this £9,069 was taken for renewals, £27,071 for interest, £24,251 for sinking fund and other amounts for interest, leaving £3,876 to be carried forward.

The gross revenue was £10,506 better than in the corresponding period of 1915.

The renewals account now amounts to £107,581, the sinking fund account to £203,683, and the insurance reserve to £8,985.

ELECTRIFICATION OF CABLE TRAMWAYS.—The Melbourne City Council has adopted the recommendation of the Public Works Committee that the Government be urged to provide for placing electrical equipment underground if it is decided to electrify the cable tramway. The Lord Mayor stated that any suggestion to install the overhead system of electric traction would meet with the Council's strongest opposition. *Melbourne Age.*

The Victorian Government proposes shortly to introduce a Bill for the permanent control of the metropolitan tramways, both cable and electric; the Bill will also provide for payment of compensation to the Railway Commissioners for the loss of revenue on suburban railways affected by the competition of tramways. The proposed new authority will also take over the electric supply and control of parks and gardens.

The Melbourne City Council has decided to oppose any Bill of this nature.

Birmingham.—The local papers refer at considerable length to the possible stoppage of the tramways during periods when the city power stations are unequal to the great demand being made upon them at the present time. The Electric Supply Committee, in a report, states that in a year the maximum demand rose by 12,000 kw., thus exceeding the 10,000 kw. of new plant brought into use. The coal conveyors at Summer Lane station were provided for 26,500 kw., but 36,500 kw. of plant is now installed, and the conveyors, due to the heavy duty, are in need of substantial repairs. A larger proportion of better-class coal is to be employed, and an order has been placed for new conveyor parts, an additional chimney and economiser, and for increasing the areas of the grates. The tramway stoppage of Wednesday, last week, was due to a turbine breakdown at the Nechells station, which it is now stated will be put right within 10 days. The tramway department has made arrangements to provide conductors with "breakdown" tickets to exchange for those held by passengers in cars which are held up, such tickets being available for the remainder of the journey at a later date.

Burnley.—**FREE TICKETS.** The Tramways Committee has decided to recommend the T.C. to provide special free tickets for wounded soldiers, entitling them to travel either singly or in parties on any car, at any time, and from or to any point on the system of the local tramways.

Canada.—It is stated that the Canadian Pacific Railway will electrify its line between Kingston and Renfrew in the near future, and that a power plant will be installed on the Mississippi river at Sharbot Lake to develop power for this project as well as to supply current to Kingston and vicinity. *Canadian Electrical News.*

Continental.—**ITALY.**—The Central Umbrian Railway, opened provisionally with steam traction, will next year be converted to electric working, the current being supplied by the Società del Carburio di Calcio. Energy from the station at Papigno will be transformed at Marsciano to single-phase current for the supply of the contact lines, which will be on the catenary system. The traffic will be worked by locomotives, each equipped with four single-phase motors of 90 h.p. each. *L'Ingegniera Ferroviaria.*

NORWAY.—It is proposed to start a company to manufacture electric automobiles. The share capital required is estimated at 800,000 kroner, working expenses at 270,500 kroner, and the receipts at 420,000 kroner per year. Output is estimated provisionally at 160 motor-cars yearly. Later the building of automobiles *de Luxe* is projected.

It is under consideration to convert to electric working the railway line from Bergen to Nestun, the power to be drawn from the Bergen municipal station.

The plans are being prepared for the construction of an electric railway to connect Trondheim with Fjeldsøter, the scheme having Government approval.

SPAIN.—La Sociedad Tranvías de Zaragoza has drawn up a scheme for the construction of a further line of electric tramway in the town of Zaragoza; in accordance with the usual plan in that country, the carrying through of the project is being put up by the Government to public tender.

A new company is reported to be in course of formation at Aviles with the object of constructing a new electric tramway to connect the towns of Villalegre, Aviles and Castrillon.

Dublin.—The receipts of the Dublin United (Electric) Tramways Co. for the half-yearly term show an aggregate to October 13th of £249,786, as against £251,240 in the corresponding period of last year, a decrease of £1,454. The weekly receipts have shown a steady increase of late, and there can be no doubt that the half-year will conclude with a substantial balance to credit.

Ealing.—As a result of negotiations, the Council has agreed not to press the London United Tramways Co. in regard to reconstruction of tracks after the war, if the necessary work of improving the condition of the track is carried out now.

Glasgow.—Through dissatisfaction with the attitude taken up by the management, the position of the engineers in the employment of the Tramways Committee is again expected to be brought before the Local Munitions Tribunal. Failing an amicable settlement, the probability is that the men will, under the terms of the Sheriff's award, make application for their clearance certificates. Close upon 1,000 men are affected.

LANARKSHIRE.—Women car conductors in the employment of the Lanarkshire Tramways Co. are threatening to resign in batches, owing to the prevalence of hooliganism in the districts tapped by the system. The company has issued posters threatening to discontinue the early morning service and all cars after dusk, unless the rowdy element immediately disappears.

Oulton Broad.—**BULK SUPPLY.**—The Lowestoft T.C. has decided to continue on the same terms the supply of current in bulk to Oulton Broad.

Southend-on-Sea.—The engineer has reported on the difficulty of dealing with rail corrugation under present conditions, and of keeping the cars in repair—due to the restricted supply of material. Arrangements are to be made, if possible, to permit of the rail corrugation machine being used when traffic is suspended. It has been decided to allocate £3,300 from the tramway funds in relief of the rates.

WAGES.—The Tramways Committee has resolved that male drivers, conductors, and inspectors with 12 months' service be granted a war bonus of 2s. per week additional to the existing war bonus of 2s. per week.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Government has completed the purchase of the Shaw Wireless, Ltd., works for £55,000. The founder of the concern, the Rev. A. J. Shaw, died in Melbourne on August 26th.

The plant is said to be capable of producing most of the requirements for wireless equipment. The wireless system in Australia is now controlled entirely by the Navy Department. The works of Shaw Wireless, Ltd., will become a naval establishment, but work will also be performed for the postal and defence departments. It is also probable that the system of wireless telegraphs in Australia, now confined to the coast, will be extended inland.

Mr. Balsillie, the wireless expert, who has been making experiments in the matter of causing rain by wireless waves, states that he has proved conclusively that rain can be stimulated by electrical means. His experiments have proved that at least 30 per cent. of the stimulation can be maintained. He emphasises the point that he does not claim to produce rain—only to stimulate light showers. *Auckland Weekly News.*

Manchester.—There was a large attendance of the telegraph and telephone workers of Manchester and the surrounding districts at a meeting, on Sunday, at which a resolution demanding arbitration respecting their claim for wage increases of 3s., 4s., and 5s. was passed. The resolution further declared that the advances offered by the Government were quite inadequate.

New Zealand.—The Auckland wireless station, which has been closed since May, 1915, has been reopened.

The Government has decided to erect a wireless station at Rarotonga, which will constitute another link in the Empire, as many islands of the Pacific, such as Samoa and Fiji, will be brought into closer touch with New Zealand, and, consequently, with other portions of the Empire. The work will be carried out by the Post and Telegraph Department.

The Government is to enter into an agreement with the Eastern Extension Cable Co. with regard to a proposal to remove the cable station from Wakaupaka to Wellington. *Auckland Weekly News.*

Russia.—The Russian Government has requested the Great Northern Telegraph Co. to recall all the Danish operators employed at the company's stations in Russia, including Petrograd, for the duration of the war, and replace them by Russians. No foreigners are to be employed in future in the Russian Postal or Telegraph Service.

Spain.—It is reported that the Spanish Ministry of Posts and Telegraphs is contemplating the purchase of a steamer specially equipped for the repair of the submarine telegraph cables owned by the Spanish Government.

Johannesburg.—November 13th. South African Railways Administration. 71,778 tungsten drawn-wire lamps, 19,741 solid-drawn tungsten lamps, and 2,412 carbon-filament lamps.*

November 20th. Corporation. 500 or 1,000 trolley wheels for tramcars (Contract No. 181).*

November 27th. Corporation. 1,000 sets of single-pole, ironclad house-service cut-outs (Contract No. 187).*

Manchester.—October 24th. Corporation Tramways. Hard-drawn copper trolley wire. Mr. J. M. McElroy, General Manager, 55, Piccadilly, Manchester.

New Zealand. DUNEDIN, January 24th, 1917. Motor-generator, accessories and spares. City Electrical Engineer, Market Street, Dunedin.*

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Glasgow.—The Tramways Committee recommends for acceptance the tender of Messrs. Edgar Allen & Co., Ltd., for special trackwork.

London.—The Metropolitan Asylums Board reports that the agreements with the Tudor Accumulator Co. for the maintenance of the batteries of electric vehicles Nos. 2 and 3, at Queen Mary's Hospital, expired on September 26th. The assistant engineer states that the present is a very unsatisfactory time for entering into new contracts of this description, owing to the high cost of materials, and he advises that the existing agreements should be extended for a period of 12 months, which the company is willing to agree to. The agreements provide for the payment of 1½d. and 1½d. per mile run respectively for the two vehicles, one of which is 25 cwt. and the other 30 cwt. The Committee recommends that the agreements be so extended.

L.C.C.—The Stores and Contracts Committee reports that the current contracts for the supply of general stores, including electric cables, lamp fittings, &c., will expire on December 31st next. For the supply for 1917 the Committee proposes to continue the present practice of purchasing some classes of goods at the current market rates or under special quotations; in other cases new forms of tender and schedules are being prepared. The tenders will be received early in November, and, as the number will be comparatively large, the Committee recommends that it be authorised to open the tenders to be received for the supply of goods included in the general stores section, 1917.

MARYLEBONE.—The Electricity Committee reports that, owing to the fluctuations in the prices of materials and the abnormal conditions generally, it is not possible to obtain satisfactory tenders for goods or to enter into acceptable contracts. The Committee has therefore authorised the general manager to purchase such goods as are required in the open market on the best terms obtainable, and to report all such purchases to the Committee.

Malvern.—U.D.C. Coal (500 tons of Highley slack) for the electricity works: South Wales & Cannock Chase Coal Co.

Paisley.—Corporation. Tenders for new high-tension switchboard.

British Thomson-Houston Co., Ltd.	£2,862
British Wireless Co., Ltd.	2,838
Simon Bros. Electric Works, Ltd.	2,693

It was agreed to accept the offer of Messrs. Siemens Bros., as being the lowest, delivery to be made within 18 weeks.

Spain.—La Compania Electrica del Uruemea, of San Sebastian, has just placed a contract with Messrs. Picard, Pictet and Co., of Geneva, for the construction of a 2,300-H.P. hydraulic turbine, designed to work under a head of about 600 ft. and to run at a speed of 500 R.P.M. A 1,600-KW. three-phase alternator to run in conjunction with the same machine has also been ordered from Messrs. Brown, Boveri & Co. of Baden.

Wakefield.—Corporation:

E. Green & Son, Ltd., Foundations and trackwork for an additional 600,000 ft. of track in 24 weeks. 2421.
Statement Engineering Co., Newbold, 2801.

Walthamstow.—U.D.C. 152 time switches for street lighting: Venner Time Switches, Ltd.

Widnesbury.—T.C. 500-KW. rotary converter, with transformer, starting and switch gear, duplicate main and ventilating gear: British Westinghouse Electric & Manufacturing Co., Ltd., £3,190.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. SYDNEY.—January 22nd, 1917. Electrical plant (converter, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.*

January 8th. Municipal Council Electric Lighting Department. 33,000-volt switchgear. E.L. Department, Town Hall. Specification 108. 6d.

MELBOURNE.—October 31st and November 8th. Deputy P.M.G. Telephone parts: switchboard; instruments, &c. Schedules Nos. 1,363, 1,364 and 1,368.*

December 11th. City Council. Supply and erection of coal transporter plant. See "Official Notices" September 15th.

PERTH.—November 8th. P.M.G. Accumulator parts (Schedule 527 W.A.).*

SOUTH AUSTRALIA.—November 15th. P.M.G.'s Department. Automatic switchboards and all associated apparatus, for telephone exchanges, Brighton and Glenelg.

Dublin.—November 2nd. Great Northern Railway Co. (Ireland). Contracts for general stores for 12 months (including several electrical items). See "Official Notices" October 13th.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, October 20th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, Westminster, S.W. Paper on "The recent Diesel Engines and Applications: Energy Diagram to show Heat Balance," by the late Lieut. Colonel Williams to be presented by Professor Burstall.

Institution of Electrical Engineers (Western Local Section).—Monday, October 23rd. At 6 p.m. At Merchant Venturers' Training College, Bristol. Address by the chairman, Prof. D. Robertson.

Institution of Civil Engineers.—Tuesday, October 24th. At 5.30 p.m. At Great George Street, Westminster, S.W. James Forrest Lecture, "The Development of Apparatus for Handling Heavy Merchandise and Merchandise at Ports and other large centres of traffic," by Sir J. E. Griffith.

NOTES.

Engineers' Wages.—A Conference of representatives of the Engineers Employers' Federation and the Amalgamated Society of Engineers and kindred allied trade organisations was held at York, when the question of increases in wages was discussed. The proceedings lasted all day, but no satisfactory result was arrived at. The application of the engineers was for an advance of 1s. per week. It is believed an offer of 6s. per week was made, but this was not acceptable to the men's representatives. The question will now be referred to the Government Productions Committee. *Morning Post.*

Memorial to Sir Wm. Ramsay.—A meeting to consider the steps to be taken to raise a memorial to the late Prof. Sir William Ramsay, K.C.B., F.R.S., will be held at University College, London, on Tuesday, October 31st. After the meeting, the Director of the University College Chemical Laboratories, Prof. J. Norman Collie, F.R.S., will deliver a memorial lecture on "The Scientific Work of Sir William Ramsay."

Copper Prices.—THE WEEK'S CHANGES. —MOSSES, F. Smith & Co. report, Wednesday, October 18th:—Electrolytic bars rose from £112 to £113; ditto sheets, from £160 to £161; ditto rods, from £151 to £152; ditto H.C. wire, no change.

Messrs. James & Shakespear report, Wednesday, October 18th:—Copper bars, sheets and rods (best selected) rose from £166 to £168.

Strength of Copper Wire Splices.—The U.S. Bureau of Standards has recently made a number of special transmission line studies in attempting to prescribe suitable sags in line conductors which would at once meet the requirements for proper unit stresses under the maximum assumed loading conditions, and also provide reasonable assurance against their blowing together in the wind.

Tests were made on the mechanical strength of Western Union and sleeve splices, and an investigation was made to determine the relative hardness of the surface and interior of different grades of copper, as well as their ability to withstand injury and vibration.

Specimens of No. 6 medium wire broke at 1,135 lb., or 51,100 lb. per sq. in. A Western Union splice without solder broke at 449 lb., showing very little strength unless the splice is soldered. Two Western Union splices were made up very similarly, but one was heated in the soldering process to a very much higher temperature than the other; one broke at 751 lb. at a point close to the splice, where the effect of the heat had annealed it. The other wire was not heated to such a high temperature, and went to 1,077 lb., nearly the full strength of the wire. A sleeve splice failed at about the same as the soldered splice, 1,035 lb., which is practically the full strength of the wire.

Hard-drawn wire or medium wire will anneal at about 250° C., or, perhaps, something under that temperature, if held there for some time. Solder will flow somewhere in the neighbourhood of 190° C. There is a margin which is not very great, some 50 or 60° C., in which soldering can be done without any serious injury to the wire.

The failure of a soldered joint occurs not in the joint itself, but usually just outside of the splice where the wire has been overheated. If this weak section is kept below the annealing temperature, a strong splice will result, even though the middle region of the splice be heated to a much higher temperature. If the soldering can be confined to the middle region of the wire, and not extended to the end turns, which contribute little or no strength to the splice, a stronger joint will be obtained with less injury to the leading-in wires, as well as with a saving of time and material.

All of the soldered splices tested were made up with a blow torch. Pouring from a ladle, however, is not so likely to overheat the wire, and this method is exclusively used by some companies.

No. 4 medium wire broke at 1,632 lb., or 49,800 lb. per sq. in. Two Western Union splices went to 1,428 and 1,465 lb. In one of these the wire broke about 1 in. outside of the splice, which may have been due to some injury there. Neither was injured very much by the high temperature. A sleeve splice failed at 1,540 lb., or about 95 per cent. of the full strength of the wire. It requires from three to three and one-half turns in the sleeve to secure this high per cent. of strength. It was found that in every case where the wires were sandpapered before inserting them in the sleeve, a greater strength was obtained, particularly on greasy bare wires.

In the small sizes it is very easy to overheat the wires, and great care must be exercised. The larger wires conduct the heat away better, and are not so liable to be overheated. Sleeve splices, with proper care, can be made to develop practically the full strength of the wire, or within a few per cent. of the full strength.

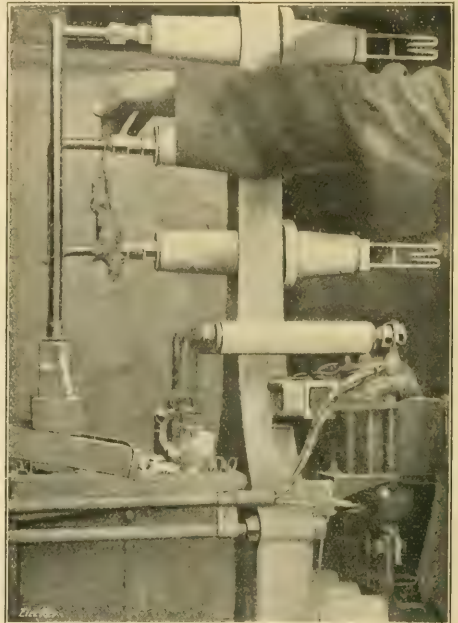
Some tests were made to determine the effect of reducing the section of the wires. A No. 6 wire, which was etched down with acid from 165 to 143 mils, broke at 63,200 lb. per sq. in. The corresponding figure for the full section is 62,000, so that it had been raised from 62,000 to 63,200 by taking off the outer shell, showing that the unit strength of the core is a little greater than that of the full section. These experiments were continued on No. 00 trolley wire, hard-drawn, where similar results were obtained. From these tests it appears that the core of the wire is just as hard as the shell. To substantiate this, Dr. Merica, of the Metallurgical Division, made some microscopic examinations of these wires. His results show absolutely no difference in the grain structure across the section of any one wire, but widely different structures between wires of different sizes and grades.

In order to determine the effect of injury and vibration on wires, a vibrating machine was built, and some vibration tests were made

on a number of wires. From these incomplete experiments it would appear that, for simple vibrations, the harder the wire the better it will stand up. Soft wire seems to crystallise very quickly. It is not always the simple vibration that determines the life of the hard-drawn wire. If a hard wire is kinked, and an attempt is made to remove the kink, the wire will break, while soft wire will not.

While hard and medium wire may in some respects be objectionable for general line use, it is believed that the experiments here recorded demonstrate that there are no serious limitations to its use. It has fewer disadvantages, and soft copper more disadvantages, than have generally been recognised.—E. R. SHEPARD, in the *Electrical World*. (Abstract.)

"Ha!—a Rat!!"—How much damage can be done in a moment by a rat bent on exploration—a successful quest, it currents were the object of it—is well shown in the accompanying illustration, for which we are indebted to a lady switchboard attendant, Miss E. H. Smith. The tragedy occurred in the Oldbury substation of the Shropshire, Worcestershire and Staffordshire Electric



Power Co. The rat climbed into the cubicle of the truck gear and got across the high-pressure conductors, tripping every breaker and causing a complete shut-down for an hour, last Friday. The damage done was estimated at about £30.

Nitrogen from the Air.—In a letter recently addressed to the *Times*, Mr. J. Orchiston, M.I.E.E., chief engineer of telegraphs, Wellington, N.Z., points out that the South Island of New Zealand is richly endowed with magnificent water powers, many of them coming right down to the water's edge in the sounds on the south-west coast. Water powers ranging up to 40,000 H.P. can be obtained at an expenditure of from £5 to £10 per H.P. for the hydraulic development, and in many cases no transmission lines would be needed, as the power station could be located alongside deep water. Heads ranging from 500 ft. to 1,000 ft. or over are procurable, so that the conduits, piping, water-wheels, foundations, &c., need be only of minimum dimensions for the output developed. In some cases less than a mile of piping is all that would be required to utilise a head of 1,000 ft. with a constant flow ranging up to 500 cu. ft. per second, fed from glaciers.

By the construction of a tunnel about five miles in length, mostly through granite, the whole of the discharge of the Te Anau Lake, covering an area of 135 sq. miles, could be diverted to one of these sounds, giving an effective head of nearly 600 ft., and a constant discharge exceeding 12,000 cu. ft. per second. Few countries can so easily provide a power of such dimensions (approximately 700,000 H.P.) at the edge of a deep-water harbour. There are numerous other water powers available inland, ranging up to 100,000 H.P., which could be developed at very low cost, but they are at present not conveniently located for transport purposes, and would involve fairly long transmission lines.

These waterfalls are located on Crown lands, and before action could be taken for their utilisation a permit would have to be obtained from the Dominion Government, who would no doubt give a willing ear to any proposal which would be the means of bringing capital to the country and the development of new industries.

Fatalities.—NEWCASTLE.—An inquest has been held upon the body of a boy named George W. Armstrong, who was killed by an electrically-driven wheel at the Elswick Works of Messrs. Armstrong, Whitworth & Co., Ltd. A work-mate said he saw deceased with his head under the 2 ft. 9 in. fencing round the ropes driving the wheel. The lad then suddenly slipped or over-balanced, and fell on to the ropes. All that witness saw after that was portions of his body flying about. The motorman in charge said it took the wheel seven or eight minutes to come to a standstill after the current was shut off. The Coroner observed that deceased was the victim of boyish curiosity, and the jury returned a verdict of "Accidental death."

ACTON.—According to a weekly newspaper Walter Permain, thirty-nine, an electrical engineer, of Acton, was killed by electric shock while at work on overhead electric wires at an Acton factory. Verdict, "Accidental death."

ROTHERHAM.—A verdict of "Accidental death" was returned in the case of G. E. Smith, forty-three, an electrician of Rotherham, whose death followed burns sustained at the works of Messrs. Thomas Firth & Sons on October 3rd.

SHEFFIELD.—An inquest was held on October 12th into the death of B. F. Theaker, aged twenty, labourer to an engineer's fitter, who was killed while working upon the fitting of a new brake on an electric crane. It appeared from the evidence that Theaker's forearm came into contact with 200-volt live wires while climbing down into the cage containing the operating handles. When the current was cut off he fell 6 ft. into the cage below. The medical evidence showed that death was due to electric shock. The works superintendent said that the current should have been switched off before Theaker went up to do the work.

BARGOE.—S. H. Chester, aged sixty-two, an assistant at the P.D. Colliery, Bargoe, was killed last Sunday week while at work on a girder 22 ft. from the ground. He lost his hold and fell backwards. There were three 3,000-volt power lines passing in proximity to the girder; the wires were on china insulators and insulated from the girder. They carried power to the motors which drove an aerial ropeway. The medical evidence showed that there were no signs of Chester having been burnt by electric wires. Verdict, "Accidental death."

Bell Signalling in Mines.—The Chief Inspector of Mines, Dr. R. A. S. Redmayne, has issued a circular drawing attention to the report of Dr. Wheeler and Prof. Thornton on electric signalling in mines (abstracted in our issue of August 11th), and stating that in mines to which Regulation 132 applies, steps must be taken without delay to bring into compliance with the Regulation any existing installations which do not already comply. No new apparatus may be installed except such as complies strictly with the Regulation. The maximum pressure of 25 volts allowed for a signalling circuit is unchanged, provided that wet Leclanché cells (quart size) are employed. Systems using dry cells or accumulators, or in which D.C. or A.C. generators are employed, can be made safe if, in addition to the use of anti-sparking devices, sufficient non-inductive resistance is permanently installed in the circuit. Bells and relays should have flame-tight covers (preferably locked), and should be so constructed and maintained that when included in a circuit with a battery at 25 volts, the break-flash produced when bare signal wires are separated after giving a signal is incapable of igniting an 8 per cent. methane-air mixture.

Legal.—At the Manchester City Police Court recently, according to a local paper, W. P. Theermann, a German subject, managing director of W. P. Theermann & Co., Ltd., electrical engineers, Manchester, was fined £10 for constantly using the telephone on his premises since the outbreak of war without obtaining a permit.

The Decimal System.—Supporters of Decimal Coinage and the Metric System recently decided to form a "Manchester and District Decimal Association," and a meeting was called by the Lord Mayor, with a view to ascertaining whether the time was ripe for such a movement. The following resolutions were unanimously adopted:—

1. That steps be taken forthwith to form an Association to be called "The Manchester and District Decimal Association," with powers to examine relevant questions, and, if thought fit, to advocate, either independently or in conjunction with others, the early adoption by the British Empire of a suitable system of decimal coins, weights and measures.

2. That the Lord Mayor be the first president of the above Association, and that Messrs. Noton Barclay, Astbury, Cowan, and Allcock be, and they are hereby appointed, a nucleus Committee, with powers to add to their number, for the furtherance of the above objects.

Mr. Harry Alcock, M.E.E., was elected hon. secretary, and is now compiling a list of local supporters, and the Committee hopes to proceed with the work of organising the Association in the immediate future.

British Department of Minerals.—Last month a proposition to form a central Department of Minerals and Metals was laid before the Advisory Council for Scientific and Industrial Research by the Councils of the Iron and Steel Institute, the Institute of Metals and the Institutions of Mining Engineers and Mining and Metallurgy. The proposed department would push forward mineral surveys of the Empire, collect and co-ordinate information on the occurrence and uses of minerals and on mining laws, &c., and advise the Government on all questions within its purview.

National Electric Power Supply.—GREATER LONDON AREA.—At a meeting of the Joint Committee of Engineers appointed by the Engineers' Committee of the Conference of Local Authorities in Greater London owning electricity undertakings, held at the Institution of Electrical Engineers on Friday, 13th inst., Mr. J. S. Highfield (Metropolitan Electric Supply Co.) stated that the National Power Supply Joint Committee did not propose to convene a Committee for the Greater London area, as it was hoped that the Committee appointed by the Conference would act in conjunction with the National Committee. It was resolved that:—
"A formal notice be sent to the secretaries of the National Committee stating that a conference had been formed of representatives of private and public interests, to consider the best method of linking-up generating stations in the Greater London area."

The Joint Committee is constituted as follows, viz.:—

COMPANIES.

The Charing Cross, West End and City Electric Supply Co., Ltd.
The City of London Electric Supply Co., Ltd.
The County of London Electric Supply Co., Ltd.
The Kensington and Knightsbridge Electric Lighting Co., Ltd.
The London Electric Supply Corporation, Ltd.
The Metropolitan Electric Supply Co., Ltd.
The Westminster Electric Supply Corporation, Ltd.

MUNICIPALITIES.

Mr. G. G. Bell, Hammersmith. Mr. A. C. Cramb, Croydon.
Mr. F. A. Bond, Battersea. Mr. L. L. Robinson, Hackney.
Mr. E. Calvert, Finchley. Mr. W. C. P. Tapper, Stepney.
Mr. C. A. Baker (London County Council).
Mr. E. T. Ruthven Murray (North Metropolitan Power Supply Co., Ltd.).
Mr. H. W. Firth (Great Eastern Railway), with Messrs. F. J. Walker (St. James' and Pall Mall Co.) and Fred. Tait (Poplar) joint honorary secretaries.

A Large Searchlight.—The General Electric Co., of Schenectady, N.Y., has lately completed, for the U.S. Navy, a searchlight with a 5-ft. mirror, the rays of light from which can, it is claimed, be seen at a distance of 200 miles.

Coal Research.—In his capacity as one of the largest coal consumers in the country, the central-station engineer must henceforward take keen interest in the efficient utilisation of our great national asset. Whilst it is too much to expect that the electrical engineer should also be an expert fuel technologist, the "chief" must be able to appreciate and utilise the services of a trained chemist on his staff. Much has yet to be learned concerning the products derived from the distillation of coal by various processes, and Germany has paid more attention than we to this matter in the past. The Kaiser Wilhelm Institute for Coal Research, inaugurated at Mulheim a.d. Ruhr shortly before the war, has just issued a report presenting the following information:—
(1) By washing coal with liquid sulphuric acid at room temperature a thick golden yellow mineral oil is obtained, having a not unpleasant smell. From 1 kg. of ordinary coal about 5 gm. of this oil are obtained. Using benzol under pressure, about 60 gm. of material can be extracted, but this contains only a small proportion of oil. By the separation of this component, the coal loses its tenacity and falls to powder. (2) By distilling coal with superheated steam, a tar is obtained which contains petroleum-like optically active oil, lubricating oil, and paraffin. (3) By treatment with ozone, over 92 per cent. of coal can be converted into a brown mass smelling like caramel, soluble in water, and of unknown composition. (4) By a new process about 20 per cent. of ozokerite can be obtained from lignite, instead of 12 per cent., as heretofore.

Institution and Lecture Notes.—Textile Association.—At the seventh annual congress of the Textile Association, which was opened at Leeds University, on Friday last, Dr. S. A. Shorter, of the University, and Mr. Howard Priestman delivered a paper and demonstration on "The Electrification of Textile Fibres," showing the conditions under which wool, silk, cotton, flax, &c., may become electrified, and the use of certain methods of de-electrification. Dr. Shorter pointed out the elementary principle that electrification was most pronounced in the case of bad conductors, on which the energy generated was retained, and added that as water was a good conductor, it naturally followed that moisture in any substance tended to diminish electrification. Silk was the most readily electrified of fabrics, owing to its low conductivity, but all textile fabrics became electrified. The mere drying of substances was sufficient to produce electrification to some extent. The energy might be discharged in various ways—by radio-active substances, X-rays, ultra-violet light, and the convection of particles.

In a later lecture and demonstration on "The Scientific Principles Underlying the Process of Textile Scouring," Dr. Shorter showed, by experiment and demonstration, that whilst the first principle in the washing of an object or material was the emulsification of the grease which acted as a binder for the dirt particles, produced by a lowering of the surface tension between the water and grease, it was a negative electrical charge which prevented the oil droplets and the dirt particles from coagulation, this negative electrical charge being increased by the presence of alkali.

Amongst other various demonstrations at the Congress were those in speed and power consumption recording, by Mr. A. Yewdall, showing the value of employing the tachograph for registering the regular or irregular running of textile machinery, and the dynamometer for registering power consumption.

Repeated reference was made, in the course of the proceedings at the Congress, to the important scheme of research into the electri-

Session of the Leeds Congress, which was conducted at the University under the aegis of the Textile Institute, by Dr. S. A. Shorter. It was presided over by Prof. W. H. Bragg, Queen's Professor of the University of London, in a most interesting presentation of the work of the Institute. It was pointed out that the Institute was led to inaugurate and maintain the Leeds Congress by a practical worker in the person of H. St. John, of this town. Prof. Bragg himself in a general address at the opening of the Congress opened a new era in the history of the Institute, by pointing out that scientific research was a series of utter surprises and discoveries, bit by bit, of things which made the extension of our powers possible, and not merely the forecasting of wonderful things in the future, based upon extension of things which we know at present. He urged all engaged in research of any kind to combine pure and applied science by every means in their power.

At the opening proceedings on the second day of the Congress, the chairman (Mr. Frank Warner, President of the Silk Association) drew attention to the two main objects of the Institute, which were, first, to spread and increase knowledge of existing methods and operations; and, secondly, to advance the general interests of the industries by means of scientific research. This latter work, he said, was now coming very much to the fore, and one of the most important researches already proceeding was that in Leeds by Dr. Shorter on the electrification of fibres. Though no report was yet available, he was informed that there had been a good deal of enlightenment already on many hitherto obscure points in the application of electricity to textile fabrics.

For these researches, the Textile Institute has a special fund. The figure up to the time of the Leeds Congress had reached £243, but it is estimated that £1,000, spread over a period of three years, will be required for the research, and it is confidently expected that that sum will be secured. Several of the subscriptions already are annual ones.

Society of Engineers.—At the ordinary meeting of the Society, to be held at the apartments of the Geological Society, Burlington House, Piccadilly, W., on December 11th, at 3 p.m., two papers will be presented for discussion dealing with the sources of minerals and mineral ores required in the engineering industry of the United Kingdom. The first paper will be presented by Prof. W. G. Fearnside, M.A., Sorby Professor of Geology at the University of Sheffield, and will deal with the minerals required by the iron and steel industries. The second will be presented by Prof. C. G. Cullis, D.Sc., M.I.M.M., Professor of Economic Mineralogy at the Imperial College of Science, and will deal with non-ferrous ores.

As the subject for discussion is of exceptional interest at the present time, and a large number of eminent engineers and metallurgists will be invited to attend, the Council has decided to throw the meeting open to the public by tickets, which may be obtained (gratis) on application to the Secretary, 17, Victoria Street, S.W. Tea and light refreshments will be provided at about 5 p.m.

Manchester Association of Engineers.—In the course of his presidential address, Mr. F. W. Reed said that the sudden change-over of our manufacturing resources from war work to civil work would be a task of considerable magnitude. A great quantity of additional machinery and new works, which had been forced into existence by the war would be available, and could, no doubt, be largely utilised for civil work. The Government would be well advised, when adjusting war taxation, to see that our industries were not impoverished. It was necessary to come to a general understanding with reference to apprentices in all the various branches of the engineering trades. They did not pay sufficient attention to the matter of the encouragement and training of apprentices. They must consider how to make the best use of adult and other labour trained in mechanical operations during the war. Arrangements might be considered for the rewarding of individual effort. Mr. Reed suggested the formation of a Central Engineering Board, composed of representatives of employers and labour, whose business it should be to arrange rules and regulations to govern employment to suit modern conditions. It would be the means of preventing misunderstandings, would tend to ensure continuity of work, and might form a final court of appeal for the settlement of labour and wage disputes.

Institution of Electrical Engineers.—The opening meeting of the session 1916-17 will take place on Thursday, November 9th, at 8 p.m., when the premiums awarded for papers read or published during the past session will be presented, and the eighth Kelvin Lecture, "Some Aspects of Lord Kelvin's Life and Work," will be delivered by Dr. Alexander Russell, vice-president.

Wire Lamp Patents. It is stated that the German Imperial Court has just given a decision in favour of the Siemens and Halske Co. in the matter of the dispute with the A.G. Julius Pintsch, which raised the question whether the latter company was justified in speaking of its glow lamps as having wire filaments, and in designating its lamps as wire lamps or Sirius wire lamps, although the filaments were not produced by the drawing process. The decision is founded upon the finding of the Lower Court that in interested trade circles something special is understood by "wire," namely, a product obtained by drawing which has been proved to possess special tensile strength. If the Pintsch Co. did not produce its filament by drawing, the Court held that it could not be characterised as wire under the special conditions prevailing in the electrical industry.

Educational. UNIVERSITY COLLEGE, LONDON. — A course of six lectures on "Long-Distance Telephony" will be given by Prof. J. A. Fleming on Fridays, at 5 p.m., commencing November 27th, applicant for the programme, (for 10 guineas) to be made to the Secretary.

Volunteer Notes. FIRST LONDON ENGINEER VOLUNTEERS. — Headquarters, Chester House, Eccleston Place, S.W. Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, October 23rd.—Tutorship for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10. Signalling Class. Recruits Drill, 6.25—8.

Tuesday, October 24th.—School of Arms, 6—7. Lecture, 7.15, "The Meaning of, and Necessity for, Drill," by Company Commander Fleming. Range Practice.

Wednesday, October 25th.—Instructional Class, 5.45. Platoon Drill, Platoon No. 3. Range Practice.

Thursday, October 26th.—Platoon Drill, Platoon No. 7. Range Practice.

Friday, October 27th.—Technical for Platoon No. 10. Regency Street. Squad and Platoon Drill, No. 9. Signalling Class. Recruits' Drill, 6.25—8.25.

Saturday, October 28th.—General Parade, 2.45. Uniform, for Drill. Recruits' Drill, 3.0.

Sunday, October 29th.—Entrenching at Otford. Parade Victoria Station (S.E. & C. Railway). Booking-office, 8.45 a.m.

(By order) MACLEOD YEATSLEY, Adjutant.

(October 21st, 1916.)

Appointments Vacant.—Resident electrical engineer (£200) for the Atherton U.D.C.; resident electrical engineer (£220) for the Horsham U.D.C.; general assistant (£2) for the St. Albans Electricity Works; switchboard attendant (£2) for the Battersea B.C. Electricity Department. See our advertisement pages to-day.

Prohibited Imports.—The *Board of Trade Journal* of October 19th contains a complete list of articles the importation of which into the United Kingdom has been prohibited, except under licence, by Royal Proclamations of February 15th, 1916, and subsequent dates, and in respect of which applications for licences should be addressed to the Controller, Department of Import Restrictions, 22, Carlisle Place, Westminster, London, S.W., together with a revised list of "Interpretations" made by the Department.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—Oban T.C. has appointed the assistant engineer, Mr. C. N. SMITHSON, as borough electrical engineer, in room of Mr. D. McLennan, who has received an appointment in London.

Doncaster Corporation Tramways Committee has appointed chief inspector A. W. BAKER to succeed Mr. Stradman, resigned, as tramway superintendent.

It is proposed to increase the salary of Mr. WHYSALL, electrical engineer at Greenock, by £50.

General.—The *Canadian Electrical News* states that Mr. GEORGE H. ARCHDEACON has been appointed general manager of the Canadian Hart Accumulator Co., the head office of which is situated at St. John's, Quebec. Mr. Archdeacon has had over 15 years' engineering experience, and was formerly upon the staff of Messrs. Ferranti, Ltd., and the Chloride Electrical Storage Co., Ltd. Mr. Archdeacon has travelled extensively in Europe and South America, and has only recently returned from China.

London Gazette Notice.—Territorial Force, Royal Engineers. Tyne Electrical Engineers. Corporal C. B. ELLIOTT to be Second Lieutenant (on probation).

Roll of Honour.—Lieutenant E. A. GODSON, of the Royal Irish Fusiliers, a director of the Electrical Apparatus Co., Ltd., has been awarded the Military Cross.

Captain JULIAN NORTH, who died at Dar-es-Salaam, East Africa, on October 11th, after a severe illness, aged 35 years, was, according to the *Morning Post*, before the war an assistant superintendent in the Indian Telegraph Department.

Second-Lieutenant ROY LESLIE BOX, R.E., who has been killed, aged 21, was, says the *Times*, when war broke out a member of the Electrical Engineers' Corps at the City and Guilds College, London. He joined up with other students.

Saddler J. PATERSON, Royal Engineers, has died from wounds. He was employed at the electricity works, Spa Road, Bolton, prior to the war.

Private A. PARKER, Border Regiment, already reported here as wounded in action, has since died at a Woolwich Hospital. He was 27 years of age, and previous to joining up had been in the accountant's department of the Manchester Corporation electricity department for ten years.

Lance Corporal G. FERNESWORTH, King's Royal Rifle Corps, who has fallen in action, was previously a dynamo attendant at Woolley Colliery, Mapplewell (Yorks.).

Private THOS. DAWES, Grenadier Guards, who fell in action on September 23rd, at the age of 20 years, was an employee of Messrs. Johnson & Phillips, Ltd., Charlton, S.E.

Gunner W. MARSH, R.F.A., who was with Messrs. Dick, Kerr & Co., Ltd., of Preston, has been wounded in the right thigh. In October, 1914, he was wounded in the side, and was discharged from the Army, but again volunteered, and went to France a year ago.

Mr. ALFRED HOLMES, formerly of the electricity staff of the Warrington Corporation, who joined the Army as a private in August, 1914, has been given the warrant rank of Sub-Conductor in the Army Ordnance Corps.

Sergeant NOLAN BOTTWOOD, Signal Company, R.E., who was apprenticed at Canning's Electrical Works, at Birmingham, has been awarded the Military Medal for conspicuous service in France.

Sapper J. SLATTERY, who has died of wounds, was an employee of the British Westinghouse Co., at Manchester.

Private J. LETTS, Lincolnshire Regiment, who has died at the Front, was formerly employed at the Lincoln electricity works.

Second-Lieutenant A. F. E. PRESCOTT, King's Liverpool Regiment, who has been killed in action, aged 22, was a mechanical engineer in the Liverpool Corporation electricity department.

Private A. HAYES, Lancashire Fusiliers, who has died of wounds, was with Messrs. W. & T. Glover, Ltd., Trafford Park, before the war.

Lieutenant A. R. COURTENAY, until recently acting manager of the publicity department of the General Electric Co., Ltd., has been promoted to a full lieutenant. Lieutenant Courtenay has had nearly nine months' service in Egypt and Salonika. He was invalided home with dysentery, but is now in good health once more, and hopes to return, before long to his former spheres of activity, whenever the Government notify that they do not require his services any longer.

Obituary.—FATHER SHAW.—On August 26th the Rev. A. J. Shaw, known throughout Australasia, and in wireless circles everywhere, as Father Shaw, died in Melbourne. He became interested in wireless telegraphy some ten years ago, and established workshops, which led to the erection of a wireless station at Randwick, N.S.W. He was in Melbourne negotiating the sale of this installation to the Commonwealth Government when he died, at the early age of 42.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Walter's Electrical Manufacturing Co., Ltd.—Charge on 249 and 251, Kew Road, Paddington, dated September 26th, 1916, to secure all moneys due or to become due from company to London County & Westminster Bank, Ltd., 11 New Road, W.

Torquay Tramways Co., Ltd.—A memorandum of satisfaction to the extent of £800 on October 4th, 1916, of charges dated March 8th, 1911, securing £600,000, has been filed.

Resisto-Electrical Manufacturing Co., Ltd.—Issue on October 3rd, 1916, of £100 debentures, part of a series of which particulars have already been filed.

Brilliant Arc Lamp & Engineering Co., Ltd.—Memorandum of satisfaction in full on September 23rd, 1916, of charges dated September 25th, 1916, to secure £4,000, of which £1,000 has been paid to bankers, has been filed.

CITY NOTES.

Amalgamated Wireless (Australia), Ltd.—Mr. H. R. DENISON presided at the half-yearly meeting of this company, held at Sydney in August. According to a Sydney newspaper, he said that the operations of the company had been considerably hampered by the war. One of the principal items in the revenue account had always been the return from its ships' message traffic; but this had been seriously restricted by the regulations that no wireless messages could be sent except under certain conditions. In spite, however, of this falling away, the profits had been well maintained in other branches of the business. The company had now 90 ships equipped with its installations—practically every ship on the Australian and New Zealand coasts, which was suitable for wireless purposes—and its revenue from these ships showed a continuous and gratifying increase. The directors had been endeavouring to secure some additions to their business in order to use their spare working capital, and for that purpose had sent their technical manager (Mr. Fisk) to England and America. Unfortunately, owing to the war, practically all the large electrical, engineering, and motor businesses in Great Britain were engaged in making armament and munitions, and it was found impossible to do anything in the nature of arranging agencies in that connection until the war ended. The board, therefore, were looking

round for some other means of utilising the spare capital referred to, and were negotiating for the purchase of certain interests, which they hoped would have the effect of bringing increased returns to the shareholders. Mr. Denison went on to express surprise at the "astounding purchase" proposed by the Minister for the Navy, of the plant, machinery, &c., of the Shaw Maritime Wireless Co. for £57,000. The reason given by the Minister, which Mr. Denison described as "farical," was that it was needed to make the wireless plant required by the Commonwealth Government for land and marine stations, and to prevent the profit from the same going to foreign manufacturers. Mr. Denison added that the position was briefly as follows:—"Practically all the wireless stations required on the coast of Australia have already been erected, and the whole of the mercantile marine equipped with installations. There is, therefore, little or nothing for such an elaborate plant as this to do in connection with wireless manufacture. Furthermore—with the exception of a very few instruments, the manufacture of which locally would be economically unsound by reason of the cost—all the requisitions of the various shipping companies in Australia and New Zealand, as also those of both Governments, since the war began (excepting for military sets), have been fully met by the supply of apparatus manufactured in Australia and by Australian workmen. The machinery necessary for doing all this work stands in our balance sheet at less than £9,000. Where, therefore, is the necessity of a purchase involving a huge amount such as £57,000? I may say," he said, "that the plant, machinery, and patent rights in question were offered to this company two years ago by Father Shaw, and also by Mr. Whiting (representing Sir Rupert Clark, who is the virtual owner); but after examination by our technical manager (Mr. Fisk) the offer was declined on the ground that it would be impossible to profitably employ such a needlessly expensive plant on wireless manufacture in Australia, and the patents were practically valueless to us."

The profits earned during the year ended June 30th, 1916, were £71,740, plus £18,347 brought forward, making £90,087. After paying debenture interest and trustees' fees, and the sum required to provide for the premium payable on the redemption of the present debenture stock, the balance is £79,297; the preference dividend (6 per cent.) absorbs £18,500, a dividend of 6 per cent. on the ordinary shares will require £15,600; £25,000 is to be set aside to supplement special reserve for contingencies, and the balance of £20,397 is to be carried forward. The directors feel that though it is difficult to foresee the position of the business in the future, they are warranted by the results of the year in recommending the above dividend on the ordinary shares. During the past year, in addition to extensions of contracts for the supply of war material, the Government entrusted the company with the construction, equipment, and management of one of the national factories, which was now approaching full output. During the year control of Messrs. Willans & Robinson, Ltd., has been acquired, and the directors anticipate that this will be of considerable value in the future expansion of business.

Bogotá Telephone Co., Ltd.—The directors report a considerable increase in the number of subscribers connected to the system during the year ended June, 1916. The plant has been maintained in an efficient condition, and the service rendered continues to give every satisfaction. In order to meet the increasing demands for telephone service, the company's premises at Bogotá have been extended so as to provide accommodation for a much larger switching equipment, which is now in course of manufacture.

Parsons Marine Steam Turbine Co., Ltd.—The directors have not been able to complete their accounts for the year ended June 30th, 1916, but they recommend a dividend of 25 per cent. for the year, free of income-tax, of which an interim dividend of 10 per cent. has already been paid, less income-tax.

United River Plate Telephone Co., Ltd.—Interim dividend of 3 per cent. (3s. per share) on the ordinary shares (free of tax), for the half-year ended June 30th.

Dartmoor Electric Supply Co., Ltd.—A petition for reducing the capital from £4,000 to £2,000 is to be heard at Exeter on November 6th.

Callender's Cable & Construction Co., Ltd.—Interim dividend on ordinary shares, 5s. per share, being at the rate of 10 per cent. per annum, less tax.

United River Plate Telephone Co., Ltd.—Interim dividend of 3 per cent. (3s. per share) on the ordinary share capital, free of income tax, for the half-year to June 30th.

Electrical Utilities Corporation, Ltd.—Dividend of $1\frac{1}{4}$ per cent. on the preferred stock for the quarter to September 30th.

Rio de Janeiro Tramway, Light & Power Co.—Dividend of $1\frac{1}{4}$ per cent. on the capital stock.

Sao Paulo Tramway, Light & Power Co., Ltd.—Dividend of 2½ per cent. on the issued common stock.

Bell Telephone Co. of Canada.—Quarterly dividend of 2 per cent. for the three months ended Sept. 30th.

Calcutta Tramways Co., Ltd.—Dividend on the ordinary shares at the rate of 1 per cent. less tax.

STOCKS AND SHARES.

TUESDAY EVENING.

HEAVINESS has crept into most of the stock Exchange markets. The principal reason given for this, in Stock Exchange circles, is money; in other words, people are looking for higher rates of interest on their investments than they have been content to take hitherto. As we noticed earlier, the issue of the 6 per cent. Exchequer Bonds, coming contemporaneously with the French National Loan, has set up a new standard, which has made it difficult to justify a good many of the prices still current in the markets. Holders of the existing stocks have therefore been trying in many cases to exchange from these latter into some of the newer forms of borrowing; and their efforts to realise such securities have resulted in general depreciation.

When such first-class investments as those in the telegraph and cable market begin to give way, it is obvious that the investor is recasting his ideas as to the interest which his money ought to produce. This is going on in all the markets, and the new loans are taking the money which in the ordinary course of things would have travelled into Stock Exchange directions. Another reason for the hesitation of the investor in employing his present money in stocks and shares is to be found in the answer of the Chancellor of the Exchequer to the question put to him last week with reference to the 4½ per cent. War Loan, when he stated that proprietors of this security would probably have the opportunity to exercise their conversion rights, an announcement which was naturally read as indicating the advent of another popular war loan before long.

Home Railway stocks have suffered severely in the depression. Nearly all the Steam issues are down on the week, and with them have gone the Undergrounds. The only firm spots are the 6 per cent. income bonds of the Underground Electric Railways and the guaranteed stocks of the Central London Railway. The last had their fall just lately, but have steadied at the lower levels. Metropolitan and Districts are decidedly weak. The prior charge lists have once more been revised in the lower direction, Metropolitan preferences again being put down. London Electric debenture and preference stocks are also lower.

The average return on Home Railway debenture stocks is now about 5 per cent. on the money, clear; while the preference issues pay about 5½ per cent. The fact that these are irredeemable scarcely counts for the moment, in view of the competition of the national issues, the cheapness of the latter being obvious, while, in the case of the former, the present buyer will find it necessary to wait for some years before he can hope to see such appreciation as will compensate him for accepting the lower rate of interest, as compared with that offered by our own and the French Governments.

This consideration applies also to the Telegraph market. Jobbers candidly confess that they have sufficient stock on their books, and they are not anxious to load up with any more at present. At the same time, the holders of the stocks are pressing to sell, regardless of the fact that, in the cases of the best-class companies, the dividends are paid free of income-tax and the companies occupy a position of great financial strength. Prices are put down with very little stock changing hands; and the man who wants to buy telegraph issues at the present time may find that he is able to get on even at the lower figure of the two quoted him as the nominal price of the stock.

The weakness has spread to speculative shares, such as Marconis, these having given way 3/16 to 23; the market explanation is that shareholders are getting tired of waiting for their expected big dividend and bonus, while the general air of dullness throughout the markets has not been conducive to bullishness over speculative shares. Eastern Extensions and Eastern ordinary stock, both ex dividend, are decidedly lower allowing for the deductions. The only firm spot is Indo-European, buyers having come forward for the shares and raised the price 42 to 51. Henleys weakened to 16½, and Telegraph Constructions to 39.

In the latter, however, electricity companies the only change is a slight fall in County of London preference. The ordinary shares, however, retain their rise of last week. The new lighting orders are not expected by the market to have any effect upon the amount of current consumed. There is rather less disposition to buy shares than there has been of late, and the market on the whole is a trifle easier.

Brazil Tractions, after being very flat at 55½, recovered to 58 on the declaration of the usual quarterly dividends on the shares of the Rio Tramways and the San Paulo Companies. Rumour had been busy in advance with the possibility of these dividends being passed; but this is getting to be such

a hoary quarterly that it is surprising to find that it has any effect upon prices. Nevertheless, the Rio Tramways Bonds have been a weak spot—the Seconds in particular. The recent strength of British Columbia electric descriptions has oozed out of their prices; the preference shed 3 points to 72, and some are asking whether the coming report is going to be as good as that they had been led to expect a month or so ago. The deferred is also 3 down, and the preferred 4. News from Mexico is not sufficiently definite to tempt enterprise in any of the stocks and shares connected with the country; prices are steady to dull, as they say in the Stock Exchange. Anglo-Argentine Tramways have weakened; the first preference eased off to 3½ and the 5 per cent. debenture stock, at 72, is 3 points down.

Industrials are disposed to give way. Babcock & Wilcox lost 1 16, going back to the round £3. British Aluminium ordinary shed its rise of last week. General Electrics gave way to 14½. The same tendency is noticeable in most of the varieties connected with industrials. The rubber market has been depressed by reason of the discovery of a law passed in Holland as long ago as last June, whereby excess profits tax is to be levied on the companies operating in Dutch territory. The iron and steel group maintains a fairly firm front, but business on the whole is quiet, and shares in consequence have given way to some extent for the time being. There is a certain amount of disappointment at the way in which developments have shaped in Roumania, and the optimism displayed at the time that Roumania ranged herself upon the side of the Allies apparently led to more buying than the purchasers were justified in undertaking. From the effects of this, together with the monetary position, the markets are suffering now.

SHARE LIST OF ELECTRICAL COMPANIES.

		Dividend		Price	Rise or fall	Yield
		1914.	1915.	Oct. 17, 1916.		
Brompton Ordinary	..	10	10	62	—	47 1 0
Charing Cross Ordinary	..	5	5	8½	—	7 1 4
do. do. 4½ Pref.	..	4½	4½	8½	—	6 6 4
Chelsea	..	6	4	3	—	6 18 4
City of London	..	8	8	102	—	6 10 8
do. do. 6 per cent. Pref.	..	6	6	103	—	6 16 8
County of London	..	7	7	11	—	6 7 8
do. do. 9 per cent. Pref.	..	6	6	104	—	6 17 1
Kensington Ordinary	..	9	7	12	—	6 10 6
London Electric	..	4	8	12	—	6 10 6
do. do. 6 per cent. Pref.	..	6	6	4½	—	6 11 4
Metropolitan	..	34	34	24	—	6 14 8
do. 4½ per cent. Pref.	..	4½	4½	24	—	7 4 0
St. James's and Pall Mall	..	10	8	64	—	6 3 1
South London	..	5	5	2½	—	6 16 1
South Metropolitan Pref.	..	7	7	14½	—	6 12 0
Westminster Ordinary	..	9	7	6½	—	6 7 8
TELEPHONS AND TELEGRAPHS.						
Anglo-Am. Tel. Pref.	..	6	6	99	—	6 19 0
do. Def.	..	30½	30½	22½	—	7 10 3
Chile Telephone	..	—	—	—	—	6 14 6
Cuba Sub. Ord.	..	5	5	8½	—	6 8 6
Eastern Extension	..	7	8	13½	—	6 15 6
Eastern Tel. Ord.	..	7	8	14½	—	6 15 1
Globe Tel. and T. Ord.	..	7	6	12½	—	6 12 0
do. Pref.	..	6	6	104	—	6 14 8
Great Northern Tel.	..	22	22	40	—	6 10 0
Indo-European	..	13	13	61	—	6 14 8
Marconi	..	10	10	51	—	3 12 9
New York Tel. 4½	..	4½	4½	100	—	4 10 0
Oriental Telephone Ord.	..	10	10	2½	—	4 6 6
United R. Plate Tel.	..	8	8	—	—	6 18 5
West India and Pan.	..	1	—	1	—	—
Western Telegraph	..	7	8	14½	—	6 10 4
HOME RAILWAYS.						
Central London, Ord. Assented	..	4	4	70	—	6 14 4
Metropolitan	..	12	11	17	—	4 7 0
do. District	..	Nil	Nil	17	—	Nil
Underground Electric Ordinary	..	Nil	Nil	1½	—	Nil
do. 5 Pref.	..	Nil	Nil	6½	—	Nil
do. do. Income	..	6	6	89	—	6 14 7
FOREIGN TRAMS, &c.						
Adelaide Sup. 6 per cent. Pref.	..	6	6	4½	—	6 1 6
Anglo-Arg. Trams, First Pref.	..	54	54	34	—	8 9 2
do. 2nd Pref.	..	54	54	—	—	—
do. 5 Deb.	..	6	6	—	—	—
Brazil Tractions	..	—	4	58	—	6 19 0
Bonny Electric Pref.	..	6	6	102	—	6 17 8
British Columbia Elec. Ry. Pref.	..	5	5	72	—	6 19 0
do. do. Preferred	..	Nil	Nil	57	—	Nil
do. do. Deferred	..	Nil	Nil	66	—	Nil
do. do. Deb.	..	42	42	69	—	6 3 2
Mexico Trams 5 per cent. Bonds	..	Nil	Nil	48	—	Nil
do. 6 per cent. Bonds	..	Nil	Nil	85	—	Nil
Mexican Light Common	..	Nil	Nil	18	—	Nil
do. Pref.	..	Nil	Nil	83	—	Nil
do. 1st Bonds	..	Nil	Nil	41	—	—
MANUFACTURING COMPANIES.						
Babcock & Wilcox	..	14	15	3	—	5 0 0
British Aluminium Ord.	..	5	7	22½	—	6 13 4
British Insulated Ord.	..	15	17½	12½	—	7 0 0
British Westinghouse Pref.	..	7½	7½	24	—	6 0 0
Callenders	..	15	30	12½	—	6 0 0
do. 5 Deb.	..	6	6	—	—	—
Cassner-Kellner	..	20	—	82	—	6 6 8
Edison & Swan, 2½ paid	..	Nil	—	10½	—	Nil
do. do. fully paid	..	Nil	—	13	—	Nil
do. do. 4 per cent. Deb.	..	5	5	62½	—	8 0 0
Electric Construction	..	6	7½	—	—	8 0 0
Gen. Elec. Pref.	..	6	6	10	—	6 0 0
do. Ord.	..	10	10	144	—	7 13 10
do. 4½ Pref.	..	20	35	46½	—	6 17 8
do. 4½ Pref.	..	—	4½	42	—	6 6 0
India-Rubber	..	10	10	12	—	6 3 4
Telegraph Con.	..	30	30	89	—	6 3 6

* Dividends paid free of income-tax.

AIR FILTERS.

[COMMUNICATED.]

THE importance of thoroughly cleaning the air used for cooling turbo-generators is recognised by all central station engineers, but apart from Mr. Christie's paper, read at the annual convention of the Incorporated Municipal Electrical Association in 1913, little has been published on the subject in this country. Mr. Christie expressed the opinion that cloth filters were very unsuitable for central-station service, as they occupied considerable space, required frequent cleaning, and owing to the combustible nature of the cloths, involved considerable fire risk. His experience with a water spray filter as used in connection with the Plenum ventilating system for large buildings led him to conclude that such an arrangement was far preferable to a cloth filter, for not only is the air thoroughly purified, but it is also cooled. The water spray filter, moreover, is easily cleaned, does not involve the renewal of cloths, offers constant resistance to the passage of the air, involves no fire risk, and in the case of large filters, the space occupied is only one half of that occupied by a cloth filter of equal capacity. The fact remains, however, that a very large number of cloth filters have been installed. One firm, for instance, between the years 1900 and 1909 built no fewer than 1,264 of these filters with an aggregate capacity of 16,100,000 cu. ft. of air per minute. But, of course, the use of wet filters for electrical purposes is a comparatively new idea. The scheme will undoubtedly be extensively adopted in due course, although there are at present a number of engineers who favour cloth filters, mainly because they believe that water spray and other wet filters are liable to charge the air with moisture.

Dry filters are still very popular on the Continent, and various types are in use, most of which have been designed by Germans. These filters usually consist of frames fixed in a suitable structure, and the number of these frames depends upon the quantity of air to be dealt with. Over each frame a cloth pocket is stretched for the purpose of catching the dust and preventing it from entering the generator. Owing to the combustible nature of these pockets, cloth filters should always be placed within brick or concrete walls, and where possible the air should be drawn from outside the building or from somewhere where the atmosphere is reasonably clean. There is no doubt that some dry air filters do involve considerable fire risk, especially when the cloths are dirty. Impregnating the cloths with a view to making them fireproof does not entirely overcome the difficulty, for it has been found that when coated with dirt they will burn more or less freely.

It is to be remembered that the conditions under which these filters operate are very conducive to fire. Large volumes of air are drawn through them, and a spark may easily set the whole filter ablaze. The fire would, of course, be drawn up into the interior of the alternator, where a great deal of damage might be done. Still, it is possible, with certain arrangements, greatly to minimise the fire risk. In some cases a trap-door or damper has been fitted in the air uptake between the filter and the turbo-alternator. Normally this is held open by a fusible metal cord attached to a heavy weight, but in the event of a fire occurring in the filter-chamber, the cord melts and the damper closes under the action of gravity.

Those who condemn the dry filter on the score of fire risk should remember that these filters are not all built on the same principle. Filters with cloth pockets are, it is true, very commonly used in this country, but other types of dry filter are also made. In one case the cotton wool filtering medium is in the form of tubes enclosed in wire gauze, which keeps out flame in the same way as the gauze used on a Davy lamp. So far as the writer is aware, however, this filter has not been tested in any central station in this country, and it is not possible to say anything definite about its performance. The makers claim, however, that the fire risks are insignificant, and that it is superior to pocket filters in other respects. Another dry filter which is claimed to be practically incombustible is made by a French firm. In this case the filter is composed

of perforated steel plates, between which cotton wool is placed. But the initial cost of this filter is considerably in excess of that of the ordinary cloth pocket filter, and up to the present it has not made much headway in connection with electrical work. Cotton rope filters are also made. The ropes are mounted in frames in such a way that when the frames are assembled in the filter the spaces between the ropes in one frame are covered by the ropes in the adjacent frame, and it is said that even when the filter is dirty, the resistance offered to the passage of air is slight and the danger of the filtering medium rupturing is avoided. Further, it is claimed that these filters, which are made in vertical and horizontal types, occupy less space than other dry filters. Rupture of the filtering fabric in cloth pocket filters is liable to occur if the filter is too small for its work, for when the cloths get dirty the resistance to the passage of air increases and the air pressure rises. Generally, it is customary to allow an effective area of 2 sq. ft. for each cubic foot of air dealt with per minute, and the air velocity is in the neighbourhood of 6 to 10 ft. per minute, according to the quantity of dirt that has to be dealt with. With the surrounding air at normal temperature, some $5\frac{1}{2}$ to $7\frac{1}{2}$ cu. ft. of air per kw. must be forced through the windings of the machines every minute. It is pretty well agreed by those who have had experience with cloth-pocket filters that the work of cleaning them is not, on the whole, a congenial form of occupation. Some advocate chemical cleaning, but the experience of most engineers is that the process destroys the filtering properties of the cloths, and, further, that the pockets shrink. The most common and the most satisfactory method of cleaning is to use a vacuum cleaner. The air resistance offered by pocket filters after cleaning is always higher than the resistance offered after a previous cleaning, and it is therefore necessary, quite apart from the cloths wearing out, occasionally to renew some of the pockets, so as to keep the resistance within permissible limits.

As regards wet filters, a type that has recently made considerable headway in this country, and which undoubtedly gives excellent results, is the Heenan wet-surface filter. As is well known, the air in this case passes over large wet surfaces. Thin galvanised plates are wound on a cast-iron centre, and between each layer a space of about one-sixteenth of an inch is left for the air to pass through. The lower part of the drum revolves in water, and the air passes through the upper part. In the opinion of the writer this type of filter requires a lot of beating. It not only effectively cleans the air, but it also cools it, and there seems to be no doubt that the air leaves the filter entirely free from loose moisture. The plates are revolved in the water at a low speed by a small motor geared to the shaft, and the amount of power required for driving the drum is not by any means a serious item. Within the last few years a considerable number of these filters have been erected in central stations, especially in stations where large sets are in use. Filters of the type used by Mr. Christie are generally known as air washers. Many kinds of these filters or washers are now built, but the fundamental principle is the same in each case. The air is brought into contact with the water in the form of spray or mist, with the result that any dirt that may be present in the air is saturated with water, and its weight increases. On its way to the generator the air passes through baffle or eliminator plates, but the water and particles of dirt having greater weight than the air, strike these plates, and are washed down into a settling tank.

The air leaves the washer clean and free from unevaporated moisture. Moreover, the temperature of the air is reduced. In the case of Mr. Christie's air washer the water screen, which consists of a series of small nozzles spaced 6 in. apart over the entire area of the filter, is placed about 2 ft. inside the air inlet, and at about 6 ft. beyond the screen the baffles are fixed. The base of the filter chamber forms a fresh water tank, which holds about 300 gallons, and is fitted with a ball cock to keep the level constant, and so compensate for evaporation. A 2-h.p. motor-driven centrifugal pump circulates the water at a pressure of about 25 lb. per sq. in. through the nozzles which project it in the form of a finely atomised spray directly against the incoming air. All solid matter in the

air is caught by the baffles and precipitated in the tank. Any beads of moisture or grit carried through with the air are effectively trapped by the baffles, and nothing but pure cool air is carried into the machine. During the winter it may be necessary in certain localities to fit a small steam coil in the water tank, otherwise the water may freeze.

It has been suggested on several occasions that if a refrigerator were used to cool the ventilating air considerable overloads might be carried by the generators, but so far no one seems to have adopted this plan. The idea has been more seriously considered since the introduction of wet filters into central stations, which is attributable to the fact that experience with these filters has shown that cool air gives a distinct advantage in the way of overloads. It is clear, however, that the type of filter does not in any way determine whether the refrigerator scheme is practicable. Dry filters could be used in conjunction with a refrigerating plant just as well as wet filters, but whether the additional cost and complication can be adequately compensated by the additional load that can be got out of the machine remains to be demonstrated. It is to be distinctly understood that the main function of all filters is to cleanse the air, and that the cooling effect of wet filters is only incidental. In tropical climates the cooling effect due to these filters may be very appreciable, but in normal climates the advantage may be much less marked; hence it is inexpedient to increase the rating of a generator, because it is to be worked in conjunction with a wet filter. An accident—a breakdown of the circulating pump for example—may put the filter out of action, and the same applies, of course, to refrigerating plants. The additional load permissible with the cool air could no longer be carried, and in the absence of reserve plant, difficulty might arise. It has been found that if the same water is circulated through an air washer, and only enough added to compensate for evaporation, the temperature of the water and air mingled with it will be within a few degrees of the wet-bulb temperature of the air; but if the whole of the water is continually renewed, the air can be cooled to the temperature of the water, and where water is plentiful, the latter scheme may possibly be adopted with advantage.

There are, as already stated, many types of air washers on the market, especially in America; but the fundamental principle is the same in each case. The variations in the different types are confined mainly to the design and arrangement of the nozzles. Into the details of the various types of washers it is unnecessary to enter, for information of this kind can be derived from the manufacturers' catalogues. What is more important to central-station engineers at the present time is a consideration of the merits and demerits of the wet and dry types. Some of the wet filters now at work in central stations were not originally designed for this class of service at all, but for use in connection with the ventilation of large public and other buildings, textile mills and factories. Practically all central station engineers who have adopted them praise the simple way in which they can be cleaned. In this respect all wet filters are undoubtedly far superior to dry filters, and, quite apart from any other advantages which wet filters offer, this feature is a decided boon. Cloth filters are often much more easily cleaned in the summer than in the winter. When the weather is dry the dirt may be removed by beating or with a vacuum cleaner, but in some places it has been found that when the weather is wet or damp the cloths are very difficult to clean indeed. The cloth pockets absorb the dirt to such an extent that after a short time it is necessary to scrap them. Everything seems to indicate that sooner or later the orthodox pocket filter commonly adopted in this country will be replaced by wet filters of some kind, unless, of course, it can be shown that some of the comparatively new dry filters mentioned are distinctly superior to those commonly employed. For small sets it is possible that dry filters may continue to be used, but in large stations wet filters are rapidly being adopted. Whether the wet surface filter will meet with greater favour than air washers remains to be seen. Both have given very satisfactory results wherever they have been tried, although, so far, wet surface filters have been more extensively used in this country than abroad. In America they use spray and dry filters, whilst on the Con-

tinental wet filters of any kind have not, up to the present, made any appreciable headway. Some American power houses, the power house of the Detroit Edison Co., for instance, have air washers placed on the roof, and air is drawn through the washers into the turbine room by means of a fan. The turbine room is thus supplied with cool, clean air, and all parts of the plant are, as a result of this arrangement, kept, comparatively speaking, clean. On leaving the washer, however, the air is heated by passing it over warm surfaces to ensure that when it comes in contact with the machine windings, it is quite dry. Cooling effects are, therefore, not obtained, but the power house has the benefit of clean and moderately cool air.

The cooling effect that has been obtained with wet filters installed in generating stations in this country has led to an interesting suggestion, namely, that electrical thermometers might replace ammeters for determining the permissible output of electrical machines. Since the load which an alternator can safely carry is determined by the permissible temperature rise, this appears to be a good idea. But the main drawback to the scheme is that it is very difficult to get the temperature of all parts of a generator. Unfortunately, it is possible for an alternator to have hot spots, and unless the temperature is measured at these places trouble is liable to arise. Some day this scheme of measuring the temperature of the windings instead of measuring the current may be adopted, but until a satisfactory method is found of arriving at the maximum temperature, it is, in the opinion of the writer, unwise to depart from the practice of basing the safe output of a generator on the actual current it supplies.

ELECTRICITY IN THE SPELTER INDUSTRY.

AT the recent meeting of the INSTITUTE OF METALS, the subject of the extraction of zinc from the ore and its subsequent refinement, by various methods, received attention. We abstract the following references to electrical methods from a paper by Mr. ERNEST A. SMITH, A.R.S.M.

In the treatment of zinc-bearing complex ores, development has been rapid in recent years; mechanical dressing and magnetic and flotation processes of concentration have done much towards solving the problem. Much progress has been made in magnetic separation, and many machines have been introduced. Electrostatic methods for the separation, by electric repulsion, of good conductors (such as certain metallic sulphides, magnetite, and hematite, &c.) from poor conductors (such as silicates, carbonates, oxides, and sulphates, including zinc blende) have been applied in practice by several inventors. Huft discarded the electrostatic generator of the Wimshurst type, and employs a dynamo current of suitable intensity. The separator is thus capable of adjustment to any required strength of electrical field, and is less liable to interference from climatic conditions. Magnetic separation of blende and pyrite may be accomplished without preliminary roasting by the use of high-intensity magnetic separators of the Wetherill type, the zinc mineral being lifted out of the mass. The more usual practice, however, is to give the mineral a magnetic or "flash" roast, rendering the iron magnetic, after which it is separated from the mass by separators of the low-intensity type, such as the Dings. The limiting factor of electric separators appears to be their inability to handle fine powders, and their liability to dust trouble, unless the dust be first removed.

In 1901 C. P. G. de Laval erected the first electric zinc-smelting furnace on a commercial scale, and four years later works were erected in Scandinavia to carry out his process. Since that time a considerable amount of attention has been given to electric furnaces for smelting zinc ores.

The electric furnace is not intended to replace the retort furnaces in the smelting of zinc ores, but to be used for the treatment of ores not suitable for the distillation process, or possibly as a substitute in localities where fuel is dear but hydro-electric power easily available. Early experimental work by W. B. Ingalls, at McGill University, confirmed the opinion that, if electric smelting is to offer any advantages, the process must be continuous, and all modern furnaces are constructed on this principle. In many of the electric furnaces now in use the energy is applied with great ingenuity and high efficiency is obtained, whilst efforts are made to reduce the electrode consumption to a minimum. The reduction in the electric furnace appears to take place more rapidly than in retort smelting, but the reaction between the carbon and carbon dioxide does not appear to occur to such an extent as in the retort. Hence the electric furnace contains an atmosphere comparatively rich in carbon dioxide, so that a

larger amount of fume (blue powder) is formed than when the retort furnace is employed.

While progress has been made, the discovery of some means of avoiding oxidation of the zinc deposits, as formed under the conditions prevailing in electric smelting, is still the problem which metallurgists have to solve in connection with this method.

The continuity of operation in the electric furnace appears to imply discharging the residue as a slag that will run, and there has consequently been a tendency for inventors of electric zinc furnaces to render the charge fusible, so that fluid slags may be tapped as from cupolas. This condition, however, prohibits any great excess of carbonaceous material in the charge, and accounts for the higher percentage of carbon dioxide frequently found in continuously operated furnaces.

The de Laval process, carried on at Trollhättan, in Sweden, develops heat by means of the arc, current being generated from water-power at prices variously given as from 38s. to 50s. per electrical H.P.-year. The works are equipped for 15,000 H.P. The furnaces are of the resistance type, with one large vertical carbon electrode passing through the roof, the other electrode being a carbon block in the bottom of the furnace. Each furnace has a capacity of about 3 metric tons, and smelts nearly 3 tons of ore in 24 hours.

The complex ore is roasted to about 7 per cent. to 8 per cent. sulphur, mixed with anthracite or coke and flux, and charged through a hopper into a closed "melting" furnace, where most of the zinc and some of the lead are volatilised, and condense chiefly as crude spelter high in lead, and partly as blue powder, which has to be re-treated. The other part of the lead is reduced to metal and is tapped out with the slag. It contains a considerable proportion of the silver. Some matte is formed, and this and the slag contain some of the lead, zinc, and silver. The crude leady spelter passes to the refining furnace, where the zinc is distilled, producing, on condensation, spelter of high purity and a further quantity of zinc dust, leaving the balance of lead and silver as base bullion. Two melting furnaces supply one refining furnace. The company owning these Scandinavian works reported recently that its smelting operations have not yet proved commercially profitable; considerable progress has, however, been made, and it is hoped that things will eventually turn out well.

The Cote and Pierron process is carried on, on a small scale, at Pau, in France; experimental work was also carried on in 1914 at Ugine, in Savoy, and Quenecan, in Belgium. An important feature of the process is the smelting of blende in the raw state. Whilst simplifying the metallurgy of the process, this method increases the difficulties of operation of the electric furnace. "The process" is based on the fact that iron replaces lead in lead sulphides at a comparatively low temperature, and zinc in zinc sulphide when the temperature is increased. It is claimed for the process that by its means zinc and lead can be completely separated. The furnace is circular, with sides and bottom lined with graphite, the top being a low dome of fire-brick. A carbon electrode, which can be raised or lowered, passes through an opening in the centre of the top, the other electrode, a cone of graphite, projects from the hearth. The furnace is charged through the roof, and the lead, slag, and iron sulphide are tapped through an aperture in the side. The volatilised zinc passes through an outlet in the upper part of the furnace to the condenser, which consists of a cylindrical shaft-like chamber of fire-brick filled with coke or anthracite, and provided with a tap-hole at its base for the discharge of the condensed zinc.

The charge, consisting of a mixture of blende, iron, and lime, is introduced into the hot furnace, and the first reaction of iron on lead sulphide is effected at a relatively low temperature. The resulting lead is then tapped. The temperature is then raised and the decomposition of the zinc sulphide by the iron brought about. The zinc distils over, and is condensed in the condenser, the carbon in which is kept at a red heat, to diminish, as far as possible, the formation of zinc fume. Finally, iron sulphide and the slag are run out.

In America considerable experimental work has been done with Johnson's electric furnace at Hartford, Conn., and it is stated that arrangements have been made to erect a 100-ton commercial plant at Keokuk, Iowa. This is a continuous process, with furnace of the resistance type, in which the charge carries the current. The charge is heated to about 900 deg. C. in a continuous pre-heater before reaching the furnace. To prevent the formation of blue powder, the carbon dioxide formed in the smelting zone is rendered innocuous by passing the gases from the furnace through an electrically-heated carbon filter, whereby the carbon dioxide is converted into harmless monoxide.

Electric zinc smelting has now passed the mere experimental stage and become a commercial process. It is not correct, however, to say that it has emerged altogether from the experimental stage, since it is being continually experimented upon by those interested in this method of smelting zinc ores.

Recently hydro-metallurgical processes have been devised in which the zinc, after having been obtained in solution, is precipitated in the metallic state by electrolysis. Electrolytes of zinc chloride solution are said to be more economical in electric current than solutions of zinc sulphate, the electro-

motive force necessary for the decomposition of the former being less than for the latter.

The Nahsen process has been employed at Lipine, Silesia, from 1893 till the present day, the electrolyte used being a solution of the double sulphate of zinc and magnesium. The Hoepfner process has been commercially successful in Germany, Austria, and England. A modification of the process is in use at the works of Brunner, Mond & Co., near Northwich, Cheshire, for the production of a fine zinc which is now made in considerable quantities for the manufacture of brass for cartridge cases and other articles requiring a highly ductile alloy.

The zinc ores are leached with waste calcium chloride in the presence of carbon dioxide; the resulting zinc chloride solution on electrolysis gives a zinc of 99.96 per cent. purity (known as Mond zinc), and chlorine gas, which is used in making bleaching powder. The anodes are of lead or carbon, and the cathodes rotating disks of zinc, partly immersed in the electrolyte. The intensity of the current is 100 amp. for 10.8 sq. ft., with an electromotive force of 3.3 to 3.8 volts.

The Hoepfner process is in operation at Duisburg, Germany. Two plants were also erected in 1914 at Kristiania and Balestrand (Norway) for the treatment of Broken Hill flotation concentrates.

The Diefenbach process is applied to Westphalian iron pyrites containing 8 per cent. of zinc, which is extracted by a chloridising roast of the crushed ore, following by leaching with plain water. The residue, which is said to contain only 0.5 per cent. zinc, is smelted for iron, whilst the aqueous solution of zinc chloride is electrolysed in double-compartment vats, the anode compartment being completely closed. The liberated chlorine is employed in the manufacture of bleaching powder.

The processes which are being tested in American plants are based on sulphuric acid leaching and subsequent electrolysis of the zinc solution, using lead anodes. The well-known Anaconda Copper Co. is now completing a 25-ton plant in which flotation zinc concentrates, after a sulphate roasting, will be leached, with barely sufficient acid to extract the zinc, the resulting liquor being purified by the addition of zinc oxide. This plant when completed will, it is stated, produce some 35,000 tons of fine zinc per annum.

At the Bully Hill mine (Shasta co., Cal.) the zinc sulphate liquor is precipitated with lime, and the precipitate of zinc hydroxide and calcium sulphate is suspended in the electrolyte to neutralise the acid as fast as it is formed. For the same purpose the Reed Zinc Co. (Palo Alto, Cal.), in the recovery of zinc from bag-house dust, use a spongy lead anode, which is converted into sulphate. By reversing the current, sulphuric acid and lead are regenerated.

At Silvertown, B.C., the ore is leached with bisulphate of soda and electrolysis carried out, with the addition of manganese sulphate. The anode becomes coated with manganese dioxide, which is redissolved and used over again.

In view of the increasing demand for electrolytic zinc, hydro-metallurgical methods of extraction are receiving renewed attention.

In a note on "Cadmium in Spelter," Mr. W. R. INGALLS remarked that the electrolytic process of zinc extraction afforded an easy means for the separation of cadmium. It should be borne distinctly in mind that the electrolytic process was going to be commercially applicable only under some limited specially favourable conditions, and was not going to drive zinc smelting out of the world's arts. However, the electrolytic zinc production that was likely to endure should go a long way toward meeting the demand for high-grade spelter, and especially spelter low in cadmium. Furthermore, inasmuch as the electrolytic cathodes had to be remelted in large furnaces, the slabs cast therefrom should be more uniform in composition than those coming from the small tapping kettles of the retort furnace.

INDUSTRIAL ECONOMIES.

IN the course of his presidential address to the BIRMINGHAM ASSOCIATION OF MECHANICAL ENGINEERS, on October 17th, Mr. R. A. CHATTOCK said that the enormously increased outputs and altered conditions of working that had been imposed upon the engineering industry would undoubtedly have a great effect in establishing a new condition of affairs in engineering after the war was over. There would probably be a large amount of industrial disorganisation when the present enormous production of munitions of war ceased, but he did not think it would be of any great duration, because it was evident on all sides that it was the intention of British manufacturers to develop the trade of the country on much better lines than formerly. They ought to take the fullest advantage of any economies that were pointed out to them by scientific research, and ought themselves to inaugurate research of this character, in order to equip themselves to meet the keen competition that was bound to come.

Research work was very expensive work; industrial combinations would be very useful by enabling groups of manufacturers to obtain valuable results for the conduct of their businesses. It would be the wrong policy for a great number of research laboratories to be installed; central research

laboratories should be established, each dealing with some special branch of the manufacturing industry, where the best brains available for the purpose could be concentrated. Most likely these laboratories would have to be placed under Government control, but they should be maintained by the firms interested in the results to be obtained from them, possibly by some form of annual contribution proportionate to the turnover of such firms.

During the present shortage of men, women had been employed to a large extent in engineering works; whilst a certain number of these might remain, he did not think that this would be so to any very great extent.

The high wages ruling at present in engineering works would probably continue to a large extent, and he did not see any objection to this if the workmen would do good work for the money they received. Unfortunately, in the past, many workmen had seemed to strive to do as little as they could for what they earned, and if this spirit were allowed to continue there was no doubt that effective competition with foreign countries, where such conditions did not obtain, would be almost impossible.

In addition to this, manufacturers must exercise greater economy in their methods of production. Perhaps the most important economy that could be effected was in connection with the supply of power required to drive their works.

In a report of the Royal Commission on Coal Supplies in 1905, an average figure of 5 lb. of coal per h.p.-hour was given as being the consumption obtained by industrial concerns in connection with the production of their own power. In the most modern electric power stations this figure could be reduced by about one half. An economy of 50 per cent. in the coal used for driving our manufactories should fully justify strong measures being taken to make it obligatory upon manufacturers not to waste coal in the way that had been going on to a large extent up to the present. A Committee of the British Association had been appointed to report upon this particular question, both with a view to economising the use of fuel and for the prevention of smoke. The deliberations of this Committee indicated that the greatest economy in the use of coal could be obtained by gasifying it and recovering its valuable by-products. This must be done on an enormous scale to be really effective. It was impossible for individual manufacturers to do this with anything like the economy that could be obtained if the whole of the coal used in the country were so treated at certain convenient centres. The number of processes involved was very considerable, and the handling of each by-product would practically be a business in itself. The capital cost involved would be heavy, and could only be made remunerative by working the process on a very large scale. He thought, however, that, if only for the proper conservation of the available coal supplies in the country, such a scheme should be developed.

The transformation of the energy in the coal into electrical energy was the one link that rendered a scheme of this kind possible, because if all the coal consumed in the country were so treated at certain centres, the energy produced would have to be transmitted all over the country for use wherever it was required. The only way of doing this with a reasonable capital expenditure was electrically.

The plants would have to be installed as near to the great coal centres as possible, having due regard to a sufficient supply of water being available for condensing purposes. This was a very important consideration, and might necessitate placing them within reach of the sea or on tidal rivers. If cooling towers were used, roughly 3,000,000 gallons of water per day were evaporated per 100,000 kw. of plant installed, so that a station of 800,000 kw. would evaporate all the water that came into Birmingham from Wales each day if it could be made available. From this it was evident that an inexhaustible supply of water was a prime necessity.

A commencement had already been made in this direction. In Yorkshire coal was being gasified at the pit; the gas was being used for firing steam boilers and producing electrical energy; sulphate of ammonia was being recovered, and coke was being produced. The Corporation of Brighton was considering a somewhat similar scheme, although in this case the by-products were to be handled by a company which was proposing to sell the gas to the Corporation for use in its generating station.

Energy in an electrical form could be economically transmitted at high pressure over very great distances by means of overhead trunk lines, transformed to a lower pressure, and distributed wherever required. It must not be forgotten that electrical energy could now be efficiently applied to practically all purposes for which coal was used.

If, therefore, energy could be produced and transmitted in this way at a figure that compared favourably with what it at present cost the consumer to supply himself, the justification for such a scheme was fully made out.

Experience in the past had shown that large modern generating stations employing the most economical apparatus obtainable had been able to supply electrical energy at a figure considerably below what obtained ten years ago, and one that was still being reduced from year to year as the stations continued to grow, and as the load factor of the stations increased. The largest stations in this country had approximately 100,000 kw. of plant installed in each. If stations were to be built to supply electrical energy for practically all purposes for which coal was now being used, they would require to be probably five times this size, or,

say, 500,000 kw. capacity of plant installed. In stations of this size it would be quite possible to arrange for some of the boilers to be fired by means of gas, and for others to be fired by coke or other form of fuel produced from the distillation of the coal. At the same time, the valuable by-products in the coal could be recovered and disposed of, thus reducing the cost of the supply of electrical energy to the consumers.

A scheme of this kind would lend itself admirably to the utilisation of the poorer quality coals which in normal times it hardly paid to work. In the report of the Royal Commission on Coal Supplies referred to above, it was estimated that this unworkable coal amounted to about 25 per cent. of the total coal raised from the pits. If such an enormous quantity could be beneficially utilised for the production of electrical energy instead of being wasted as at present, that alone should go far to justify the adoption of a scheme such as the author had outlined.

Coal could be gasified in two ways—either by high-temperature or low-temperature distillation. High-temperature distillation was used for the production of ordinary town gas, and certain by-products were obtained such as coke, coal, tar, &c. A number of products were, however, destroyed in this process.

Low-temperature distillation produced a form of smokeless fuel, different to coke in that it would burn in an open fire grate. In addition to this, a number of other valuable by-products were produced. In order, however, to obtain the same amount of heat energy in the form of gas by this process, a very much larger quantity of coal had to be treated. Something like six to eight times the weight of coal had to be handled to produce a fixed quantity of electrical energy as would have to be handled if the coal were burned to destruction in the boiler fires. This pointed to the necessity for converting the heat units in the gas, and in the coke or other fuel produced as well, into electrical energy, otherwise there would probably be difficulty in disposing of all the fuel on the outside market.

A scheme of this kind would occupy an enormously greater area of ground than the ordinary electric generating station. The production of electrical energy from a scheme such as he had outlined, at a cost far below what obtained at the present time, would make it possible for all users of coal to use electrical energy economically in substitution therefor. Owing, however, to the conservative nature of the average man, it was very doubtful whether such a change could be brought about quickly enough to justify the erection of these larger super-stations, and to make them pay for themselves within a reasonable time, without some special steps being taken for the purpose.

The very slow development of the electric supply business that had gone on in the past in this country did not hold out much hope of any real progress being made by natural development, and in order that the public might obtain quickly the benefits that would be afforded by such a scheme, it would appear that some form of compulsion should be exercised in bringing it about. Such a course would, in Mr. Chattock's opinion, be fully justified, having regard to the national importance of the results that would be obtained:—

1. By the proper conservation of the coal supply of the country.

2. By the elimination of smoke from our atmosphere.

3. By the possibility of giving a supply of power to manufacturers and other users at a figure so low that it would represent a saving in their cost of production, and consequently a most valuable asset to the commercial prosperity of the country, and a weapon to fight foreign competition.

4. By relieving the congestion on the railways owing to the reduced traffic of coal which at present had to be delivered all over the country, and under this scheme would only have to be delivered by special lines to certain fixed centres.

Compulsion could be exercised directly by Government control of the coal supply of the country, or indirectly by putting a tax upon all users of coal who consumed it in an uneconomical manner. Such a tax should be utilised for financing a scheme of the kind indicated until it became self-supporting.

In pressing for the adoption of this method, by which such an enormous economy could be effected, he knew that there was bound to be very serious opposition from many existing interests; it was obviously impossible to inaugurate such a change without interfering to perhaps a large extent with those interests, but if the great benefits to be derived from it were proved by searching inquiry to be obtainable, then, in his opinion, the Government ought to take the matter up and deal with it in the national interests. Now was the time to act if they were to place British industries upon a basis firm enough to meet successfully all foreign competition.

ENGINEERING APPRENTICESHIP.

FOR the subject of his presidential address to the ASSOCIATION OF SUPERVISING ELECTRICIANS, on September 26th, Mr. A. P. TROTTER took up the system of apprenticeship for the electrical trade. After pointing out the distinction between "education" and "technical training" for the purpose of making a lad a skilled workman, he referred to the extreme

subdivision of trades under modern conditions, which tended to make every skilled workman a specialist. The introduction of machinery into the textile industry was one of the causes of the break-up of the old apprentice system, and the loss of the personal element in the modern business firm put an end to the direct relationship that formerly obtained between master and apprentice, thus rendering it uncertain who should undertake the important duty of teaching. Employers should consider whether it was worth their while to take such steps, both during the ordinary working hours of apprentices, and by allowing them to attend trade classes, to secure young men trained to do good and intelligent work in the style of the firm, and well versed with its special lines. Apprenticeship would secure these. The inevitable wasters would drift in, but a probationary period of not less than one month, but not more than six, would give them the opportunity of drifting out again.

Evening classes relating to the work on which a lad had been engaged all day were not desirable. They had their uses in certain cases. They required not only grit, but a good physique. They were a valuable means of improving and widening the knowledge of those who had not had the benefit of a regular apprenticeship, or who had an ambition to rise higher in their trade, or to follow some other branches of their daily occupation.

The apprentice should be bound to attend, and the employer should see that he did attend, the chosen trade or handicraft day classes (without loss of wages), for periods of at least two or three hours per week, or two mornings or afternoons every week, thus making a minimum of six hours' weekly instruction in the theory and practice of his trade. For technical classes to be successful, it was desirable that the teaching should be in close touch with the trade, and employers should be invited to take an active interest in the scope and method of the training.

This instruction should not be a mere extension of the daily work, carried on under the supervision of a teacher, but in the case of most trades it ought to consist of a study of general or scientific principles, illustrated or demonstrated by examples taken from the practice of the daily work.

In a science class a teacher avoided spoon-feeding, because he was using science for an educational purpose, and wished his students to think out problems for themselves. He illustrated general principles and theories which constituted any particular science by experiment. In a trade class much of this was reversed. The experiment, whether the tinning of a soldering iron, or the charging of an accumulator, was the starting point, the main thing to be understood, and the principles and theories were brought in to explain it. The importance of systematic work should be taught. One man would fumble for an hour or more with a detector, sorting out circuits in a tangle of wires; another would finish them off in a few minutes because he worked on a method.

Mathematics were absolutely essential for the higher branches of electrical engineering, and in the more simple departments, such as fault localisation, mathematics enabled a trained man to take wonderfully short cuts. But a thorough grasp of the subject from a common-sense point of view would often enable a plain man to "get there."

An apprentice should come so grounded in simple arithmetic that he should not have to be taught it, but only have to exercise his knowledge of it in the trade classes.

The demand for trade classes in any special subject must precede the supply. The City Guilds had done a great deal for higher scientific teaching; it would be appropriate that help should come from this quarter to revive apprenticeship, which was originally instituted as the carefully guarded entrance to the Guilds, and that they should aid in the development of the guild spirit—a pride in craftsmanship of the highest quality. Courses of instruction were already provided in London by the London County Council at day schools, to a greater extent than was generally known; and since these were by no means centralised, but were widely distributed, they could be carried on in the same way not only in other cities, but in the smaller towns.

Seeing that the London County Council was prepared to provide trade classes for apprentices, and that it controlled or was in touch with a large number of polytechnics and technical institutes, no special organisation of the electrical trade seemed necessary. It only remained for time to put themselves in touch with the facilities which already existed.

The main advantage to the electrical engineering industry in encouraging the apprenticeship system was that it secured good workmen thoroughly instructed in the craft. In the case of electrical contractors engaged in wiring, sound workmanship became a matter of public importance. Ironmongers and decorators, who had succeeded in putting up electric bells, had gone on to try their hands at wiring for electric light, with disastrous results.

The old period of apprenticeship of seven years was too long in these days of competition and higher pressure. An apprentice who received sound training in trade classes, and thus learnt to understand his work intelligently, would master it sooner than a boy coming straight from an elementary school to pick up a trade by simply working at it. The period of modern apprenticeship should not exceed five years, and in some cases of simple repetition work, might be reduced to three. In general four years seemed to be a suitable period for electrical contractors. If there was a variety of work,

the apprentice might not have a chance of seeing it all during a period of less than four years.

Mr. Trotter deprecated the payment of a premium. In the absence of a premium, relations became simplified, a small wage was paid, and this placed the master in his proper position.

He recommended those who wished to receive apprentices, or to obtain more information on the subject, to communicate with the Secretary of The National Institution of Apprenticeship, 28, York Place, Baker Street, London, W. It had arranged apprenticeships in 81 cases for electrical fittings makers, electrical fitters and turners, electrical instrument makers, electrical brass workers, and armature and coil winders, and in 142 cases for general electrical engineers.

There was another institution, The Apprenticeship and Skilled Employment Association, with an office at 53, Denison House, Vauxhall Bridge Road, London, S.W., with a considerable number of affiliated local committees.

INDUSTRIAL ELECTRIC HEATING.

IN A paper read recently before the National Electric Light Association, by Mr. E. F. Collins, the author discusses the progress made in industrial electric heating in recent times and the advantages, in improved quality of product and, in many cases, decreased cost, which have resulted; his remarks in abstract are as follows:—

A decision as to whether electric heat may be employed to replace other means of heating cannot safely be determined by comparison, simply on a B.T.U. basis of cost of electric heat as against heat for fuel. The heating engineer must consider the advantages, control of temperature, ease and directness of application, increase of production, reduction in fire risks, decrease of labour of attendance, decreased cost of up-keep, freedom from smoke, gases, and excessive heat lost to the room creating discomfort to the operators in hot weather, saving in floor space, increased quality of production; and saving of lost heat due to fuel being burned uneconomically through the carelessness of operators in adjusting fires, burners, &c. A kilowatt-hour in an electric heater must create 3,412 B.T.U.; on the other hand, the writer has seen cases where the operator used double the fuel oil that was required for certain heating, simply because he did not have the skill or care to adjust his mixtures at the burner for perfect combustion.

It is intended in this paper to deal only with the application of electric heat in industrial processes that require 950° F. or less. Three general types of heating units have been developed by the manufacturer to cover industrial heating devices not requiring more than 950° F. These units are the air heater unit, the hot-plate or cast-in or embedded unit, and the immersion type unit. These units are generally of the metallic resistance type, this resistance being of the nickel-chrome combination, which is free from corrosion in the air at temperatures much in excess of their normal operating temperatures. These units are designed so that they may be used singly or in combination to take care of standard voltage such as 550, 440, 200, 110 alternating or direct current.

The air-heater type of unit consists in general of a framework of steel or cast iron carrying insulators made from mineral compounds such that they afford high insulation resistance even at the fusing point of the metallic resistance which they carry. This resistance, in the best designs, is of the nickel-chrome-type alloy, and is non-corrodible in air at a temperature of 800° C. or higher. Where a number of these heaters are connected together in air, an oven, or other heating chamber, it has been found best to use steel bus-bars and connections mounted upon insulators having the same characteristics as the heater insulators. In addition to high insulation and refractoriness at high temperatures, this compound has practically no expansion and contraction, and is not affected by moisture even at high temperature.

Air heaters have a very wide application. When used in heating ovens, they are usually units of capacity ranging from 3 to 10 k.w., which may be distributed to give uniform heating results and the desired oven temperature. Standard control panels both for hand and automatic control through the medium of an oven thermostat are available, and are, in fact, a necessity for most installations.

The hot-plate cast-in, or embedded type of unit, consists generally of a metallic resistance properly insulated and clamped between metal plates, or it may have the resistance wire suitably insulated and cast in a metal plate or container as an integral part of such, or the same type of wire may be embedded by rolling, swaging, welding, or other method in metal plates or other carrying parts. Such units are usually employed by clamping them in contact with the parts to be heated, and are suitably lagged to prevent loss of heat from external surfaces in contact with the room. These units are likewise designed for use in standard voltage circuits, either individually or in combination, and in many cases are wound to give three heats through the use of a three-point snap-switch.

The immersion type of unit is, in general, of such form that the resistance itself may be immersed in the body of fluid it is to heat, or it may be protected from direct contact with the fluid by an intervening insulated and protecting sheath. One end of the sheath protrudes from the fluid, and carries the heater terminals. In the application of the immersion heater to industrial uses, the writer favours automatic regulation of temperatures, and to this end recommends the use of a thermostat and automatic switch to control and prevent overheating, and yet allow the most rapid heating.

The following table shows some of the more common industrial applications of the foregoing heating units and the particular type of unit usually employed:—

Device.	Temp. deg. F.	Type of heating unit.	Method of heat control.
Baking ovens (general)	200-400	Air	Hand or automatic
Baking ovens (general)	100-350	"	Automatic
Baking ovens (general)	100-350	"	"
Baking bread & pastry	150-400	"	"
Baking machinery controls	250-500	"	"
Baking insulations	200-500	"	"
Annealing apparatus	350-700	"	"
Annealing aluminium	500-800	"	"
Annealing glass	900-1,000	"	"
Tempering steel	200-1,000	Air and hot plate	"
Melting iron	620-700	"	"
Melting tin	450-500	"	"
Melting babbitt	100-250	"	"
Wax and rosin	150-500	Air, plate and immersion	"
Heating coils	100-1,000	Plate and immersion	"
Heating water	212-212	Air, plate and immersion	Hand or automatic
Making steam	212-500	Air and immersion	Automatic
Heating metal moulds	200-1,000	Air and plate	Hand or automatic
Lumber drying kilns	100-200	Air	Automatic
Boiling varnishes	100-750	"	Hand or automatic
Heating buildings	0-80	"	Hand
Soldering	100-650	Plate	"
Glass plates	100-200	Cartridge	Hand or automatic
Melting type metal	100-700	"	"
Linotype machines	625-700	"	"
Sheet-rolling	650-700	"	Hand

These heating processes employing the air heater have, during the past two years, yielded the central stations a large KW.-hour output. Very great success has attended the use of the air heater in baking-ovens whose temperatures range from 300 to 500° F. A specific use is that of japan baking. It may be said that already more than 40,000 kw. of connected load in air heaters has been installed for this purpose. The writer does not know of a single installation changed to electric heat which has not been so satisfactory that it has worked to extend the use of electric heat for baking purposes.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

FRANCE AND ALGERIA.—In reference to the issue, by the new French Customs Office in London, of licences authorising the importation into France and Algeria of goods of British manufacture which are included in the list of articles prohibited to be imported into these countries, it is pointed out by the Board of Trade that it would prevent delay in the issue of the licences if British firms would specify in their applications the value of the goods (expressed in English currency), and the weight of the packages in kilogrammes (kilogramme = 2.2046 lb.), as well as in English units. Exporters desiring to obtain licences should apply to the French Customs Office, King's House, Kingsway, W.C. Forms of application may be written, typed, or printed, so long as they are strictly in accordance with the model printed in the *Board of Trade Journal* of September 7th.

FRANCE.—A Presidential Decree prohibits as from September 17th the exportation and re-exportation of electrical material suitable for use in war, and any detached parts thereof.

GERMAN NEW GUINEA.—A new Customs tariff has been issued by the Administrator under the British Military Administration, with effect from May 18th last. All goods not specifically tariffed and not included in the free list are dutiable on importation at the rate of 10 per cent. *ad valorem*. Besides Government requirements, the free list includes, *inter alia*, scientific instruments, motor cars, machinery (all parts), and samples.

EGYPT.—Revised Tariff valuations for use in assessing duties on metals imported into Egypt have been issued with effect from September 1st to October 31st. Duty is leviable on these valuations at the rate of 8 per cent.

MEXICO.—The Board of Trade have received a copy of a Mexican Decree, dated July 31st, by which extensive alterations are introduced into the Mexican Customs Tariff, and a translation of the complete tariff, as amended, is published as a Supplement to the *Board of Trade Journal* of October 19th. The Decree abrogates the general surtax of 10 per cent. of the import duties, established in 1912. The general rules for the application of the tariff, the explanatory notes, and the tariff index are to be revised by the Ministry of Finance in conformity with the new Decree, which is to take effect as from November 1st. Goods imported in vessels which arrive at the Mexican port of importation after 12 o'clock midnight on October 31st will be subject to the new rates of duty.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 14,972 "Thermostats." FERRANTI, LTD., & R. WEAVING. October 2nd.
- 13,984 "Magnets for magnetic ignition apparatus for explosion or internal-combustion motors." C. A. HELL & O. W. HELL. October 2nd.
- 11,012 "Electric heating devices." R. K. HEWES. October 3rd.
- 14,027 "Magnetic compasses." F. BARKER & SON AND E. W. BARKER. October 3rd.
- 14,029 "Means for connecting electric lines for telephony, &c." L. C. BARNARD AND THE KILN AUTOMATIC THERMOSYS CO. October 3rd.
- 14,031 "Wireless electric circuit-controlling apparatus." M. INOUE. October 3rd (Japan, May 11th).
- 14,041 "Electrical apparatus." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). October 3rd.
- 14,057 "Apparatus and solutions and mixtures for conducting, conveying, and detecting electrical currents by means of a jet." F. D. DOWLING. October 4th.
- 14,064 "Electrolytic manufacture of magnesium metal." E. A. ASHCROFT. October 4th.
- 14,065 "Electrolytic manufacture of sodium potassium alloys with or without other metals." E. A. ASHCROFT. October 4th.
- 14,068 "Repairing electric power transmission lines and other over-ground lines." J. A. HESBERRY. October 4th.
- 14,081 "Electric arc lamps." H. B. GRAY & W. HEAPE. October 4th.
- 14,111 "Reflectors for electric bulb lamps." T. H. A. McQUINN. October 4th.
- 14,113 "Electric conductors." J. D. SHAW. October 4th.
- 14,143 "Circuit-interrupting systems." BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO. October 5th. (U.S.A. October 9th, 1915.)
- 14,169 "Electrically-propelled vehicles." F. W. A. RADFORD. October 5th.
- 14,215 "Electrolytic cells." J. W. WALKER. October 6th.
- 14,218 "High-tension magneto machines for ignition systems of internal-combustion engines." G. N. FELL (Bignami). October 6th.
- 14,246 "Ignition apparatus for internal-combustion engines." K. E. L. GUINNESS. October 6th.
- 14,247 "Ignition apparatus for internal-combustion engines." K. E. L. GUINNESS. October 6th.
- 14,262 "Non-sparking sparking plug for internal-combustion engines." C. S. HARRISON. October 7th.
- 14,276 "Circuit interrupters." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. October 7th.
- 14,280 "Sprockets for current-testing apparatus for electrical appliances." W. J. DAVIS & C. E. HUNTER. October 7th.
- 14,291 "Recording attachment for electric current measuring and testing apparatus." W. J. DAVIS & C. E. HUNTER. October 7th.
- 14,293 "Means for supporting lengths of wire, particularly applicable to line insulators." BULLERS, LTD. October 7th.

PUBLISHED SPECIFICATIONS.

1915.

- 14,009. ELECTRIC SIGNALING APPARATUS. J. W. Mackenzie (Otto G. H. E. Kefauver, of U.S.A.). August 20th.
- 13,110. PORTABLE ELECTRIC LAMP FOR WRITING PURPOSES. P. Summerfield. September 14th.
- 14,129. ARRANGEMENT FOR PRODUCING SHORT UNIDIRECTED HIGH-TENSION ELECTRIC CURRENT IMPULSES. W. Otto. September 14th.
- 14,267. DYNAMO-ELECTRIC MACHINES. A. H. Neuland. September 17th.
- 14,450. DYNAMO-ELECTRIC MACHINES. F. A. Heys (Neuland Patents, Ltd.). September 22nd.
- 14,482. DYNAMO-ELECTRIC MACHINES. F. A. Heys (Neuland Patents, Ltd.). September 22nd.
- 14,483. DYNAMO-ELECTRIC MACHINES. F. A. Heys (Neuland Patents, Ltd.). September 22nd.
- 14,484. DYNAMO-ELECTRIC MACHINES. F. A. Heys (Neuland Patents, Ltd.). September 22nd.
- 13,561. DYNAMO-ELECTRIC MACHINES OF THE COMMUTATOR TYPE. G. Schroeder. September 23rd.
- 14,562. DYNAMO-ELECTRIC MACHINES OF THE COMMUTATOR TYPE. G. Schroeder. September 23rd.
- 16,207. TELEPHONE TRANSMITTERS. E. A. Grahame. November 17th.
- 16,469. PORTABLE ELECTRIC LAMPS. C. H. Hefford. November 22nd.
- 16,502. ELECTRIC SWITCH APPLIANCES. Mavor & Coulson, Ltd., and W. Lawrence. November 23rd.

1916.

- The numbers in brackets are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.
- 3,295. HIGH-TENSION MOTORS. A. H. Midgley and Vandervell & Co. March 4th, 1916. [101,420.]
- 4,190. PROCESS FOR THE ELECTROLYSIS OF ALKALI CHLORIDES. R. van Hessel. March 21st, 1916. [101,440.]
- 4,901. ELECTRIC HEATING DEVICES. L. Heller. July 16th, 1914. (Divided application on 14,905 15.) [100,230.]
- 5,163. ELECTRICALLY INDICATING THE PRESENCE OF SALINE, ALKALINE, OR ACID IONISMS IN FRESH-WATER USED FOR STEAM GENERATORS AND FOR OTHER PURPOSES. W. C. Crockett & Bromell Patents Co. April 8th, 1916. [101,387.]
- 5,391. CONTINUOUS-CURRENT DYNAMO-ELECTRIC GENERATORS. Allmann Svenska Elektriska Aktiebolaget. May 5th, 1915. [100,394.]
- 5,526. DYNAMO-ELECTRIC MACHINES. A. H. Neuland. September 17th, 1915. (Divided application on 14,482 15.) [101,447.]
- 7,291. REFILLABLE ELECTRIC FUSE PLUGS. J. G. Clements. May 22nd, 1915. [100,538.]
- 9,332. MAGNETIC COMPASS. J. J. Steward. July 3rd, 1916. [101,466.]
- 9,937. DYNAMO-ELECTRIC POWER TRANSMISSION APPARATUS OF THE UNIPOLAR TYPE. M. Breshaw. July 10th, 1914. (Divided application on 8,334 15.) [100,894.]

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It is now quite a year since we referred to the situation of the electrical industry in Austria, which even at that time was declared by a Vienna correspondent of the *E.T.Z.* to have overcome the initial difficulties which arose on the outbreak of the war. In the meantime, many events have taken place, and it may be of interest to inquire into the state of the industry as set forth in the columns of the leading newspaper in Vienna at the beginning of September. Although optimistic in tone, the report is free from the boasting strain which generally characterises the statements made in Germany in relation to Teutonic industries in particular. In the first place, the Vienna newspaper remarks that the state of the electrical manufacturing industry is very satisfactory, as there is no lack of activity owing to the great part played by electrical engineering in modern warfare, and the works are intensively occupied on the production of dynamos, motors, transformers, searchlight projectors, lamps, carbons, batteries, &c., together with cables and wire, and telephone and telegraph apparatus, for army and naval purposes. The question in this case concerns not only the meeting of the increase in the requirements, but also the renewal of worn-out and exhausted stocks. On the other hand, the demand on the part of private customers has receded largely to the background; but it has not come to a complete standstill, as many works and other establishments which are engaged on army contracts have been compelled to make extensions, and have had recourse to a greater extent to the use of electric power in consequence of the rapidity of execution of the work and the scarcity of labour. These developments have brought plenty of orders to the electrical works, although not yielding full compensation to the latter through the reserve manifested, except by some hydro-electric works engaged particularly on the production of artificial fertilisers, in the construction of new electricity works and tramways for the account of both municipal authorities and private companies. Yet even this deficiency has been equalised by more skilful adaptation and the assumption of new branches of manufacturing by embarking upon the production of munitions and allied war requirements.

It is under these circumstances, the report continues, that the difficulties have been surmounted and the results have been shown in the financial statements of the works. At the same time, it is admitted that a scarcity of skilled workmen has existed at times, owing to the calling of men to the army, and that raw materials became short and increasingly costly. But these obstacles are declared to have been overcome by the introduction of female labour and by technical ingenuity, which resulted in the provision of cheap substitutes for the raw materials in sufficient quantities.

The same conditions which influenced the manufacturing works are reported to have also applied to the electricity supply works, where there was a dearth of labour and a contraction in the deliveries of such materials as coal, lubricating oil, &c., and a display of reserve and economy in the use of artificial lighting, which was accentuated by the introduction of "summer-time" and the earlier closing of the shops. On the other hand, the supply of

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electrical energy for power purposes has generally increased, so that the total consumption has not shown any considerable reduction. Apart from this development, both the manufacturing and the supply works are devoting themselves to the problems which have matured in consequence of the war. In the case of the former, for example, the idea of a syndicate has to some extent become a matter of special attraction, as such a combination would place a limit on irregularity in prices and conditions of sale, whilst at the same time it is thought that it would strengthen the idea of an economic connection with the German firms and groups, and so smooth the path towards the establishment of a common economic policy between the Central Powers in the electrical industry. This contention, in the opinion of its advocates, is supported by the argument that the intellectual and technical work as between Austria and Germany has always shown the most intimate points of contact, whereas the importance of the Customs duties from the standpoint of the expansion of the Austrian electrical industry has frequently been over-estimated, as was set forth statistically by E. Honigmann some time ago. In contradistinction to this view of the question, which is opposed by a number of firms, it is submitted that intellectual community is sufficient, owing to the apprehension that the powerful German industry would overthrow the Austrian trade.

A further factor in the situation relates to the supply branch of the industry, where the question of the institution of a Government electricity monopoly and the scheme for the imposition of a tax on consumption have been seriously brought forward.

The Industrial Worker and the War Funds.

THE longer the war lasts the more important will become the financial burdens that, as a nation, we have to carry on our own behalf and on behalf of our Allies. The necessity for husbanding our resources, therefore, should command increasingly the serious attention of all of us who remain at home. Our brave Forces are doing magnificently in their particular spheres, and those who remain behind should be putting every ounce of their strength into efforts for keeping up the supply of munitions and conserving certain interests so that we may be able to carry out the Allies' fixed determination to dictate the terms of peace, and so that the Home Fires may be brightly burning for the boys when they come back to us. The horrors of war are being brought home to all to-day, but the poignancy of personal loss is being mitigated by the consoling knowledge that self-sacrifice is now the almost universal contribution to the winning of the Victory of the Freedom of Europe. But such contribution, magnificent as it is, and often so proudly and cheerfully borne, is by no means our only responsibility. Another and a very important one is represented by the War Savings movement. Many of our readers, no doubt, are professional men with fixed incomes who know only too well how the shoe pinches in these days of heavy taxes and increased expenses. They have been learning the lesson of doing without. Such, however, is by no means the case with millions of industrial workers, including hundreds of thousands of young women and lads who are handling weekly more money than they ever had before. Observers in certain factories state that the tendency towards extravagance spends itself after a few weeks, when the novelty of possession passes off, but in too many cases, unfortunately, this is not so, and money is expended freely upon what in war-time must be described as luxuries. What we have to do is to bring home to all industrial workers that they are rendering a distinct disservice to the nation if they purchase unnecessary

things which tend either to occupy labour which ought to be free for national service in some other form, or which occupy transport and increase our import indebtedness to neutral countries. The nation needs the assistance of the millions in finding the money for the war as well as in actual fighting and munition-making. In addition to this, inasmuch as nobody can predict with certainty what the state of general employment will be after demobilisation, it is in the interests of the workers themselves that they should be putting their surplus earnings into a stocking in preparation for possible rainy days. Expert observers note with a certain measure of apprehension the industrial revolution which is taking place, and they urge upon us the necessity for doing without now in order that we may obviate serious deprivation then.

It may be imagined that, at first blush, this matter is of no concern to an electrical paper, but a careful study of the subject will, we are sure, show that it is a national matter, and is one which concerns all who are connected with our own industries. The establishment of War-Savings Committees in all parts of the kingdom is serving to bring the importance of the question home to the minds of the people, but we think that the various industrial businesses which we as a journal represent, employing hundreds of thousands of workers, may find it possible to assist the movement very materially. In the main, we believe that the spendthrift tendency could be checked by educating the people on points such as we have mentioned, and it is for those responsible for the management of our factories to devise means suited to their own particular cases for securing a patriotic response either by schemes of their own or by co-operation with the Government War-Savings Committees. There may still remain some workers, particularly among the junior classes of both sexes, whose appreciation of the responsibilities of life is so light that they will prefer to "eat, drink, and be merry" unless by some form of peaceful suasion they can be induced, in their own and in the Allied interest, to take all above a certain necessary proportion of their earnings in the form of War-Savings Certificates. The very last thing that we should care to advocate would be excessive infringement of personal liberties in days when we are fighting the oppression of Prussian militarism, but in times when we have conscription of man-power we sometimes hear the cry also for the "conscription of wealth." To ask the "wealthier" wage-earners to lend their surplus wages to the State at a high rate of interest falls a long way short of conscription, and, to our mind, it would be quite as justifiable a proceeding as to ask the investor to hand over American securities for the financial convenience of the nation. Perhaps it might be as well for directors and managers of our companies and businesses to consider what further steps they can legitimately take financially to assist the Allied cause without occasioning untimely friction among their workpeople.

Workmen's Compensation.

THE case of Woolley v. Watson, Marsh & Co., Ltd., which was reported in our issue of October 13th, at p. 410, appears to deserve some further notice. The applicant claimed compensation for injury occasioned by an accident arising out of and in the course of his employment. He was a skilled electrician working at a cinema palace which was being reconstructed. It was alleged by the respondents, on the testimony of two witnesses, that at the time of the accident the applicant was assisting a labourer employed by another firm also working on the job. The applicant denied this story, and his denial was accepted by the learned judge on the ground that "the respondents could have called the man in support of their story." In

our necessarily brief epitome of the case as it was presented to the learned judge, we were unable to set out all the facts. In so far as he decided a question of fact in favour of the applicant we should not venture to criticise his decision, but, according to a letter which we have since received from the respondents, the judge is said to have ruled that "where there are numerous contractors working on a job together, and one firm's man goes to the assistance of another man who is not under the same employer, and an accident occurs by so doing, although that man is not actually in the course of his employment, his employer is responsible."

If this is an accurate version of what the judge said, it is open to two objections. In the first place, it appears to be directly contrary to numerous decisions of the Court of Appeal, and, in the second place, it was a mere *obiter dictum*, that is to say, an expression of opinion which was unnecessary for the decision of the case, because it was open to the judge to find as a fact that the story about the barrow was untrue. That some such point was discussed is clear from what the judge (according to our report) said in his judgment: "He deprecated all these quibbling points that were so often raised in cases of this kind." We venture to deprecate any such general expression of opinion as calculated to bring the administration of County Court justice into disrepute. Whether he be a workman or an employer backed by an insurance company, every litigant is entitled to bring his case before the Court and have it decided according to law. If a legal point appears to be a quibble, that is the fault of the legislator who made the law, not the fault of the lawyer who raises the point in the interests of his client. If County Court judges go out of their way to make observations of this kind they have only themselves to blame if an impression gets abroad in some districts that when there is a dispute between workman and employer the scales are weighted in favour of the workman.

We have received from the **The Bribery and Secret Commissions Prevention League** an interesting communication summarising the work achieved during the war in the direction of stamping out this detestable practice, with which of late the public has become only too familiar. They point out that, in order to obtain the necessary evidence to convict, in almost every case, one side has to be allowed to go free, and to give evidence against the other; in fact, to be bribed to do so with a free pardon.

Until recently, it appears, the view has been taken by the judicial authorities that it is the man who betrays his fiduciary position who must be punished in those cases in which the conviction of only one of the parties is possible. Only in a single case has a contractor been convicted for attempted bribery.

For years we have endeavoured to distinguish clearly between bribery and blackmail; and we are still of opinion that blackmailing is the commoner offence of the two. No man offers a bribe to another, unless he is convinced that bribery affords the only method of doing business in that particular quarter; in other words, that the purchaser's agent is a blackmailer who must be "squared" either to give the order, or afterwards to pass the goods.

Mr. Asquith stated in the House of Commons the other day that the Home Secretary would introduce a Bill at an early date to deal with contractors who bribed or attempted to bribe public servants. The League is also at present promoting an amending Bill in Parliament, which has for its object the removal of the Attorney-General's fiat, which is now necessary before a prosecution can be undertaken.

We are by no means in agreement with this pro-

posal, as we think it would open the door to false accusation and persecutions of a particularly obnoxious character. All the same, we would support any amendment of the Bill which would make it more effective against the evil, which, we fear, is a great and growing one.

Our faith in legislation, however, is limited; and we venture to suggest to the League that much more propaganda work might be undertaken with advantage. For instance, a lecture describing exactly the nature of the offence (on which many people are extremely vague in their ideas) ought to be carefully prepared and issued to all schools and colleges to be read out by the headmaster to the assembled school at stated intervals.

If the tradesmen who have the privilege of supplying school books, stationery, and other articles to the pupils could attend at the reading it might also be useful.

A short declaration describing the offence in clear terms should be submitted to and signed by every official of the Government or of the municipalities before appointment, and a similar printed declaration might with advantage be adopted in private firms.

A definite question should be introduced in all Civil Service examinations, and also in those of the great engineering societies. Law examinations should also not omit such an important subject; as we fear even solicitors occasionally take a little consideration from insurance societies and mortgage brokers to whom they recommend their clients, or a "negotiation fee" when arranging a loan. The same men generally carry their righteous indignation to excess when some wretched traveller, acting under secret instructions from his principals, gets caught offering to share his own commission with a buyer, when the living of himself and his family may depend on getting the order. Finally, and most important of all, as urged by Lord Cromer, reasonably adequate salaries should be attached to responsible positions.

THE announcement that the **A Department of Commercial Intelligence** President of the Board of Trade has decided to amalgamate the Commercial Intelligence Branch and the Exhibitions Branch of the Board, and to call the combined department the Department of Commercial Intelligence will be welcomed by traders generally. The two branches have both performed excellent service to the trading community, and their activities have been particularly marked while we have been at war. In normal times their operations have, of course, been handicapped by certain limitations, and a good deal of criticism has been offered, not always, we fear, because of their want of merit, but sometimes because it has been the habit to judge them as the offspring of the Board of Trade. We have frequently stated here that our own experience of the Commercial Intelligence Branch has not been by any means unsatisfactory. Our relations with those responsible for its conduct have always been of the most cordial kind. They have placed themselves at our disposal time and time again with all the willingness and courtesy that anyone could desire, and they have never found us lacking when opportunities have arisen for us to co-operate with them in matters calling for any information that it lay in our power to give. We are particularly anxious to pay this tribute to the Department on the occasion of the retirement of Mr. Thomas Worthington, who has had its doings under his supervision as director right from its initiation, and has now retired under the age limit. Exactly what the amalgamation of the two departments will mean in regard to detailed working experience will show, but Sir William Clark, K.C.S.I., C.M.G., who will

be Controller-General of the new department, is a young man with a wide experience of both diplomatic and industrial affairs, and he takes the helm at a time when it is intended "to improve the organisation for assisting British trade by collecting and disseminating commercial information."

The change is a sign of Government movement in the interests of national trade, and we must be thankful if only for that, but it comes at perhaps the most important parting of the ways that has ever occurred in connection with British trade, and if Sir William is able to sort out from the floods of trade suggestions that have overwhelmed us all during the past two years a few of the best, and apply them, our industries will reap great benefit during the period of his office. We offer him and his department our hearty good wishes in the large and difficult undertaking upon which they now set out. No doubt many questions will arise for revision under his guidance as he meets the Commercial Intelligence Committee from time to time, and among these there will inevitably be the matter of publicity. It may be necessary to consider whether the present manner of handling trade and consular reports, the form of the Board of Trade *Journal*, and even the constitution of the Committee of the Department, are all that the needs of to-day call for, and it may be that it will be found possible to secure more active co-operation from the trade Press, now too often prone to scoff; but in regard to these things we must at present wait and see.

Industrial Fatigue.

THE second interim report of Dr. A. F. Stanley Kent on industrial fatigue, which we summarise elsewhere in this issue, is a valuable

addition to our knowledge of a subject which has been far too long neglected, and affords an interesting example of the application of scientific method to industrial conditions. In other words, it illustrates the importance of *measurement and system* as opposed to guesswork and superficial reasoning, for the author establishes by experiment the fact that the output of the human organism, unlike that of a machine, is not proportional to the hours of labour, but may even show a material increase when the working period is shortened. Hence he concludes that the working of overtime, and particularly Sunday labour, is generally detrimental to output, as well as to the health and well-being of the worker, and is both physiologically and economically extravagant. It is not clear, however, that these conclusions apply without modification to workers who may be classed as "machine-minders," and whose output is not dependent upon their manual dexterity and physical effort, though the quality of the work in this case may suffer from the relaxation of their attention or the lessened acuity of their senses.

The process of recovery from fatigue is not confined to periods of rest, but is constantly in progress even whilst fatigue is being produced, and the author points out the difficulty of isolating these antagonistic effects; he remarks that only the resultant is of importance, but it would seem that if more detailed knowledge could be obtained regarding each of these factors the information would be very helpful in organising the programme of work. It has been shown by previous investigators that by a proper allocation of the working time to successive periods of work and rest, extraordinary results can be obtained, and if we only knew the laws which govern the physiological processes it might be possible greatly to increase output without imposing any additional strain on the worker. It is evident also from the observation of Dr. Kent and his assistants that greater attention should be paid to the feeding of the factory worker, by the dissemination of sound ideas as to diet as well as the provision of well-managed canteens at the factories, the cost of which would be abundantly repaid.

THE USE OF IONISED AIR IN AGRICULTURE.*

By INGVAR JORGENSEN.

DURING the last 10 to 15 years some interest has been aroused both in agricultural and technical circles in regard to the application of ionised air (produced by an electric discharge from a system of thin wires) in agriculture and other plant industries.

It is impossible to deal with the history of the subject briefly, as it is one of the oldest branches of electrical science, and the literature is very voluminous. It will be sufficient to state that interest in the subject in this country mainly dates from the publication of Prof. Lemström's book in 1904.† Subsequently Mr. J. E. Newman started some experiments, and developed, in conjunction with Sir O. Lodge, a new method for generating the necessary high-tension electricity, and a new arrangement of the overhead network; this apparatus is sold by the Agricultural Electric Discharge Co., of Gloucester. It has been described so frequently in recent years in various technical and agricultural journals, that it is unnecessary to enter into a detailed description here. Sir O. Lodge gave a fairly complete account of the experiments undertaken by the Agricultural Electric Discharge Co. in his Kelvin lecture to the Institution of Electrical Engineers in 1914.‡ The technical information given was, however, very meagre, and on many points not very helpful; I have therefore attempted in the present paper to state some of the fundamental principles involved in the method, in the hope that electrical engineers may be persuaded to take some interest in the matter, for the resulting technical research should lead to the replacement of the present system by a cheaper and more efficient one.

The methods employed by both Prof. Lemström and Sir O. Lodge were very primitive, and it is to be regretted that these two eminent physicists have not attempted to investigate the physical questions involved in the scientific application of the method. The entire absence of quantitative measurements is a striking feature of their work, although it is clear that, without such measurements, satisfactory progress is not possible.

If the subject is to be advanced from the position in which it has remained now for 200 years—that of an amusing pastime for electrical amateurs—an extensive series of researches is required, and close collaboration between electrical engineers and agricultural scientists becomes necessary. The results of the investigation which has been carried out for the Board of Agriculture in the last four years seem to indicate that such a research might be profitable.

The chief features of the Newman-Lodge system are as follows:—

Alternating high-tension current is generated by an induction coil (mercury turbine break, condenser in parallel with the primary). One terminal of the secondary is connected to earth; the other is connected through a series of Lodge rectifiers to the discharge network. The construction of this network will be seen from fig. 3. The wire system is carried on insulators of the type used in high-tension power transmission, which are mounted on poles. The wires nowhere touch the insulators, but are held taut at some distance from them by means of paraffined cord. The distance of the network above the ground is 15 ft.

The apparatus provided by the Agricultural Discharge Co. is generally supplied with an ammeter in the primary circuit and spark gaps (1-in. balls) before and after the rectifiers. If the apparatus is started, the ammeter will

* The information contained in this article is derived from experiments carried out by the writer in Copenhagen (at the Government Agricultural Experimental Station) and in this country under the Board of Agriculture, in conjunction, first, with Prof. J. H. Priestley (University of Leeds) and, later, with Prof. V. H. Blackman (Imperial College of Science and Technology).

† S. Lemström, "Electricity in Agriculture and Horticulture," 1904.

‡ O. Lodge, *Journal Inst. Elect. Eng.*, March 2nd, 1914.

§ A description of this valve will be found in *Phil. Mag.*, 1911, Vol. XXII, page 1.

probably show that 2—3 amperes are used in the primary of the coil, and the sparking distance at the field spark gap (indicating the potential difference between the wire network and earth) to be $\frac{1}{2}$ in.— $\frac{3}{4}$ in. These are the facts available from Sir O. Lodge's experiments; what further happens he describes in a manner which is not very helpful scientifically.

"Leakage immediately begins, and the charge fizzes off from the wires with a sound which is sometimes audible, and with a glow sometimes visible in the dark. Anyone walking about below the wires can sometimes feel the effect on the hair of the head as of a cobweb on the face. They are then feeling the stimulating action of the electrification."

This reminds one strikingly of another worker on the subject of electro-culture, Garolla (1892), who sent a current from galvanic cells through the soil of some pot cultures, and used a current of such a strength "that it burns the tongue."

However, some information may be obtained from measurements in the high-tension circuit. To illustrate this, I may refer to some experiments of my own,* where a wire (galvanised iron) was suspended 1 metre from the ground. The length of the wire was 10 metres. It was charged

bigger is the current and the lower the voltage to which the wire can be kept charged. Also it is noticed that the current is bigger when the wire is charged negatively (up to 1.5 times as much as when it is charged positively).

All these facts are, of course, only confirmation of what would be expected from pure physical principles (see, for instance, J. J. Thomson: "Conduction of Electricity through Gases").

A cotton-covered wire will give a stronger discharge than a bare wire of the same diameter if the atmosphere is dry.

Such measurements in the high-tension circuit (or earth circuit) are necessarily very approximate, and when high voltages are used, as in the Lodge-Newman apparatus, they require rather special apparatus for measurement.

The following facts are disclosed by such crude measurements:—

For a definite source of high-tension electricity the strength of the discharge depends on:—

1. The sign of the charge.
2. The diameter of the discharge wire.
3. The distance from ground of the discharge wire.
- To this may be added if more complicated systems of discharge wires are used:—
4. The physical structure of the elements (wires, &c.) of the discharging system.
5. The number of discharge wires employed, and the distance between them.

A comparison between the system used by Lemström and that of Lodge-Newman will make clear how impossible it is



FIG. 1.—SHOWING THE LODGE-NEWMAN APPARATUS.

From left to right: Mercury turbine break with gas-bag for coal gas, induction coil, spark gap, five Lodge valves, and field spark gap. From here the wave is carried to the field through the window at the top of the picture; insulated cable such as is used in X-ray work is employed between the spark gap and the first pole (surrounded by a piece of quartz tubing where the cable passes through the window).

from an influence machine revolving at a constant speed. By using wires of different diameter it will be observed that both the current passing through the discharge wire and the potential to which it can be charged vary considerably:—

Diameter of wire.	Voltage.	Current.
0.36 mm.	27,000	$2\frac{1}{2} \times 10^{-6}$ amperes
0.45 "	30,000	2.0×10^{-5} "
0.85 "	30,000	1.5×10^{-5} "
2.15 "	36,000	0.75×10^{-5} "

Similar big variations are obtained by keeping the diameter of the wire constant and varying its distance from the ground. The nearer the wire is to the ground, the



FIG. 2.—SHOWING A POLE WITH INSULATOR.

Distance, 15 ft. from ground. To the right a screen of $\frac{1}{4}$ -in. wire netting, which was used in some preliminary experiments to prevent the discharge from reaching the "control." This screen did not prove any good, as it was considerably lower than the discharge wires.

to judge the relative merits of the two systems when technical measurements are not at hand:—

	Diameter of discharge wire.	Distance from ground.	Distance between discharge wires.	Spark length between net and earth.	Sign of charge.
Lemström	0.6 mm., but with discharge points every metre.	0.4 m.	1.25 m.	0.5-2.5 mm.	+ or -
Lodge-Newman	0.6 mm.	5 m.	10 m.	10—20 mm.	+

It will also be understood that the measurement of spark length is not very helpful in attempting to get an absolute measure of the discharge.

Still more complicated than the laboratory conditions are the conditions under which the discharge takes place in the open air. Meteorological factors obviously play a much more important part, and cannot be controlled as in laboratory experiments. It becomes imperative to obtain an absolute measure of the current actually passing through the air. The writer has made an attempt to develop certain methods of measurement of the electric air currents. These measurements were not undertaken from the point of view

* I. Jorgensen, Tidsskrift for Vindelektricitet, Copenhagen, May, 1910.

of physical research, but in order to obtain quick and easy methods which could be conveniently employed in the agricultural experiments.

Let us consider the physical processes concerned in the discharge. What happens is that neutral gas molecules acquire a charge, + or -. According to the working theory of modern physics, the structure of the atom can be represented by assuming the presence of one or more positively charged nuclei, round which revolve negatively charged electrons. Thus the hydrogen atom, which is the simplest built atom, consists of one nucleus and one electron. The charge of the nucleus and the electron is the same with opposite sign (5×10^{-10} electrostatic units).

If an electron is removed from an atom or molecule, the latter will assume a positive charge; if an electron is added to a system it will appear with a positive charge.

In the case of a discharge of electricity from a thin wire charged to a high potential—positively, for example—it can be imagined that the charging of the wire consists in the withdrawal of electrons from the metal molecules, these electrons being replaced by electrons from the gas molecules in the neighbourhood of the wires. The charged atoms or molecules (ions) will move towards earth under the influence of the electric forces (potential difference between the charged wire and ground); from neutral molecules in the plant or soil they will acquire electrons, and thus become neutral, &c.

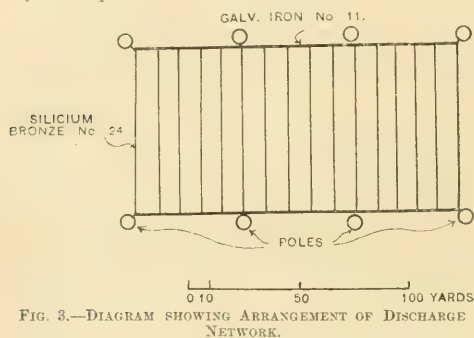


FIG. 3.—DIAGRAM SHOWING ARRANGEMENT OF DISCHARGE NETWORK.

In the discharge in atmospheric air the ions will not be simply atoms or molecules, but a charged atom or molecule surrounded by a cluster of neutral molecules. The number of molecules determines the speed with which the ions travel under the influence of an electric field, *e.g.*, the ion is characterised by its mobility, the velocity of an ion in a field of an intensity of 1 volt per cm.

A general expression for the current passing through the air is the following:—

$$i = n u e,$$

where i is current density, n the number of ions, u the velocity of the positive ions, and e the charge of an ion (5×10^{-10} electrostatic units); if both positive and negative ions were formed the expression would have been—

$$i = n_1 u_1 e + n_2 u_2 e;$$

but measurements showed that with the wires charged positively the current was carried only by positive ions.

The formula may also be written $i = n \cdot e \cdot \frac{dr}{dx} \cdot c$ where the velocity of the ions has been replaced by the product of potential gradient $\frac{dr}{dx}$ and the specific velocity of the ions. The product ner is called the specific conductivity of the air.

On the determination of these two quantities, the potential gradient and the specific conductivity, depends the measurement of such small electric currents in the air as are produced by the Lodge-Newman system.

Space does not permit of a lengthy description of the apparatus employed for the measurements and the precautions which must be taken in order to obtain reliable results; the reader is referred to a text-book on atmospheric electricity—Mache and Schweidler,* for instance—where measurements of a somewhat similar nature are described.

(To be concluded.)

THE PRODUCTION OF SMALL DRY BATTERIES IN THE U.S.A.

Is a paper recently read before the American Electrochemical Society, C. F. Burgess called attention to the remarkable growth in the production of dry cells, despite developments in the telephone field, signal work, and gas-engine ignition, which have been predicted as factors to reduce greatly the demand for dry cells. The author stated that if 50,000,000 represents the annual output of standard, or so-called No. 6, dry cells in the United States, this figure may be multiplied several times to represent the number of small dry cells used for flashlight and miscellaneous other purposes. High-efficiency miniature tungsten lamps and improved quality of the battery have been important factors in stimulating the flashlight industry.

Considerable information was given in the paper on efficiency, output, and other characteristics of small dry cells, based on a

TABLE I.—RATING OF DRY CELLS FOR FLASHLIGHTS.

Flashlight bulbs.	Volts.	Amperes.	Type of battery to be used.	Ohms resistance per cell.
Clear ...	2.7	0.35	2-cell—tubular type	3.84
	3.8	0.35	3 cell—tubular type	3.62
	2.9	0.35	2 cell—tubular type	4.14
	4.0	0.35	3 cell—tubular type	3.81
Opal back...	2.5	0.35	2 cell—case type	3.57
	3.8	0.35	3 cell—case type	3.62
	2.5	0.25	2 cell—case type	5.00
	Average...			3.94

summary of tests made on about 4,000 cells. The two most important characteristics by which the value of a flashlight battery may be determined, according to the author of the paper, are ability to furnish light over a period of time, or its capacity, and its ability to withstand deterioration when not in use, or its shelf life. Other characteristics of importance are voltage, recuperation, uniformity, size, and cost. An accompanying table gives data on flashlight lamps as now standardised by manufacturers.

The data in the table indicate that about 4 ohms is the average resistance of the common sizes of lamps, and this is adopted as the standard. It is the resistance recommended by the committee on standard methods of testing dry cells, as outlined in

TABLE II.—CAPACITY OR HOURS OF BURNING FOR SMALL DRY CELLS.

Brand.	Size of cells— inches.				1 1/2 x 2 1/2.	1 1/2 x 3 1/2.
	2 1/2 x 1 1/2.	1 1/2 x 1 1/2.	2 1/2 x 1 1/2.	1 1/2 x 2 1/2.		
A	13.25	3.5	3.75	1.9	56 min.	70 min.
B		3.6	4.2	1.7	—	—
C	10.5	2		.85	13 min.	—
D	13.25	5	4.2	2.0	63 min.	66 min.
E	13.75	4.1		1.4	40 min.	—
F	9.25	3.1	2.5	1.25	34 min.	45 min.
G	8.75	3.2		1.1	—	—
H	13.25	4.3	4	1.9	40 min.	75 min.

the transactions of the American Electrochemical Society. A voltage of 0.5 across the cell terminals when delivering current to the 4 ohms resistance is taken as the point where the current has fallen so low as to give a non-useful light. The standard method of capacity test consists in connecting an individual cell to a resistance coil of 4 ohms, and discharging continuously until its voltage drops to 0.5 volt. Most of the flashlight cells will drop to 0.5 volt during an eight-hour period. The larger cells will run

TABLE III.—DURABILITY OR SHELF WEAR FOR SMALL DRY CELLS.

Expressed in monthly percentage reduction in flash.

Brand.	Size of cells— inches.				1 1/2 x 2 1/2.	1 1/2 x 3 1/2.
	2 1/2 x 1 1/2.	1 1/2 x 1 1/2.	2 1/2 x 1 1/2.	1 1/2 x 2 1/2.		
A	3.66	8.3	9.2	9	12	9.3
B	1.55	6.45	9.1	10	—	—
C	1.87	3.83	—	5	25	—
D	2.40	5.7	5.0	8.1	6.6	10.5
E	5.10	7.5		9.6	14	15.3
F	14.3	11.2	14.1	25.0	—	14.0
G	10.8	12	10	22.0	25	—
H	10	12.5	9.1	15.0	27	13.3

beyond this, giving some chance to recuperate before the beginning of the following test period.

The author states that, from long experience and a great many tests, the best method of determining the deterioration going on within the cell is by measuring the short-circuit flash which the cell gives when connected momentarily to an ammeter. A cell which gives a flash current of 8 amperes when new may drop

* Mache and Schweidler: "Die Atmosphärische Elektrizität." Braunschweig, 1909.

to 4 amperes after six months, and this indicates roughly a depreciation in capacity of 50 per cent. While the decrease in flash is not strictly proportional to the decrease in ampere-hour capacity, it is nevertheless a far better indication than is the drop in open-circuit voltage.

Dry cells vary in initial voltage far less than they do in other characteristics. The author pointed out that grades of materials supplied as well as the methods of manufacture influence the voltage to a small degree. Likewise the ability of a battery to "recuperate" can be given to a cell by certain variations in the methods of manufacture. Thus a coarser grade of manganese will show a higher recuperative ability than will a very finely powdered more active grade. In general, it may be considered that high recuperative ability is inconsistent with ability to deliver current constantly without serious dropping in voltage.

TABLE IV. PERFORMANCE THAT SHOULD BE EXPECTED FROM A DRY CELL OF GOOD QUALITY.

Cell dimensions.	Capacity, minutes.	Per cent. monthly deterioration.
2.25 x 1.25 in. (57.2 x 38.8 mm.) ...	960	Under 4
1.875 x 0.9375 in. (46.1 x 23.8 mm.) ...	300	Under 6
2.125 x 0.75 in. (54 x 19.1 mm.) ...	250	Under 8
1.875 x 0.625 in. (47.7 x 15.9 mm.) ...	120	Under 10
1.5625 x 0.5625 in. (39.7 x 14.3 mm.) ...	65	Under 12
1.875 x 0.5625 in. (47.7 x 14.3 mm.) ...	70	Under 12

The data in Tables II and III give results of tests on different brands of dry cells purchased in the open market. The capacity tests show that the best cells have a capacity of about 100 per cent. above the poorest, and from the durability tests the differences are much greater. The performance that should be expected of good quality dry cells is shown in Table IV.—*Electrical World*.

THE NATIONAL INSURANCE ACT, 1911.

UNEMPLOYMENT INSURANCE.—FURTHER DECISIONS OF THE UMPIRE.

The following additional decisions have been published:—
CONTRIBUTIONS ARE PAYABLE FOR

1,946 X. Warehousemen, storekeepers, caretakers, timekeepers or watchmen employed wholly or mainly by way of manual labour in factories or workshops, or in yards or stores immediately connected therewith, when the aforesaid factories or workshops are engaged wholly or mainly in munitions work, or in any of the trades insured under the National Insurance (Part II) (Munition Workers) Act, 1916.

1,947 X. Porters, packers, messengers, cleaners, or weighmen employed in factories or workshops, or in yards or stores immediately connected therewith, when the aforesaid factories or workshops are engaged wholly or mainly in munitions work, or in any of the trades insured under the National Insurance (Part II) (Munition Workers) Act, 1916.

1,948 X. Engine drivers, boilermen, firemen, stokers, cleaners, oilers and other workmen engaged wholly or mainly in tending, driving or minding engines or machinery, or in stoking boilers for the production of power, light, or heat for use in connection with munitions work or in any of the trades insured under the National Insurance (Part II) (Munition Workers) Act, 1916.

(This decision does not relate to workmen employed by separate companies or authorities who sell electricity or power for general purposes.)

1,960 X. Workmen engaged in assembling cycle and motor repair outfits intended for use in war.

1,963 X. Workmen engaged wholly or mainly in vitreous enamelling upon metal.

1,964 X. Workmen engaged in repairing machinery belting in an establishment which is engaged wholly or mainly in munitions work or in any trade which is insurable under the National Insurance (Part II) (Munition Workers) Act, 1916.

1,965 X. Workmen engaged in making metal patterns as described in Decision B 1,138 (*Board of Trade Journal*) of October 24th, 1912) or in making patterns of other materials, if the patterns are for use in the manufacture of metal goods.

NOTE. Decision B 1,138 reads as follows:

Workmen engaged in making metal patterns (other than cast-iron patterns) not being for the use of iron, steel, brass or other foundries which are engaged wholly or mainly in making castings for use as parts of the products of a mechanical engineering establishment.

CONTRIBUTIONS ARE NOT PAYABLE FOR

1,954. Workmen engaged wholly or mainly in the manufacture of porcelain insulators or of porcelain parts of electrical switches, lampholders or other fittings, unless such insulators or switches, &c., are intended for use in war.

1,961. Colliery electricians engaged wholly or mainly in the maintenance of electric light and power installations in or about the colliery (but not in colliery buildings or shops) and not engaged

wholly or mainly in repairs to the electrical machinery or switchgear.

1,962. Workmen described as out-door erectors and engaged wholly or mainly in the installation of accumulators.

1,967. Workmen employed in crushing blast furnace slag for use as material for road-making.

Notice is given that the Umpire has received an application for a decision as to whether contributions are payable or not in respect of stablemen employed in connection with any insured trade (476 X).

Any representations were to be made in writing to the Umpire by, or on behalf of, any workman or employer, and forwarded to the Registrar, Office of the Umpire, 47, Victoria Street, London, S.W., on or before October 26th, 1916. A decision on this application will be given on or after October 30th.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

G.E.C. Rotary Converter Traction Equipment in Barcelona.

The accompanying views show the electrical equipment of the Coello sub-station of the Barcelona Tramways Co., aggregating 1,500 kw. Three-phase power is received at 6,000 volts, reduced to 450 volts by oil-insulated air-cooled transformers in the basement and is situated between the machines. To gain access to each trans-

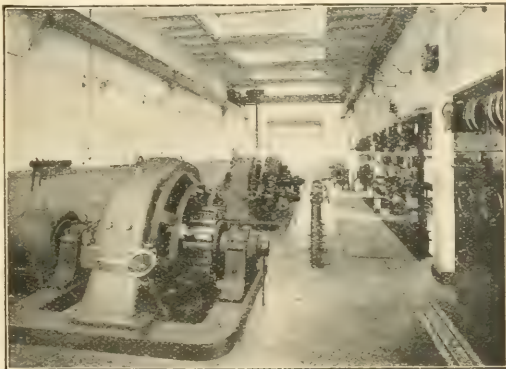


FIG. 1.—THE COELLO SUB-STATION OF THE BARCELONA TRAMWAYS CO. SHOWING WITTON ROTARY CONVERTERS.

former, a removable chequer plate is let into the floor, which can be lifted when the transformer needs attention or inspection. The converting equipment comprises three 300-kw. shunt-wound Witton rotary converters running at a speed of 750 R.P.M.,

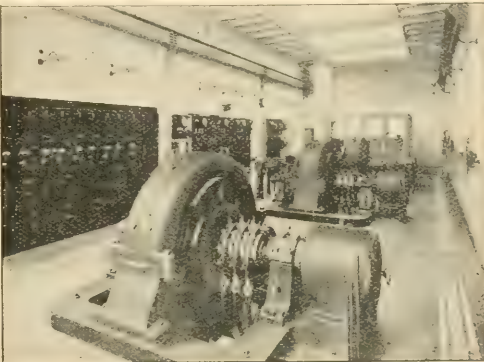


FIG. 2. A.C. SIDE OF ROTARY CONVERTERS AND WITTON FEEDER SWITCHBOARD.

fitted with interpoles, and generating direct current at 600 volts. The energy so produced is used entirely for traction purposes.

Each rotary converter is provided with a slip-ring starting motor for running up to speed, synchronising being effected by operating

to rotate the core of the slipping motor. The motor is carried on a bracket at the end of the shaft. Switchboard pillars for controlling the regulators are mounted near the switchboard, as shown in fig. 1. In addition, each rotary may be run up from the continuous current supply by means of a changeover switch and starting resistance, and may be operated from a handwheel pillar. On the top of the board a double-pole changeover switch is also provided to reverse the shunt coil of the reverse-current trip when starting the motor.

A portion of the main switchboard controlling the low-tension section of the station is also seen in fig. 1. In fig. 2 a view of the A.C. side of the rotaries and the feeder switchboard is shown.

On the controlling switchboard each rotary converter A.C. panel is fitted with ammeter, power-factor meter, and switch and fuses for the starting motor. Adjacent to each A.C. panel is the corresponding D.C. panel, on which is mounted a circuit-breaker having overload trips as well as a tripping coil operating in conjunction with an over-speed device for each converter, in addition to the change-over switch and the single-pole main switch for starting from the continuous-current side.

A synchroscope with machine and bus-bar voltmeters is carried on a swinging bracket at the end of the board. The feeder panels are each fitted with a single-pole circuit-breaker, main switch, and ammeter.

The complete installation, as described, was supplied by the GENERAL ELECTRIC CO., LTD., of London.

Small Commutators.

An ingenious method of constructing small commutators from round bar material is disclosed in a patent No. 1,195,861, granted to EDWARD F. SMITH, of Cincinnati, Ohio. Copper in the shape of a cylindrical block is formed with a central bore, having counter-sunk recesses in its opposite flat sides and radially arranged cuts which extend in from the periphery toward this bore. These cuts are all of practically equal depth and terminate so as to leave an intact annular zone of metal around the bore, so that a blank results as shown in fig. 3. This blank is then placed in a cylinder, and dielectrical material, in plastic condition, is placed upon the

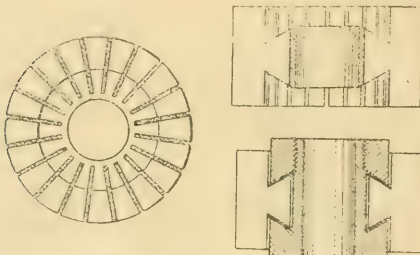


FIG. 3. SECTION OF COMMUTATOR BLANK, INSULATING MATERIAL IN PLACE, AND SECTION OF COMPLETED COMMUTATOR.

blank within the cylinder. By means of a plunger this material is forced against the blank so as to enter all open parts of it, the object being to fill these parts completely. The blanks are then removed from the cylinder, surplus material, especially that which fills the bore and recesses, is removed, and the blanks are set aside to permit the material to harden. Next the blanks are rebored to remove the metal within the bore, from which action finally a structure results, composed of segments all insulated from each other by the binding material. A bushing forms a bearing for the commutator.—*Electrical World*.

Improved Pocket Lamp.

The best battery and bulb fail to make up a satisfactory pocket lamp, unless a convenient and reliable switch is provided to control the connection between the two. The sliding or in-and-out switch button and spring generally provided at the side of the battery case is not above criticism. Either it fails at times to make contact with certainty, or it goes "on" unnoticed and quickly exhausts the battery. Both of these failings are particularly serious in the case of lamps to be used for military purposes: delay in obtaining light, and, worse still, the involuntary showing of a light may be fatal. To overcome these difficulties, SCHNEIDER & CO. (Frankfurt-on-Main) have patented the "Disco" lamp, in which a rotary switch is operated by a serrated ring mounted concentrically with the lamp bulb and lens on the front of the battery case, the latter being fitted with one or other of the strap attachments now usual for military lamps. The switch ring improves the appearance of the lens mounting, and is used only when the lamp is required to burn continuously. For momentary illumination or flash-signalling, a spring contact is provided at the top of the battery case. The switch ring carries a pin, which, according as the lamp is "on" or "off," engages in the recess at the corner of one or other of two springy strips at the point where the strip bends from the horizontal to the vertical. After going vertically for a short distance, the strips again turn horizontally, one below the other, thus forming the press-switch which is in parallel with the rotary switch and is used for momentary completion of the circuit.—*E.T.Z.*

CORRESPONDENCE.

Letters received by us after 5 P.M. on THURSDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Centralisation of Electricity Supply.

We all believe that Mr. Williams's suggestions are made in the interests of the industry, and most of us think that much more may be done than now is being done to improve our position. Yet Mr. Williams will pardon us for examining his scheme before we give it our support.

First of all, Mr. Williams hopes to abolish the present control wielded by the Home Office, L.G.B., B. of T., and Parliament itself. But will all these authorities accept a Bill which invites them to expire and to bequeath their manifold powers to a new authority? Is it not far more likely that Parliament will hatch out a plan whereby the new governing body will, in its turn, be controlled by the H.O., L.G.B., and B. of T., and that things will be worse than ever? Above all things, Parliament is not likely to delegate its own powers to any commercial body. We must bear in mind that a large number of candidates are even now preparing to have a shot at the £400 per annum, at the election which will come after the war, and many of them have no knowledge of business at all. Not a few of them believe that Parliament should manage all business in the interest of the State, and they feel convinced that the said management can be carried out by a body of Members of Parliament who neither know nor care anything for the principles which govern business transactions. Now these gentlemen will work hand-in-hand with our Government officials to secure that no existing powers shall be abated one whit. Rather they will take advantage of the controlling Bill to take over the whole electricity supply industry.

Let us not forget the fate of the telephone. It began with many independent companies, which were eventually taken over by the National Co. According to Mr. Williams's idea, no doubt the thing should have stopped there. But it did not. The Government took it over for the benefit of the State. (It would be interesting to read some of the then Postmaster-General's speeches in the light of the present fiasco.) The State has not received benefits from the change. It has lost the rich royalties it used to get, it has raised charges to subscribers in a wholesale way, and is losing subscribers also in a wholesale way. According to the newspapers, it has lost 4,000 in London alone. Think of what that would mean to the nation if it should happen to the electrical industry. We shall do well not to tempt the next Parliament by putting any such Bill before it until we have reason to think that the members of the House are to be trusted with the responsibility.

But if we should be assured that Parliament would accept Mr. Williams's Board of Control, are we sure it would be the best thing for the industry? Mr. Williams quotes the Public Trustee as being a great success. (There are contrary opinions even on that point.) The Public Trustee is just one of those cases where the department may be run strictly on rule and red tape, and I have no doubt that all the Trustee's actions are so regulated. But the electrical industry is different. By the time the Board had got out its series of rules and regulations many of them would be out of date, and one cannot imagine a dignified Permanent Board varying its rules immediately just because some young unknown engineer, in a distant part of the land, had desired it! The Board, after 10 years, would become like a bench of bishops, wondering how new men dared to have ideas of their own, when they ought to take their opinions from the great and recognised authorities.

If we are to have a Board of Control, let us have a live one which will automatically shed its fossils and barnacles. A Board selected from the existing Councils of the large Institutions concerned, with an efficient paid staff and a laboratory, might do useful work indeed. But do not let us make the mistake of putting into its hands too much power at first. It will be far better to add to its authority when it has proved itself worthy of the confidence of the whole industry.

M. H. O.

October 15th, 1914.

Coal Economy.

One does not have much time nowadays to wade through long papers, speeches and addresses, and the pithy summaries you are accustomed to give of these are extremely valuable. In one of your leaders of this week, under the above heading, you make a note on Mr. Chattock's valuable address to the Birmingham Association of Mechanical Engineers, pointing out that he suggests "that some of the boilers in a large pit-mouth generating station should be fired with coke obtained from the distillation of coal, or, as an alternative, that coke might be gasified in producers, the advantage of the latter being uniformity in the firing of boilers and the avoidance of the difficulties met with in burning coke in boiler furnaces."

The great advantage, however, of gasifying coke, instead of burning it, is that from 30 to 60 lb. of ammonium sulphate can be recovered per ton of coke gasified, because it contains from $\frac{1}{2}$ to 1 per cent. of nitrogen. It is true that if we distil coal and burn only coke and gas, we have gone a tremendously long way in preserving the by-products of coal, but in big power stations, where large quantities of gas would be required, there is no doubt whatever that it would pay to gasify coke in ammonia recovery

producers. About 120,000 cu. ft. of gas is obtained per ton of fuel with a calorific value of about 120 B. TH. U. per cu. ft.

The producer offers a superior method of firing boilers to the coke furnace. There is a lower percentage of carbon left in the ash, and the efficiency of the gas-fired boiler must also be greater than that of a coke or coal-fired boiler, because the admixture of gas and air is under much better control, and air leakage is more easily prevented, so that a gas-fired boiler ought to work under laboratory conditions almost continuously.

I have recently seen some accounts of gas-fired boilers where efficiencies have been obtained much higher than anything that can be done with coal-firing, even when the latter is carried out under test conditions; the boilers were specially designed for gas-firing, and not coal-fired boilers, adapted to gas-firing—the latter method will not give a better efficiency than coal-firing.

A. Hugh Seabrook.

St. Marylebone Electricity Supply.

October 23rd, 1916.

[We are glad that Mr. Seabrook finds our summaries useful, but may point out that his summary of our remarks (between inverted commas) is not a verbatim quotation. In his address, Mr. Chattock did not mention gas producers fed with coke, which were the subject of our own comment. We quite agree with Mr. Seabrook's remarks, and in this connection the article on gas-firing, which appears elsewhere in this issue, will be found of interest.—Eds. ELEC. REV.]

The British Mannesmann Tube Co.

I desire to draw attention to the above matter, in order to illustrate one instance where the presumably good intentions of the Public Trustee in transferring German-owned concerns into British hands have apparently miscarried.

The British Mannesmann Tube Co. was the property of German interests resident in Germany, and these interests have recently been sold by the Public Trustee to a British financial group, the first directors of which are given in the Press as follows:—

Mr. Richard S. Guinness (chairman),
Sir Robert Balfour, M.P.,
Sir Hugh Bell, and
Mr. G. Hethey (managing director).

The announcement in the Press was doubtless intended to convey the impression that this previously well-known German concern had now become British; but the real facts disclose a state of affairs quite different. In other words, whilst the ownership of the business has passed into British hands, the actual management of the business remains in the hands of individuals of German birth.

On patriotic grounds it is to be regretted that the board of this British syndicate should have appointed as one of their colleagues and managing director an individual of German birth, whose commercial career as head of the German Mannesmann interests in this country has been entirely associated with, and supported by, German interests; and that they should further allow two important positions in this company to be occupied by two sons of the said individual, of military age, born in Germany of German parents.

In other words, here we have an instance of the Public Trustee selling the German-owned company to a British financial syndicate the members of which, whether for want of knowledge of the business themselves or other motives, allow the business to be continued under the previous German-inspired management.

Apart from the question of patriotism and of the obvious desirability of cleansing our industries of German influence, it seems to me almost incomprehensible that the Public Trustee, who is apparently empowered to negotiate by private treaty for the disposal of these German-owned concerns, should not be required to satisfy himself that the sale will have the effect of converting the previous German concern into a British concern *in toto*.

E. J. Fox.

London, S.W., October 19th, 1916.

[Our correspondent's solicitude for the protection of British interests, especially in this particular branch of industry, is readily intelligible; but, in this instance, he appears to be "barking up the wrong tree," as the Public Trustee, we believe, has nothing to do with the *personnel* employed by the concerns which he has transferred to British ownership. As regards the nationality of the managing director, Dr. Macnamara stated in the House of Commons, on October 18th, that he was a naturalised British subject of German origin, and was assisted by his two sons, who wore the badge "On war service" issued by the Admiralty.—Eds. ELEC. REV.]

TRANSFORMERS IN PARALLEL.

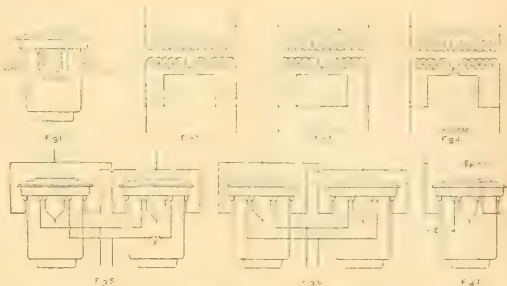
THE simple distributing transformer usually has two high-voltage leads and four low-voltage leads coming out from its windings, as indicated in fig. 1. The schematic diagram of the windings and the way the leads are brought out are shown in fig. 2. It will be seen that the two centre leads of the low-voltage coils are crossed inside the transformer before they are brought out through the case. This does not make any change in connecting the two sections in series on the outside of the transformer, as indicated in fig. 3, which is the same as connecting two batteries in series.

When the coils are connected in parallel, care must be exercised

and adjacent leads connected together, as in fig. 4. Looking at the connections from the outside of the transformer, it would appear as though the two sections of the winding were short-circuited, but the diagram shows that the right-hand terminals of both sections are connected together, also the left-hand terminals. This is just what is done in connecting batteries or other direct-current elements in parallel—like poles are connected.

Transformers to operate in parallel should be of the same voltage, frequency and size, and possess the same characteristics, which means that they should be of the same make. In connecting transformers in parallel, it is only necessary to observe the same rules as are used for connecting two or more pieces of direct-current apparatus in parallel; namely, connect like poles to like poles. The question now arises which are like terminals on two or more transformers. This is easily determined in most cases. After the transformers are arranged symmetrically, as in fig. 5, connect the right-hand terminals together and the left-hand terminals together and bring out a lead from each junction point, as indicated.

There is, however, a chance that one of the transformers may have its leads brought out in such a way as to cause a short-circuit when the transformers are connected as shown in the figures. To



FIGS. 1-4. TRANSFORMERS IN PARALLEL.

guard against this a piece of small fuse wire may be connected, as indicated at F. If the connections are correct, the fuse will not blow when the transformers are made alive without load; otherwise the fuse will blow. In case of a wrong connection it may be remedied by crossing either the high or low-voltage leads on one of the transformers, as indicated in fig. 6. A better way would be to test the transformers and find out which has wrong polarity and correct it.

The polarity may be tested as represented in fig. 7. Connect the high-voltage terminals to the line and one terminal of the low-voltage coil to the high-voltage winding, as indicated in the figure. Measure the electromotive force at E_1 and E' . If it is greater at E' than at E_1 , the transformer has the correct polarity; if less, the polarity is wrong and either the high or the low-voltage leads must be crossed inside the transformer. The test may be made with 110 or 220-volt current.—Power.

INDUSTRIAL LIGHTING BY ELECTRICITY.

THE tendency of the present day, in arranging schemes of artificial lighting, is, as in many other matters, to endeavour to crystallise the whole matter as much as possible, and in the case of lighting into three points; that is, height of lamp or lighting "unit"; spacing distance; and the candle-power of the unit employed.

Whilst useful enough and easy of application in *new* buildings, in *old* buildings the points mentioned commonly have to be the subject of part consideration only, in order that other influencing conditions may have the necessary consideration.

A point one would specially draw attention to in this connection is the need of "general" as well as "local" or "individual" lighting in most, if not all, of the premises which the mechanical and the civil engineer have to deal with. Individual or local lighting of sufficient intensity for machine tools, benches, desks, &c., is necessary if each operator is to properly perform his duties. "General" lighting, on the other hand, is equally necessary, for by this proper supervision and discipline is possible and the safety of those persons secured who have to move about through passages and gangways. Where individual lighting is provided the value of the former is considered sufficient if of the nature of about 1.5 ft. candles.

The essentials of satisfactory illumination may be summed up as comprising:—

1. Adequacy; that is to say, the *degree* of illumination produced on the working surface must be sufficient for the work or operation to be properly carried on.

*Abstract of paper read before the Junior Institution of Engineers by Frederick H. Taylor.

2. The lighting unit or source of light must be so placed that the light does not strike directly upon the eye of the operator either when he is engaged in his work or when looking horizontally across the workshop or room.

3. The lighting units should be so placed as to prevent shadows on the work or heavy shadows about those parts of the premises to which the workpeople have access.

4. Construction, so far as the degree of illumination is concerned, is also necessary.

The value of reflection and colour in artificial illumination is commonly overlooked. The experiments carried out at the National Physical Laboratory by the Home Office Departmental Committee, in a room specially fitted out with different methods of lighting, may here be cited.

Three systems of lighting were tried:—Direct, indirect, and shielded. With the walls blackened instead of whitened, the reduction in illumination at the centre of the room was approximately 25 per cent for direct lighting; 7 per cent. for indirect lighting, and negligible for shielded lighting. The influence of colour in artificial lighting is also often overlooked.

The effect of mental depression on remaining under blueish light for any length of time in some persons is most noticeable. Mercury vapour lamps when used for general lighting have been noticed to give different results with different people, where all other conditions were equal; one man, for example, insisted on the addition of an ordinary glow-lamp in order to carry on his work, whereas other workers considered this quite unnecessary.

Obviously for either "direct" or "indirect" lighting the most important item is the reflector, or, as it is more often called, the "shade." By the choice of a reflector either of the "extensive," "intensive," or "focusing" type, and with the spacing distance arranged with regard to height, it is easily possible to obtain any desired illumination, and with the source of light well screened from the eye.

With the use of tungsten lamps, ventilation of the reflector or lamp-fitting becomes necessary owing to the high temperature of the filament.

The details of fittings, apart from reflectors and shades, still leave room for improvement; lampholders in particular might well be more substantially made, and with more area of contact in the electrical parts.

Flexible cords for pendant fittings are frequently either poor in quality or deficient in section, or both, and frequently a good cord is used in an unsuitable position.

Proper systematic maintenance of electric lighting installations is a matter which, in this country, has received but the scantiest of attention. If considered properly, the lighting is virtually a tool, one of the tools necessary to the work going on, and this work cannot be properly and economically done if this tool is to be allowed to fall into utter deterioration. The cost of lighting commonly bears but a very small proportion indeed to the total stand-by, or "dead-weight" charges of the establishment, and this cost could only be increased by an inappreciable amount when the cost of systematic maintenance is added.

Maintenance contracts when carried out by general electrical contractors should include a half-yearly test and report upon the insulation resistance of the job, a point by point test of the earthing of all metal work, checking of the supply company's meter readings and quarterly charges, and might also, in many instances, justify provision for a guaranteed minimum illumination in foot candles to be maintained in specified areas or places. From a test published concerning a factory installation, the deterioration in lighting due to dust and dirt over a period of 48 days was as follows:—Starting from an initial illumination of 4 ft. candles, at the end of six days this had become 2.8, at 18 days 2.2, at 36 days 2.1, and at 48 days 2. Glass reflectors were used.

The opportunity is sometimes presented of choosing between a D.C. supply and an A.C. So far as the ordinary working voltages are concerned, there is little to choose between them, if metal filament lamps, either of the vacuum or the gas-filled type, are used. If small candle-power lamps of the ½-watt type are essential, and alternating current is available, a static transformer may be used to convert down from a higher voltage to, say, 50 volts when lamps of the 30- and 60-watt sizes become available for parallel operation, but such cases require careful consideration if the runs of the wiring are of considerable length, as the voltage drop may necessitate unusually heavy conductors. For arc lighting one generally prefers a D.C. supply. With low periodicities fluctuations in light are well known in A.C. arc circuits.

Proper switch control of lighting is a matter well worthy of more careful consideration than it usually receives, and this would result in added convenience and economy. The points one has in mind are:—(a) A more liberal use of switches, (b) better location, and (c) the use of two or three point control.

For individual or local lighting, the switches should be as conveniently near as possible to the lamps controlled. These can be further controlled by a master-switch or switches placed conveniently for use by the shop-foreman, who would also control the "general lighting." In some cases it is a great convenience to be able to control one or more lights from two or more positions.

Switches in factories commonly suffer from lack of adequate mechanical protection. Where conduit wiring is adopted, iron switch boxes which absolutely protect the switch and

only leave the knob projecting are to be preferred. Owing to its light construction, the ordinary "5-ampere" switch, even if only loaded to less than half this amount, is, at modern voltages, liable to rapid wear. The author has often found it pay well to adopt switches rated at 10 amps. for 2- or 3-amp. circuits on this account.

For factory use, screwed tube is very largely used, as affording a good mechanical job as well as a sound one electrically. From a fire risk point of view, it is obviously beyond question.

It should preferably be kept clear of all other metal work, be made electrically and mechanically continuous throughout, and properly earthed at least at one point.

When placed well out of reach, and in dry situations, open cleat wiring may often be used very successfully to form a cheap job.

With a view to maintaining efficiency in the lighting, attention may well be given to the following details in the circuit wiring:—

1. "General" lighting to be circuited separately from the local lighting, and, where possible, alternate units to form a circuit.

2. A more liberal allowance in the number of circuits or "ways" per distributor should be adopted, thus insuring a minimum of the lighting units being out of action in the event of a circuit fuse blowing.

3. Motor circuits to be entirely distinct from those supplying lighting, both as regards wiring and the fusing at main or sub-main distributing boards.

INDUSTRIAL FATIGUE.

In continuation of his investigation of industrial fatigue by physiological methods, Dr. A. F. STANLEY KENT recently submitted a second interim report to the Chief Inspector of Factories, which is of great interest and value to the managers of manufacturing and allied concerns. The experiments, which included a variety of simple tests designed to indicate the condition at any moment of the acuity of hearing and of sight, the blood-pressure, and the general response of the worker's organism to an external stimulus involving a "complex reaction," were carried on at seven factories during the past year, the industries employing both male and female labour, and covering a wide range of operations, including light and heavy engineering. The observations were directed primarily to the attainment of the maximum efficiency and output of munition factories, consistently with the maintenance of the health and energy of the workers, but obviously apply generally to manufacturing industries.

Dr. Kent lays special stress on the progressive development of fatigue throughout the week, and on the concomitant diminution in the power of recovery, the disadvantage of working overtime on consecutive days, and the development of fatigue during day and night shifts, and discusses also the process of recovery from fatigue under different conditions. The variation in rate of output of repetition workers throughout the day and the week, as shown in curves and charts, presents remarkable features, particularly in connection with the effect of overtime, which always appears to be accompanied by a marked fall in the rate, besides a remaining effect which reduces the rate on the following day; in fact, evidence is adduced to show that the working of overtime may lead to an actual diminution of the aggregate output. The very important influence of home conditions upon the development of fatigue and upon the output is clearly demonstrated, and the value of rest intervals is proved.

The author draws from his observations a strong argument against the practice sometimes adopted of working on Sunday; whereas in normal times the lessened efficiency found towards the end of the week is remedied by the rest obtained on Saturday afternoon and Sunday, if Sunday labour is introduced the rest period is inadequate, and the fatigue becomes permanent and cumulative, so that eventually the worker either breaks down under the strain, or, consciously or otherwise, slackens his efforts until equilibrium between fatigue and recuperation is once more attained. In either case the result is disastrous from the point of view of output, and often from the point of view of health also.

The effect of daily overtime is less marked than that of Sunday labour, though the rate of output during the overtime period has been proved to be far less than during the hours of normal labour, due, in Dr. Kent's opinion, to fatigue. Again, in factories where the output depends mainly upon the number of hours that the machinery can be kept running, and the direct influence of the operatives is small, it may be desirable to preserve overtime, though the introduction of a fresh shift would be preferable.

Another point that is brought out is the importance of taking food before going to work in the early morning, as regards the output obtained.

The work of investigation, which has been in progress for some years, is still going on, and now occupies the whole time of three investigators. Amongst the more important conclusions with regard to fatigue as a result of overtime are the following:—

Existing industrial conditions lead to an increase of the

normal development of fatigue and to a diminution of the normal power of recovery. Members of the office staff may show signs of fatigue and overstrain equally with the factory hands. Ordinary tests give the resultant of these two processes, which is useful practically, as indicating the existing state, or "fitness," of the worker.

Development of fatigue preponderates during labour, recovery preponderates during rest. During the day fatigue accumulates. During the night the accumulation is dissipated. Since production is greatest and recovery is least towards the end of a period, day, and week, fatigue accumulation is then at its maximum. A lengthening of period, day, or week leads to increased fatigue accumulation. The distribution of overtime days affects the result.

Under present conditions, production of fatigue becomes progressively more rapid from day to day; recovery becomes less rapid. Thus fatigue accumulates, and "balancing," which tends to diminish fatigue by diminishing application, is introduced. Production and recovery are restored to the normal, and accumulated fatigue is dissipated, by the week-end rest. Where the week-end rest is suspended, fatigue will persist. Residual fatigue, resulting from inadequate rest, leads to lowered efficiency and lessened output.

Overtime labour, when performed by a tired worker, results in an amount of fatigue out of proportion to the length and severity of the labour. Fatigue production is increased and recovery is lessened by overtime. The fatigue which follows a period of overtime is influenced by the previous condition of the worker. An increase in the amount of overtime worked in a given period will produce an increase of fatigue out of proportion to the increased time. Overtime periods worked on consecutive days produce more fatigue than if separated by days of ordinary length. Overtime introduced late in the week produces more fatigue than if introduced earlier. Overtime, even when not leading to injurious fatigue, is deleterious to health as necessitating long hours spent in the atmosphere and surroundings of the mill, interference with meals, sleep, relaxation, and exercise in the open air. The effect of overtime is not confined to the days on which it is worked. In the great majority of cases investigated, overtime was not desired by the workers. The harmful effect of overtime may be accentuated by the presence of unfriendly supervisors. Overtime labour is physiologically and economically extravagant. It frequently fails in achieving its object.

Labour performed at night may be regarded as analogous to overtime labour. It is performed at unusual hours. Its effect in producing fatigue may be greater than that of a similar task performed during the day. This effect appears to be modified after the night work has been in progress for some days, owing to an adaptation of the normal diurnal variations of the worker to the new conditions. For this reason a weekly change from day shift to night shift and *vice versa* appears to be unduly frequent. The difficulty of obtaining satisfactory sleep by day affects the result.

These conclusions do not relate to excessive overtime, but to two hours added to the normal day on two or three days a week—Sunday being a rest-day. Remarkably that the fatigue manifested indicates that overtime labour is more harmful to the worker than labour performed during ordinary hours. Dr. Kent points out that it is physiologically extravagant; it is also economically extravagant, for higher wages are paid for overtime, though even higher wages are not sufficient to make it universally desired by the workers.

Comparing day and night work, it was observed that the degree of fatigue developed was greater during the night shift than during the day. This is largely due to the inadequacy of the rest obtained in the day time, all the men examined stating that they slept well by night but badly by day, as might be expected in view of the difficulty of securing favourable conditions in a workman's home. It appears likely that, as there is a gradual adjustment of the organism to night work, tending to lessened fatigue, the period over which the day or night shift is worked by individual men might with advantage be lengthened.

It is interesting to note that, despite the Sunday rest, usually at the start on Monday the rate of output is distinctly low, apparently due to the temporary loss or weakening of the habit of working, and the necessity for an effort on the part of the worker to overcome the disinclination to work; the same phenomenon has been observed, in lesser degree, in the early morning of each day.

A mass of detailed data is included in the report, showing some remarkable facts. For instance, the output of four workers was tabulated for each division of the day over a period of four weeks; one of these had found for herself that by working only eight hours a day she could work so much more quickly that she could easily make up for the lost time. The other three were first-class workers, working 12 hours a day, until overtime was abolished and the working day was reduced to 10 hours. It was ascertained by strict observation that the output of the 8-hour worker was greater than the average output of the 12-hour workers by more than 8 per cent.; moreover, when the 12-hour workers were put on a 10-hour day, their total output increased by more than 5 per cent.

The results of unsatisfactory feeding were found to be very marked, particularly in the early morning when no breakfast had been taken; increased resistance to fatigue follows improved feeding, and Dr. Kent severely criticises the diet

affected by many of the workers, especially the women. The inference is that the establishment of canteens at the works, supplying wholesome food at a low price, is highly desirable, unless it is possible for the worker to obtain a satisfactory meal at her own home. Such canteens should be provided with separate tables, and should be managed by a committee of the workers.

As the output of a factory depends upon many considerations, including the nature of the operations and the influence of the individual worker upon the volume of output, the nominal length of the working day, the actual hours worked, &c., Dr. Kent lays down no rule as to the method of attaining the maximum output, but states that this is a matter of the accurate adjustment of the factors concerned, based upon exhaustive investigation and patient experiment—particularly in connection with the actual time worked, and the actual rate of working. As for the effect of overtime upon the general health of the worker, a difficult subject for investigation, an estimate has been formed by comparing the results given by the same individual at different periods, under different conditions, thus avoiding the very unreliable course of comparing the health of one person with that of another. During a period of several weeks, whilst the working hours were changed from 12 and 10 to eight hours, in each case that was examined, the suspension of overtime was followed by a measured improvement in the general condition of the worker, and in nearly all cases the reduction of the working time from 10 to eight hours by omitting the early morning period brought about a further improvement, but of much less magnitude. Similarly, it was found that the loss of time by workers during their working hours was materially diminished when the working hours were shortened, being reduced from 19.5 per cent. to 15 per cent. on the suppression of overtime in the case of a group of work-people, and further to 13.3 per cent. on reducing the hours to eight per day.

WAR ITEMS.

Prohibited Exports.—A Proclamation has been issued adding the following, among other headings, to those already included under the Exportation Prohibition Acts:—

Copper wires and cables containing copper.

Rubber, gutta-percha, or balata goods made wholly or partly of (except rubber hose, armoured or reinforced with steel or iron wire).

A. E. G. Shipbuilding.—According to the Berne correspondent of the *Morning Post*, a German newspaper says that the object of the Hamburg Shipbuilding Yard, founded by the Hamburg-Amerika Line and the Allgemeine Electricität-Gesellschaft, is mainly the construction of a series of fast cargo boats, all of the same type, and such as have hitherto been a monopoly of English shipbuilders. Shipbuilders, industrialists, and financiers are collaborating in providing means for the resumption of peace work.

A Metals Committee.—The President of the Board of Trade has appointed Sir Gerard Albert Muntz, Bart. (chairman), Mr. Cecil Lindsay Budd, Mr. Clive Cookson, Mr. Charles William Fielding, Lieut.-Colonel A. J. Foster, Mr. Andrew Wilson Tait, and Mr. Alfred Harold Wiggan, J.P., to be a committee to consider the position after the war, especially in relation to international competition, of the lead, copper, tin, and such other of the non-ferrous metal trades as may be referred to the Committee, and to report what measures, if any, are necessary or desirable to safeguard that position. The secretary of the Committee is Mr. James F. Ronca, to whom all communications relating to the Committee should be addressed at 7, Whitehall Gardens, S.W.

Sale of Enemy Goods in Australia.—An Australian newspaper states that the Attorney General (Mr. Hughes) decided last month owing to his having been unable, through pressure of business, to receive the proposed deputation from merchants regarding the sale of goods of enemy origin, to extend for one month in each case the time within which, as already announced, such goods may be offered for sale. It was pointed out that the last dates within which sales may be made are therefore as follows:—In the case of sales by wholesale houses, October 31st; in the case of sales by retailers, December 31st. This announcement was not to be taken as in any way permitting the sale at the present time of goods bearing enemy trade marks which have been suspended.

In reply to a deputation representing the Australian Association of British Manufacturers and their representatives, the Minister of Customs (Mr. Tudor) said that regarding enemy goods, commercial men said it was impossible to sell articles if they were known to be of enemy origin. The Government had a quantity of German goods which had been seized at the outbreak of the war, and he was told that only a very low price would be obtained for them. The department was doing all in its power to prevent dumping by the Americans, and was sending two men to the United States to verify invoices. He was strongly in favour of *ad valorem* duties, believing that the most expensive articles should pay the highest rate. He promised to consider the requests of the deputation when the tariff was being considered.

To be Wound Up.—The Board of Trade has issued orders under the Trading with the Enemy Amendment Act regarding the following to be wound up:

Kampe & Co., 2, Sandland Street, Red Lion Street, High Holborn, London, W.C., machinery merchants. Controller: T. A. Fox, 79, Mark Lane, E.C.

Burstinghaus & Co., Ltd., 41, Eastcheap, London, E.C., agency and hardware business. Controller: A. J. Foster, 37, Wallbrook, E.C.

United Carborundum & Electrite Works, Ltd., Apollo Works, New Southgate, London, N., agents for the sale of machinery. Controller: C. Eves, 62, New Broad Street, E.C.

Books for British Prisoners of War.—The Committee of the Board of Education which deals with this subject has sent us a classified list of books, each item of which represents an actual request received from some British prisoner. The following are included in the engineering sections:—Submarine Cables; Cable Testing; Electric Brake (Westinghouse); Electric Currents (Fleming); Dynamo-Electrical Machinery (Thompson); Modern Electric Practice (Maclean); Handbook of Electricity; Electrical Engineering (Slingo and Brooker); Alternating-current Machinery; Country House Electric Lighting Plant; Hydro-electric Power Transmission; Electric Tramways; Technical Electricity (Davidge); Magneto Ignition (Hibbert); Electrical Engineering Applied to Mining; Internal-combustion Engines; Diesel Oil Engines; Principles of Electricity (Campbell); Gyroscopic Compasses and Stabilisers; Telegraphy and Telephony (Herbert); Telegraphy (Morse); Wireless Telegraphy (Fortescue and Stanley); Post Office Technical Book (Herbert). Any of our readers who can supply one or more of these books are requested to communicate with Mr. A. T. Davies, Board of Education, Whitehall, S.W., but not to dispatch any books until notified that they are still required, as they may have been received from other sources. Donations to the funds will be welcomed. Those who have books to spare which are not named above should send a list of them, with their name and address written at the top.

Women Tramcar Drivers.—The question of the substitution of female labour for that of men in driving tramcars arose at Keighley Tribunal last week, when Mr. H. Webber, the borough electrical engineer, appealed for five tram drivers. Mr. Webber agreed that it would be possible to train women for the work, but he expected they would have the same trouble as had occurred in London, where there had been a strike on the question, because the Tramway and Vehicle Workers' Union were opposed to the substitution. In Keighley women could be trained in about a fortnight. Keighley, he said, was about the simplest place in the country in which to run a tramcar. They had been in communication with the men's Union, having interviewed a secretary about a month ago. The Chairman pointed out that each of the five men was under 30 years of age, but Mr. Webber said they had all been medically rejected. Personally, he would be quite prepared to introduce women drivers if the Union would agree, though, of course, he could not say exactly how his Committee would feel about it. He believed there were women drivers at Blackpool, and in some parts of Scotland. He would be prepared to recommend the Tramways Committee to fit glass fronts on the cars if they were considered necessary for the protection of women drivers in winter, though at Sheffield an experiment of the kind had been withdrawn at the request of the drivers themselves. The cases were adjourned. At the same hearing, Mr. Webber appealed for a clerk in the electricity department, who said he only weighed seven stone, and measured 27 in. round the chest and 29 in. expanded. It seemed he had been rejected twice, and he did the whole of the clerical work with the assistance only of a boy and a girl. A fit clerk had joined the Army, and the removal of this man would impose serious extra work on the engineer. The clerk was measured before the Tribunal, and his chest was found to be 32 in. expanded according to the Military Representative's measurement. Exemption to January 1st was given.

Investments in Belligerent Countries.—A fresh example of the inconvenience resulting from the holding by non-belligerent countries of electrical investments in countries which are now engaged in war is afforded by the Bank für Elektrische Unternehmungen, of Zurich, although it has to be remembered that the bank was formed originally by the Berlin A.E.G. At the recent general meeting of this institution the chairman stated that the Italian Government had just placed the Officine Elettriche Genovesi, of Genoa, and the Unione Italiana Tramways Electrici, of Genoa, under State supervision, which represented an easy sequestration, and the Government official was continually informed of the course of the business and would prevent any payment to hostile countries. The bank had asked for the diplomatic intervention of the Swiss Federal Council against this measure, because both of the Genoa undertakings were essentially of an Italian-Swiss character. Out of the 80,000 shares issued by the Officine Elettriche, the chairman remarked that 30,000 were in Italian possession, 19,950 were in the hands of the bank, 26,000 in other Swiss ownership, 2,000 in countries which are friendly towards Italy, and only 1,200 in German hands. The Teutonic holding in the Unione Italiana was also inconsiderable, and the German members of the directorates of both companies retired from the boards prior to the war. Proceeding to discuss the situation of the Russian invest-

ments, the speaker stated that the suspicion that the Petrograd Electric Light Co. of 1886 was a German undertaking had been removed, but the work of clearing up the matter had to be again commenced, owing to the frequent change of ministers. The hope, however, was justified that the company would overcome the present difficult period. The president also referred to the Imatra Co., and said that the erection of the works was impossible under existing circumstances in Russia. The Roumanian undertaking—the Electrica of Bucharest—had been placed under Government supervision; its area of supply was "not yet" included in the zone of war. In conclusion, it was mentioned that large reductions in the yield on the German investments were not to be expected, whilst the Swiss undertakings were in a very satisfactory position.

Exemption Applications.—The Smithfield Markets Electric Supply Co., Ltd., appealed at the City of London Tribunal on behalf of 16 of their employes. The men in question were J. Anthony, 29, married, wireman's mate; W. H. Allemande, shift engineer, 22, single; J. I. Biggam, shift engineer, 29, single; E. A. Copelin, driver, 25, married; W. H. Harper, shift engineer, 34, married; F. H. Tutt, foreman and meter reader, 25, single; T. E. Austin, installation and fuse attendant, 36, married; T. G. Deller, assistant driver, 40, single; H. J. Lazenbury, driver, 39, married; P. F. Roberts, shift engineer, 27; J. Richardson, wireman's mate, 27, married; C. E. J. Stevens, wireman, 29, married; E. W. Warren, 33, married; S. Hidson, 36, married; A. E. Bonsor, 23, and J. O'Connell.

Mr. James (Clerk to the Tribunal) said that there had been a fire on the company's premises, and this had thrown the whole thing into confusion. Mr. Powell, for the company, said the fire had wrecked their station. They appealed for these men because they were engaged on work of public utility, and every man was absolutely necessary for the carrying on of that business.

The Chairman (Mr. Cole) said that these men were of military age, and in this coming-out process the company must get some men who were not of military age.

Mr. Powell said that they had tried to get shift engineers by advertisements and other means, but really could not get men. The only way they could get shift engineers now was, apparently, by taking them from other stations, who would then be placed in the same position. The electrical papers, he said, contained thousands (sic.—EDITORS) of advertisements for shift engineers. The company employed three drivers, but they had lost one who had unfortunately been killed by an explosion in February, and another had been away owing to an accident. As a result of the fire, Mr. Powell said, Smithfield Market was now practically in darkness.

Mr. Davis (a member of the Tribunal) said that if the place was wrecked they could not possibly be employing these men.

Mr. Powell said it was a question of getting a reinstatement of all the electrical part of the business, and he could not say how soon it would be possible to do all this. He was afraid he could not get any definite promise of delivery at all. Every one of these men were employed in the station. They could be doing work and the actual delivery of some of the goods might possibly be postponed some time, but as it was now, the station was in such confusion that the men were employed not only in the day time, but at night as well so far as it was physically possible. The company made their own power. They had five oil engines more or less constantly running, and they also had a reserve supply, which was called upon by means of four motor generators, through which they could get supplies from other companies. It was their object to restore the station as far as possible and as soon as possible, and if the Tribunal would give them time they would in all probability be able to replace every one of those men. Practically everything had been destroyed except the engines themselves. Continuing, Mr. Powell said that all these men had their separate work at the present time, and the Chairman said that might be so when the machinery was running, but not when they were trying to put the place in order.

It was stated that the recommendation of the Military authorities was that seven of the men should be postponed till March 8th, one for two months, and that the rest should go. The Tribunal, however, decided to adjourn the case for a month, the Chairman remarking that possibly half of these men might then have to go.

At Sheffield, the Wolf Safety Lamp Co. applied for exemption for J. L. Conway, 34, works manager; R. S. Harvey, 25, married, and W. Robson, 28, single, electricians. Exemption until December 31st was granted to Conway, to Harvey until November 30th, and Robson's application was disallowed.

At Farsley Tribunal, the Morley Electrical Engineering Co., Ltd., appealed for Harold Moor (25, married); Leonard Magson (30, married); John Hartley (36, single), and F. H. Platts (37, married), on the ground that they were in certified occupations. In reply to an observation by a member of the Tribunal that Moor, at 25 years of age, was rather young to be a foreman, Mr. W. Summerscales, representing the company, reminded the Tribunal that the electrical industry itself is young. There was, he said, no picking up of men of 45 years of age. A workman who learned the industry under the old régime was little use now, as the methods and

almost everything had completely changed. Conditional exemption to December 31st was granted in each case.

At Shipley Tribunal, Richard Lindley, electrician, said he employed four men, all of whom were ineligible. He had attested for the Navy, but his papers had been returned. They had said there must have been some misapprehension, as there was no right of appeal for men attested for the Navy. He said he had tried through the Labour Exchange to secure direct exemption because of the nature of his trade, and had been recommended to apply to the Ministry of Munitions. After two applications there he was told it was no use asking for badges when he had an appeal pending. Until he got the appeal settled the request would have to be refused. Postponement to February 28th was allowed.

Sheffield Tribunal has granted exemption until December 31st to Mr. A. B. Gott (35), electrical engineer, who appealed on business grounds.

At Folkestone, an appeal was made by F. O. Cox, electrician at the Pleasure Gardens Theatre, it being urged that it was essential for the safety of the public that a skilled man should be in charge. He was engaged when the installation was put down, and had been in charge ever since. A month was granted.

Ilfracombe Tribunal have granted exemption until March 1st to Mr. A. H. Friend, electrical engineer, who is passed in Class C 1.

At Torquay, the Corporation electricity department appealed for an employé passed for C 2. Mr. Keenan, assistant electrical engineer, said that the man was of much greater value to him than he would be in the Army, on account of his physical condition, and he urged conditional exemption. On the recommendation of the Military representative exemption was given until January 1st.

Before the Surrey Appeal Court, the Military appealed against exemption granted at Godalming to A. G. Mitchell (21), shift engineer with the Urban Electric Supply Co., Ltd., on account of age and the man not being in a certified occupation. Mr. Robertson, for the company, said that he had been unable to replace the man. Mr. Skeet: Have you tried at the various polytechnics? Surely there are a lot of young men in training there. Mr. Robertson: No; we are not allowed to employ anyone under 16 years of age. He added that Mitchell was paid 24s. per week and the bonus. Mr. Poulter: And do I understand that this man is doing what is generally done by two men? Yes. The Chairman and Captain Gerahy both expressed the opinion that if better wages were offered another man could be found, but Mr. Robertson said if he offered £3 a week he would not get anyone. Captain Gerahy: If you advertised for a C 3 man who is no use as a clerk, and offered proper wages, you would get someone. The appeal of the Military was allowed.

The Chiswick Electric Light Supply Co. appealed at Aberystwyth for extended exemption for E. R. Chamberlain, shift engineer. It was stated that before the war five men were engaged at the Aberystwyth works; now there were only two besides the manager, and if Chamberlain was taken it would be impossible to supply the town with current. The two men worked from 8 a.m. to midnight. The two apprentices they had could not possibly undertake the work. Abortive efforts had been made to find a substitute. The application was refused on condition that the calling up is not before January 1st.

Mr. G. Hitchens, of Holloway, appealed at Bath for his brother, F. J. Hitchens (38), electric fitter. On account of the classification, the appeal was withdrawn without prejudice, subject to Hitchens joining the St. John Ambulance Brigade.

Conditional exemption, owing to his being in a certified occupation, has been granted to Mr. W. A. Harwood, electrical engineer, of Hebden Bridge.

At Rugby, exemption was claimed by Mr. W. H. Linnell for H. W. Gilbert (23), electrician and wireman, passed for labour at home. He was, it was stated, the only man left in the electrical department, which would have to be closed down if he went. The Chairman observed that the firm had done very well, and exemption until January 1st was allowed.

A Military appeal against temporary exemption allowed to Mr. Linnell, jun., was withdrawn, as he is entering the Army.

An appeal was made to the East Sussex Tribunal against exemption refused to Chas. Winter (41 in January), electrician at the Albany Hotel, Hastings, who, it was said, could not be replaced. The Court directed that the man should join up at the end of a month.

Temporary exemption until March 1st has been granted by the Barnstaple Tribunal to G. W. Branch (29), electrician, who is passed in Class C 3.

Gloucestershire Tribunal have withdrawn an exemption certificate granted at Cheltenham to a driver, aged 28, engaged with the Light Railway Co. The company has given up 64 out of 92 men, and the man was one of eight left who could be trusted to drive a car up Cleve Hill. The Chairman suggested that there should be fewer opportunities for the public to ride up Cleve Hill.

Gloucestershire Tribunal has refused exemption to the working partner (28 and single) in a Gloucester firm of electricians. At Rawmarsh, Mr. Brown, manager of the Mexborough and Swinton Tramways, appealed for two motor-men, aged respectively 24 and 39, and a brake repairer and general assistant in the car repairing depot. The two motor-men were conditionally exempted, as they are not passed for

general service, and the other man was put back for nine weeks for a medical re-examination.

At Weston-super-Mare, absolute exemption was claimed by Mr. A. J. Kettle (33), electrical engineer, of Churchill. A month was allowed.

At Axbridge, the Winscombe Electric Light & Power Co., Ltd., appealed for Mr. W. Hill Reed (38), engineer and secretary and general manager. The company, it was stated, supplied about 130 customers in five parishes, and the concern was run not for private profit, but in the interests of the public, no dividend or directors' fees having been paid. Mr. Reed took night duty, and looked after the engines and plant in alternate weeks. The Tribunal allowed six months' exemption.

Exeter Tribunal has refused extended exemption to Mr. C. H. Steele (38), electrical engineer, and Western representative for a cable construction company.

At Oxford, the Electric Tramways Co. appealed for exemption for four drivers. The Military representative pressed for two of the men, and this course was adopted, two being conditionally exempted and two being refused any time.

At Exeter, Mr. W. J. Hall, electrician, engaged at Exwick Laundry, was allowed only 13 days' grace for his place to be filled. The Military intimated that they had five substitutes available.

At Hastings, Mr. F. Wordley, electrical engineer, appealed for R. Merrifield (39), electrical fitter, claimed to be in a certified occupation. He was given conditional exemption without time limit.

Before the Hants Appeal Court, on October 19th, the Military appealed against conditional exemption allowed to C. W. Spencer (20), with the Isle of Wight Electric Light & Power Co., at Shanklin. Lieutenant Ward contended that a man of 20, who was an apprentice, could not be considered the hub of any business, and the concern could surely be carried on without him. The manager of the works urged that Spencer was in a certified occupation. The certificate was cancelled, and three months' exemption granted.

At Ryde (Isle of Wight), Messrs. Ashton & Holt, electrical engineers, appealed for W. White (24), electrical wireman, the only man left with the firm. He was given until January 19th, with leave to appeal again.

At Gloucester, on October 18th, a firm of electricians appealed for the only electrical wireman (40) left, who was an original member of the Volunteer Training Corps. Seven men had enlisted, and the firm had several Government jobs in hand. Conditional exemption was allowed.

Teddington Tribunal on October 17th granted exemption until December 16th to E. Eddey and W. Brandon, electricians, appealed for by Mr. Langston Jones.

At Walthamstow, on October 20th, Mr. G. R. Spurr, electrical engineer to the U.D.C., appealed for a trolley-head cleaner, aged 23, and said that he was extremely short-handed, and could possibly train a man to do the work in six months. Asked if it was not possible for discharged soldiers to do the work, Mr. Spurr said that he had tried three, and the result had been most unsatisfactory. The work was actually overhauling. Exemption was refused.

At the Deeside Military Tribunal, the Marquis of Aberdeen asked for exemption for Alex. Gordon, electrician, The Lodge, Tarland. In the opinion of the Advisory Committee this was not work of national importance. The Factor said they had tried a man who took funk at the engine and gave up the job. This was the only man round about the place. There was great danger in doing the work with a new and inexperienced man. He asked for temporary exemption. The claim was dismissed.

LEGAL.

REMY MAGNETOS DISPUTE.

A DISPUTE with regard to the sale in this country of the Remy magnetos manufactured by the Remy Electric Co. of America, was settled before Mr. Justice Darling in the King's Bench Division. Mr. Walter H. Johnson and the Imperial Motor Industries, Ltd., were sued by Smith & Sons (Motor Accessories), Ltd., for an alleged breach of a contract by which Smith & Sons were to have an exclusive agency for the sale of the Remy magnetos in England. It was alleged that the defendant company had induced Mr. Johnson to break his contract with the plaintiffs, and conspiracy was alleged. The contract was disputed and the conspiracy denied. Mr. Gordon Stewart, K.C., and Mr. Charles Doughty appeared for the plaintiffs, and the defendants were represented by Sir John Simon, K.C., Mr. Ernest Pollock, K.C., Mr. Neilson and Mr. Douglas Hogg.

In the course of the case Mr. STEWART stated that one result of the defendants' action was that on certain magnetos purchased by the Mechanical Transport Department of the War Office the plaintiffs would have made a profit of £11,775, whereas the defendants' margin of profit was £25,000.

At the conclusion of the plaintiffs' case his LORDSHIP held that there was no evidence of conspiracy, and that there was no case to go to the jury against the Imperial Motor Industries.

On that holding the parties agreed that judgment should be entered for the plaintiff company against Mr. Johnson for an agreed sum.

ELECTRICAL COMPANIES LITIGATION.

THE action by the British Thomson-Houston Co., Ltd. against the A. and A. Electric Co., Ltd., which stood third in the list of cases to be tried by Mr. Justice Sargant in the Chancery Division, was mentioned by His Lordship on Thursday last week on an application to fix a day for the hearing. Counsel for the defendants applied that the case should not be taken before November 8th, the reason being that Mr. Dane, the solicitor for the defendants, had been called up on military service, and it was necessary for some one to take up the case; and that Mr. Russell Clarke, counsel for the defendants, was at present on Admiralty service, and hoped to be free in three weeks' time.

MR. GRAY, for the plaintiffs, assented and his Lordship acceded to the application.

WORKS MANAGER FINED.

WE read in a provincial paper that at a northern town, on Saturday, the manager of a works engaged on the production of war material was fined £10 and costs for failing to have a responsible person in charge to receive official messages. The chief constable said the firm promised to comply with the conditions attached to exemption. On a particular night no reply was received to telephone calls to the works, which were later found to be closed. The negligence of the defendant in not informing the police might have led to endless confusion.

TAMPERING WITH A FUSE BOX.

AT the Highgate Petty Sessions last week before Mr. Walter Reynolds and other magistrates, Frederick John Beaumont was summoned for wilfully injuring a fuse-box and other electrical fittings belonging to the Hornsey Corporation.

MR. TATHAM, for the Hornsey Borough Council, said that about eight o'clock on the night of the 2nd inst. Mr. Staniland, the borough electrical engineer, noticed at his private house that the light was "jumpy," and, thinking something might be wrong, he telephoned to the works. The same thing had been noticed there, and the staff were on their guard. About 9.10 p.m. defendant rang up to say his fuse had "gone," and he asked that a man might go round to put it right. Having regard to the fact that there was something wrong with the light, he was told that a man could not be sent that night but that one would call in the morning. On the following day an inspector called and found the Council's fuse-box had been broken open. There were two fuse-boxes; a consumer might touch his own but not the Council's. There was a red notice stating that this was the property of the Council and must not be interfered with. To do so might cause very serious damage; it might put out the electric lighting of that part of the district, and some hours might elapse before it could be put right.

GIVING evidence in support of this statement, MR. STANILAND said that on the following day he called on Mr. Beaumont, who admitted he had put a fuse in the box, which was badly knocked about and burnt. Explaining what occurred, witness said that defendant's fuse had "gone," and then apparently the Council's. The latter was of fine wire for safety's sake, but defendant had put in a dangerously thick wire and actually soldered it. When the fuses went defendant would have no supply, and he tried to restore it. The variations of the pressure on that circuit were due to his inexperienced manipulation of the fuse. The cost of repairs, &c., had been £2 7s. 7½d., and that of keeping an engine running and extra time of the staff—as it was thought there was mains trouble—£1.

MR. R. MORITZ, chairman of the Electricity Supply Committee of the Council, said they had had several of these cases during the six years he had held the position, and they were reluctantly compelled to bring a case to court.

THE CHAIRMAN: We feel that this is a serious matter, and we must inflict the full penalty of £5.

THE CLERK doubted whether the magistrates could also order the payment of the £3 7s. 7½d. on that summons.

MR. TATHAM said that as the penalty would go to the Council he was content, and he did not ask for solicitor's costs.—*Hornsey Journal*.

A DEAL IN MARCONI SHARES LITIGATION AT AN END.

AN action which has been pending for a long time in the Chancery Division over a deal in a large block of shares in the Marconi Wireless Telegraph Co. of America was settled on Monday. Mr. Justice Sargant was to have heard a motion on that day, in which the defendants to the action (Mr. Godfrey Isaacs, Mr. G. Marconi, and the directors of the Marconi Wireless Telegraph Co., Ltd.) were to apply to the Court to strike out the statement of claim in the action on the ground that it showed no reasonable cause of action. The plaintiffs who were respondents to this motion were Mr. Locker-Lampson, M.P., and Lieutenant Wright, suing on behalf of themselves and all other shareholders of the English Marconi Co., except such as were defendants. The object of the action was to secure to the shareholders the benefit of the "deal." Among counsel briefed in the case were Mr. P. O. Lawrence, K.C., Mr. Upjohn, K.C., Mr. Romer, K.C., for the plaintiff respondents; and Sir J. Simon, K.C., M.P., Mr. Gore-Browne, K.C., Mr. F. Russell, K.C., Mr. Tomlin, K.C., and Mr. Maugham, K.C., for the defendants and applicants.

MR. GORE-BROWNE had just opened the motion in his charge, stating that there were several others all exactly the same, when he was interrupted by a communication, and he broke off his statement, and told the Judge that the case had been settled by the parties outside the Court.

MR. UPJOHN said no word of a settlement had reached the other side.

SIR J. SIMON, who had just come into Court, said an arrangement had been come to by the parties, for which none of the counsel in the case could be charged with any responsibility. They had arranged, subject to his Lordship's approval, that the action should be disposed of by an order, such as the motion asked for, staying all proceedings on terms agreed.

An order was made as asked.

STUBBS v. BRITISH ELECTRICAL FEDERATION, LTD.

THE British Electrical Federation, Ltd., were on Monday defendants in an action by Mr. John Stevenson Stubbs, an advertising contractor of Liverpool, heard before Mr. Pollock, one of the High Courts Official Referees, in which he claimed a balance of commission upon certain advertising contracts obtained by him for the Federation. He also asked for an account of moneys received on account of advertisements up to the date of the determination of his contract. The terms of the plaintiff's contract with the defendants were that he was to receive a salary of £400 a year and commission at the rate of 5 per cent. upon receipts up to £4,000 a year, above £4,000 and up to £7,000, 4 per cent., above £7,000, and up to £10,000, 3 per cent., and over £10,000 2½ per cent. The employment came to an end in 1914, and plaintiff alleged that he had not been paid the full commission as agreed. Since the action was commenced the account claimed had been furnished to the plaintiff, and the question between the parties was whether contracts made during the three years of engagement continued chargeable to commission after the three years had expired. Evidence was called on both sides, and, in the result, the Referee found that the plaintiff had received all the money due to him, and gave judgment for the defendants, with costs.

BUSINESS NOTES.

Catalogues and Lists.—BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., Trafford Park, Manchester. —Three new publications: Supply List No. 150/9 gives particulars and prices of electric cooking and heating apparatus and "Utility" motors; Supply List No. 181/2 contains illustrated descriptions and prices of electric vacuum and suction cleaners ("Premier," "Imperial," "Little Briton," "Simplex," and "Briton"); and Control Catalogue No. 76/1B, dealing with resistance units for alternating or direct current circuits.

GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—Folder, giving illustrations and prices of a series of the "Good Citizen" anti-Zepp, lamp shades. These shades are of cardboard, and instead of being fixed to the lampholder, are held by cords, which are tied to the flexible wire above the lamp at the height necessary to screen the rays from the window. They are made in various sizes and shapes, and in various tints. The shades have been designed to meet the lighting requirements without shutting off more light than is absolutely necessary.

"Z" ELECTRIC LAMP MANUFACTURING CO., LTD., Southfields, London, S.W.—New season's catalogue (16 pages) of a wide range of "Z" drawn-watt lamps, from a pocket-lamp bulb to a 1,500-watt "half-watt." Prices are tabulated of one-watt lamps, plain and twisted candle lamps, "Zedite" candles, traction lamps, train-lighting lamps; also half-watt lamps, motor-car type lamps, sign and illumination type, flashlight type, and "Penlite" pocket torches. Copies will be sent to anybody in the trade on application.

THE ENDOLITHIC MANUFACTURING CO., LTD., 61½, Fore Street, E.C.—List of articles made by the company, and coloured leaflet illustrating examples of metal and other labels for machinery, switchgear, and other purposes.

CREDEnda CONDUTTS CO., LTD., Chester Street, Aston, Birmingham.—Two folders giving brief particulars and prices of (1) special lines in domestic electric heating and cooking apparatus; (2) Credenda conduits and fittings.

CROMPTON & CO., LTD., Chelmsford.—20-page Projector list (P1), giving full particulars of their standard searchlight projectors of various types and sizes. The list is excellently illustrated.

Bankruptcy Proceedings.—A. F. HAWDON, electrical engineer, Gosforth.—Third and final dividend, 1s. 3d. in the £, payable October 26th, at the Official Receiver's Office, 30, Mosley Street, Newcastle-upon-Tyne.

Patent Restorations.—An order has been made restoring Letters Patent No. 13,719, of 1908, granted to J. C. B. Ingleby for "Improvements in or relating to squirrel-cage rotors for induction motors and alternators."

Orders have been made restoring the following Letters Patent granted to Carl Bloesser:—

No. 22,472, of 1907, for "Improvements in power transmission gearing."

No. 18,169, of 1908, for "Improvements relating to endless metal driving-bands."

No. 18,170, of 1908, for "Improvements relating to endless metal driving-bands."

Dissolution.—RICHARDS & RHODES, electrical engineers, Station Buildings, Keighley.—Messrs. S. Richards & J. S. Rhodes have dissolved partnership. Mr. Richards will attend to debts, &c., and continue the business under his own name.

Trade Announcements.—MESSRS. SHERRINGTON, electricians, have opened new showroom premises at 221A, Lord Street, Southport.

THE MICA MANUFACTURING CO., of Volta Works, Cazenove Road, Stoke Newington, N., write to point out that the Mica Manufacturing Co., which, as stated in our issue of October 13th, has been struck off the register, is a concern which ceased to exist many years ago. The present company was in no way connected with that business.

MR. SHERARD COWPER-COLES, who has severed his connection with the Homogeneous Lead Coating Co., announces that he is carrying on his business at 1, French Street, Sunbury-on-Thames.

Book Notices.—"Income-tax in Relation to Local Authorities." By F. Ogden Whiteley and W. Whittingham. Bradford: W. Byles & Sons, Ltd. Price 10s. 6d.

Prima Journal, No. 4 Vol. II, October 1916, London: Oakley House, Bloomsbury Street, W.C. Price 1s. net.

"How to Make Low-pressure Transformers." Third Edition. By Prof. F. E. Austin. London: E. and F. N. Spon, Ltd. Price 2s.

"Telegraphy." By T. E. Herbert. London: Whittaker & Co. Price 9s. net.

A Trade Bank in Spain.—A Bill is to be presented to the Spanish Cortes for the establishment of a bank for foreign trade. To be known as the Banco Espanol de Comercio Exterior, the objects of the new institution are to be:—The granting of credit to facilitate the export of goods of all kinds and the import of raw materials and accessories for agriculture and the national industries; the discount, purchase and sale of international drafts in any currency; the opening of credits in foreign money for operations abroad; the nationalisation of acceptances and drafts resulting from the importation of foreign merchandise, warehouses and of free zones; the formation of information bureaux and commercial museums; the granting of loans for guaranteeing vessels; and maritime insurance. The capital is to be not less than £1,500,000, to be subscribed by the banks and the public.—*Financial Times*.

Switching Examination.—MESSRS. A. P. LUNDBERG AND SONS have just got out a new edition of their Exam. Folder, affording particulars of their free examinations in electric-light switching. The unsolicited expressions of opinion from examinees given therein make interesting reading, and a reference is made to the good opinions of central-station chief engineers, and professors and teachers, which appear in other of the firm's publications, which go to show that the subject of electric-light switching has fully justified its claim to be an important branch of electrical installation work.

For Sale.—Llandilo U.D.C. is offering a D.C. steam generating set for sale. MESSRS. SHIRLAU ALLEN & Co. are shortly to sell by auction certain plant, material, &c., under the winding-up of the Phoenix Electrical Co. and the Caledon Electrical Co. Particulars will be found in our advertisement pages to-day.

LIGHTING AND POWER NOTES.

Accrington.—WAGES.—The Electricity Committee has granted increased wages to certain employes, representing an average increase of 20 per cent. on pre-war rates.

Barnes.—LOAN APPLICATION.—The U.D.C. is to apply to the L.G.B. for permission to borrow £2,000 for house services, on account of the £5,000 sanction for this purpose in January, 1914.

Bingley.—POWER CHARGES.—At a meeting of the District Council, last week, attention was called by Mr. Turner to the higher charges for electric current for motive power at Bingley, as compared with those at Keighley, the neighbouring town. He complained that, though £8,000 had been spent in equipment, all the department seemed to cater for was household consumers. It was intimated that the matter would be put before the Electricity Committee for consideration.

Bognor.—The Electricity Co. has intimated its decision to charge every consumer for a minimum of 20 units per quarter. The matter has come before the U.D.C., which has referred it for consideration to the Legal Committee.

Bradford.—LINKING-UP.—The Electricity Committee has authorised Mr. T. Roles, the engineer, to attend the meeting to be held in Leeds, for the purpose of appointing a local Committee for the area in connection with the scheme of linking-up electric supply undertakings.

Continental.—GERMANY.—It was officially announced in July that the Rheinisch Westfälisches Elektrizitätswerk had been granted permission by the Government to construct three 100,000-volt overhead mains in different districts. Although no reference to this matter is contained in the annual report for 1915-16 of this great undertaking for the supply of electricity and gas, it is stated that the 100,000-volt iron main leading to the district of Crefeld has been constantly in service since October, 1915, and it may, therefore, be assumed that the three new mains for the same voltage will also be of iron or steel. The report mentions that the total connections of the company's works and its associated works of Bergesist, of Bruhl, the Bergische Works, of

Reisholz, and the Bergische Works, of Lenner, increased from 357,000 kW. in 1914-15 to 400,000 in 1915, of which 212,000 kW. applied to the Rhein. Westf. Works. The number of glow lamp connections rose from 1,400,000 to 1,500,000, and the motors from 37,000 to 38,000 in the two years respectively, whilst the sales advanced from 293,000,000 kW.-hours to 388,118,000 kW.-hours. In addition, the sales of gas, which was supplied through a long-distance network of 127 miles, increased from 26,835,000 cb. metres to 33,945,000 cb. metres, and 5,019,000 cb. metres of gas were also supplied by the gas works managed by the company. The net profits realised in 1915-16 reached £222,000, or approximately the same as in the preceding year, and the dividend at 8 per cent. on the ordinary share capital of £2,500,000 (apart from loans of £1,820,000) is the same as in 1914-15. A less important undertaking—that of the Elektrizitätswerk Westfalen, of Bochum—also had a larger turnover in 1915-16, the sales having risen from 43,776,000 kW.-hours in 1914-15 to 55,150,000 kW.-hours last year. The net profits amounted to £26,000, as compared with £25,000 in 1914-15, and the dividend is 6 per cent. as in the preceding year. The sales of the Hamburg Electricity Works increased to a still greater extent—namely, from 43,453,000 kW.-hours in 1914-15 to 63,447,000 kW.-hours last year, but the net profits declined from £167,000 to £88,000, and the rate of dividend on the ordinary capital of £1,100,000 (exclusive of preference shares and loans of £500,000) receded from 1½ per cent. in 1914-15 to 6 per cent. last year.

RUSSIA.—According to the "Pravitelstvenni Vvestnik," a large electrical undertaking is being founded in Southern "Esterbothnia," in which three towns and 28 rural districts are concerned. It is intended to form a company for carrying out the project, and to set up four stations for the generation of electrical power, viz., at Sturo, Iistaro, Kurikka and Alavu. It is proposed to absorb all the small electrical undertakings at present existing in these districts. In the region covered by the operations of the new company there are many waterfalls and extensive peat deposits which will make it possible for power to be generated at a moderate price. *Board of Trade Journal*.

Eastbourne.—BONUSES. The whole of the Corporation electrical staff is to receive an additional war bonus of 1s. per week. This will entail an additional expenditure of approximately £88 per annum, and a total increase under this heading since the commencement of the war of approximately £250.

Elland.—PRICE INCREASE.—The U.D.C. has intimated that the price of electric current will be increased to 5d. per unit for lighting and for power purposes by 7½ per cent., making a total advance of 20 per cent.

Glasgow.—PLANT SHORTAGE.—The chief engineer of the electricity department reported that the position of the department was getting serious, owing to shortage of plant to meet the continually increasing demand. The load this winter would call for the simultaneous use of practically the whole of the generating plant belonging to the Corporation, including the Pinkston power station. The installation of additional boiler plant in Pinkston station would enable the department to get through the winter of 1917-18, but generating plant of the size which must now be bought would take at least two years to get installed and running. The Committee was aware that in November, 1911, a site for a new generating station was purchased at Dalmarnock Bridge. It was agreed that this new station should be proceeded with in the beginning of 1914, with a view to having the new works running during the winter of 1916. In March and August, 1914, offers were accepted for clearing the ground and for foundations for part of the works. On the declaration of war the Corporation decided that, beyond completing the contracts which had already been placed, the erection and equipment of the works should be postponed. The department had now, however, arrived at a stage when it appeared to him that the Committee must instruct him to stop connecting new consumers, or empower him, if new consumers were to be connected, to withdraw the supply from them during the winter months, or proceed with a portion of the new generating station at Dalmarnock. Mr. Lackie appended a statement showing the maximum demand, plant capacity, and amount of spare plant in other undertakings, municipal and company-owned, which were comparable to Glasgow, as follows:—

Name of town.	Maximum demand.	Plant capacity, kW.	Spare.	Percentage of spares.
Glasgow ...	50,000	54,550	4,550	9 %
Birmingham ...	33,000	41,505	8,505	25 %
Edinburgh ...	11,400	20,390	8,990	80 %
Dundee ...	7,011	16,500	9,486	120 %
Leeds ...	16,700	26,500	9,800	60 %
Liverpool ...	23,511	44,600	21,089	90 %
Manchester ...	19,897	57,300	7,403	17 %
Sheffield ...	23,618	26,000	2,382	10 %

Companies.

Charing Cross ...	12,664	26,480	13,816	100 %
Central ...	10,443	19,695	9,252	90 %
Chelsea ...	19,739	30,000	10,261	50 %
City of London ...	13,700	20,300	6,600	50 %

The Committee has been empowered to proceed with the fourth part of the Dalmarnock scheme, representing an addition of about 40,000 H.P. of plant.

Halifax.—WAGES.—The T.C. has been recommended to grant a war bonus of 4s. per week, on certain conditions, to employees of the electricity department.

High Wycombe.—**FLUORESCENT LIGHTING.**—The Electricity Committee has accepted an offer from the T.C. of £100 per quarter for the replacement of the existing lamps by 115 per lamp per quarter for each lamp lighted, subject to the present contract being renewed for not less than seven years from the date of the removal of the restrictions. The Council has decided not to consider the question of renewing the existing contract at the present time.

Huddersfield.—**PRICE INCREASE.**—The Corporation electricity department has intimated an increase in the price of electricity to all consumers of a further 12 per cent. on pre-war rates for the quarter expiring at the end of the present year.

India.—Definite progress has now been made with the electrification of the pumping plant at Hosanghatta, so far as the Bangalore City side of the scheme is concerned. It is understood that the present steam system will be replaced before the end of the official year. A return on capital outlay of as much as 30 per cent. is anticipated, that is, having regard to the saving on wood fuel, or a saving all round of fully 60 per cent., if, and when, the Station Municipality joins the scheme.—*Indian Engineering.*

Keighley.—A recommendation to expend £2,000 on the provision of a 1,400 cable for the electricity supply undertaking is to be made to the T.C.

Kilmarnock.—**EXTENSION OF SUPPLY.**—A number of applications have been received by the Corporation electricity department for a supply of electricity for lighting from intending consumers in Troon, and the manager is negotiating for an overhead line extension.

London.—**ST. PANCRAS.**—The Electricity Committee has decided to share the expense of changing over the University College supply from 110 to 220 volts.

The Committee has authorised the substitution of further arc lamps by 100 half-watt lamps, at an estimated cost of £325.

Application is to be made to the L.C.C. for sanction to the borrowing of £11,931, the estimated capital expenditure on the electricity undertaking to March 31st, 1917.

The Committee has agreed to a general increase in wages of the electricity employees for the period of the war.

SOUTHWARK.—The borough engineer is to purchase a new motor for the crushing plant at Manor Place dépôt, at not exceeding £150.

Manchester.—**DAYLIGHT SAVING.**—The returns of the electricity department on the effect of the Daylight Savings Act show that for the quarter ended September 30th, the actual consumption for lighting purposes increased by 6 per cent. on units supplied. The consumption for power purposes increased to an enormous extent. The fact that more electricity should be used for lighting purposes despite the extra hour of daylight as compared with the same period of 1915 is interesting, and it is difficult to account for it unless it is due to an increase in the number of householders using electricity for lighting purposes only.

Morocco.—The plant at the central station in Tangier, of the Compania Trasatlantica, has recently been increased by the addition of a 200-H.P. Sulzer-Diesel engine and a 135-kw. generator.

Perth.—**BONUSES.**—The Corporation Electricity Committee has granted a war bonus of 2s. per week to the employees at the electricity station.

Southampton.—**PROPOSED EXTENSIONS.**—The borough electrical engineer has drawn attention to the necessity of preparing a scheme of boiler extensions, and has been authorised to prepare such a scheme. In view of experience as to the heating of stored coal, a drift had been cut through the large heap, which was found to be in good condition. The Council has in stock about four times as much coal as in normal times.

Swansea.—The manager of the Municipal Markets is to confer with the borough electrical engineer as to the fitting up of lights to the stalls at present without lights. The chairman of the Electricity Committee, with the borough officials, is, if necessary, to interview the L.G.B. to obtain sanction to expenditure essential to carry out an extension of plant at the generating station.

Tynemouth.—The electrical engineer has advised that it was not necessary to take any action in regard to linking-up, in view of the existing agreement with the Newcastle Electric Supply Co. with regard to bulk supply. In view of the demands on that company, it has been considered desirable to prepare the Corporation's plant for running.

Walkden.—**ELECTRIC PUMPING PLANT.**—An electric plant having been installed at Ellesmere Colliery, Walkden, the Roughfield Colliery, a short distance away, which has been used for pumping purposes for over 20 years, is now being dismantled.

Weymouth.—**PRICE INCREASE.**—The T.C. has increased the price of energy from 5d. to 6d. per unit, as from October 1st.

TRAMWAY and RAILWAY NOTES.

Accrington.—**ACCIDENT.**—Last week a collision occurred between a Blackburn car and a single-deck bogie car, causing the services between Accrington and Church to be disorganised for some time, though no one was injured.

Blackpool.—Figures placed before the Tramways Committee show that the receipts are still on the upgrade as compared with last year. For the period from September 15th to October 12th, the receipts were £9,068, an increase of £1,266 over the corresponding period twelve months ago. The aggregate for the year to date was £71,577, against £61,180 last year, an increase of £10,396.

Bolton.—**WAGES.**—The Tramways Committee has declined to accede to an application by the employees for an advance of 3d. per hour in wages.

Bradford.—**WAGES.**—The recent decision of the Bradford Tramways Committee to refer to the Board of Trade, under the Munitions Act, the demand of the tramway employees for advanced wages, which would involve an additional charge of about £21,000 a year to the department, was opposed at last week's meeting of the City Council, and the chairman of the Tramways Committee agreed to the minute being referred back for further consideration. It now transpires that the matter is being left for the new Committee, which will be appointed next month, to deal with.

The tramways Committee, in view of the shortage of labour and other conditions of the time, has recommended that the general manager (Mr. C. J. Spencer) be given liberty to curtail car services as he may think fit.

Edinburgh.—**TROLLEY SYSTEM RECOMMENDED.**—The Sub-Committee appointed by the Corporation Tramway Committee to consider the system of traction to be installed on the expiration of the present company's lease in 1919, has reported in favour of the overhead trolley system as the best, most reliable, convenient, and economical solution of the city's transit requirements.

Leeds.—**MINERAL TRAFFIC.**—In connection with recent negotiations between the Tramways Committee and the Leeds Fire-clay Co. in respect of a proposal that the tramways should convey material between the company's Cardigan Pit and its works at Wortley, the Tramways Committee last week appointed a Sub-Committee to conclude arrangements with the company for the construction of a light railway and the conveyance of material between the points concerned.

A B. of T. arbitrator, to whom was referred the question of wages and war bonus for tramway workers—particularly the women conductors—has decided against the application of the women to be placed on the same sliding scale of wages as the men, the Council's decision here being upheld; but in regard to war bonus, which the Council refused to the women, the women are awarded half of the 3s. per week now paid to men, so far as concerns women of three months' service, and the full bonus for women with 12 months' service. The payments are to be retrospective from the time of qualification. The Corporation's refusal was based on the standpoint that the women were temporary employees.

Rochdale.—**WIND SCREENS.**—The Tramways Committee has decided, after consideration, to take no action at present in the matter of fixing screens on the cars for the protection of the drivers in bad weather. The Committee has, however, expressed its willingness, as an experiment, to have, later on, screens fixed to one or two cars on the Bacup section.

Swansea.—The agreement has been completed between the Tramway Co. and the Corporation relative to the supply of electrical energy by the Corporation to the tramways worked by the company. The Electrical Committee states, in regard to linking-up, that by the arrangement with the Tramway Co. it has already done much in this direction, and is endeavouring to make similar arrangements with other large independent customers.

TELEGRAPH and TELEPHONE NOTES.

Blackburn.—The change from the manual to the automatic telephone system was accomplished at Blackburn last week in the quick time of 70 seconds. There is now inter-area exchange with Accrington, and this is the first instance of two towns being thus put into automatic telephonic communication.

Mauritius.—The telegraph money-order service will be extended to Mauritius on November 1st.

Russia.—Negotiations are reported to be in progress between the Russian Post and Telegraph Department and the Swedish-Danish-Russian Telephone Co. with regard to the purchase by the State of the telephone exchanges in the Moscow district, the concession for which will shortly expire and is not to be renewed.

The King's "Our Day" Message.—In connection with "Our Day" (October 19th) the Eastern Telegraph Co. circulated the King's message from the Red Cross headquarters free of all cost to every place where the "Eastern" flies its flag. The Western Union and Commercial Union Cable Companies acted in a similar spirit in connection with the circulation of the message to the Dominions, Colonies, and dependencies served by their lines.—*Financial Times*.

The Telegraph and A.C. Traction. In the *Annales des Pôles, Télégraphes et Téléphones*, M. Marius Latour describes the system which he proposed in 1912 for overcoming the disturbances produced in telephone lines in the neighbourhood of A.C. railways, and which has been installed on the system of the Compagnie du Chemin de Fer du Midi, with the collaboration of Messrs. L. Boucher and Delpy. The essential features of the system are:—Shunting the receiving apparatus, preferably in front of the key, with a resonating circuit capable of side-tracking the disturbing currents, in combination with the insertion in series with the receiver of an impedance of suitable value to increase the effect of the resonating shunt circuit; putting in series with the telegraphic line a suitable impedance capable of reducing the disturbing currents and permitting the passage without deformation of the signalling currents; and distributing the latter impedance along the whole length of the line in order to reduce the maximum potential difference between the telegraph line and earth.—*Génie Civil*.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—**SYDNEY.**—January 22nd, 1917. Electrical plant (converter, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.*

January 8th. Municipal Council Electric Lighting Department. 33,000-volt switchgear. E.L. Department, Town Hall. Specification 10s. 6d.*

MELBOURNE.—December 11th. City Council. Supply and erection of coal transporter plant. See "Official Notices" September 15th.

PERTH.—November 8th. P.M.G. Accumulator parts (Schedule 527 W.A.).*

SOUTH AUSTRALIA.—November 15th. P.M.G.'s Department. Automatic switchboards and all associated apparatus, for telephone exchanges, Brighton and Glenelg.

NEW SOUTH WALES.—Time for sending in tenders for 50-ton electric overhead travelling crane for Yarra Street power-house. Newcastle, extended to January 3rd.*

Bradford.—November 11th. Stores for the Tramways Department. Tramway Offices, 7, Hall Ings. Deposit £1 is. (returnable).

Dublin.—November 2nd. Great Northern Railway Co. (Ireland). Contracts for general stores for 12 months (including several electrical items). See "Official Notices" October 13th.

Glasgow.—October 28th. Corporation. Six months' electrical material for the Cleansing Department. Particulars from Mr. W. Greig, Superintendent, 20, Trongate.

Grenada.—Government. Time for sending in tenders for electric supply at St. George's and suburbs is extended to December 31st. Tenders to Colonial Secretary, Grenada, British West Indies.

Johannesburg.—November 13th. South African Railways Administration. 71,778 tungsten drawn-wire lamps, 19,741 solid-drawn tungsten lamps, and 2,412 carbon-filament lamps.*

November 20th. Corporation. 500 or 1,000 trolley wheels for trams (Contract No. 181).*

November 27th. Corporation. 1,000 sets of single-pole, ironclad house-service cut-outs (Contract No. 187).*

Manchester.—October 30th. Low-pressure water and exhaust-steam pipes and supports at Bloom Street generating station. Specifications from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Newport.—November 6th. Corporation. Rotary converters and switchgear. See "Official Notices" to-day.

New Zealand.—**DUNEDIN.**—January 24th, 1917. Motor-generator, accessories and spares. City Electrical Engineer, Market Street, Dunedin.*

Walsall.—November 4th. Corporation. Stores for the Tramways Department. Particulars from the Tramway Manager.

Wolverhampton.—October 30th. Wiring installation (400 points), Bushbury, for Messrs. Macfarlane & Robinson, Stafford Street. Returnable deposit of £1 is.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Glasgow.—The Electricity Committee has empowered Messrs. Train & Taylor to proceed with the construction of the outfall culvert at the new electricity generating station at Dalmarnock, at a cost of £8,500.

Government Contracts.—List of new contracts placed during September, 1916.

W. H. OLEFSEN.

Bridge-meeters. Evershed & Vignoles, Ltd.
Electric cable and wire.—B.I. & Helsby Cables, Ltd.; Connolly Bros., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph and India-Rubber Works, Ltd.; Johnson & Phillips, Ltd.; St. Helena Cable & Rubber Co., Ltd.; Siemens Bros. & Co., Ltd.
Electric cells.—C. Fuller & Son, Ltd.; Siemens Bros. & Co., Ltd.
Conduit fittings for electric light plant.—Simplex Conduits, Ltd.
Generating sets.—Austin Motor Co. (1914), Ltd.; Norris, Henty and Gardner, Ltd.
Switchboard indicators.—Automatic Telephone Co., Ltd.
Electric lamps.—British Thomson-Houston Co., Ltd.; Dick, Kerr & Co., Ltd.; "Z" Electric Lamp Mfg. Co., Ltd.
Switches.—Sperry & Co., Ltd.
Traquair's Tack.—W. Jones.
Works services. Extension of switchboards at Edinburgh General Electric Co., Ltd.

H.M. OFFICE OF WORKS.

Electric wiring, Kew.—Insurance Office of C. Cooper & Co.

POST OFFICE.

Telephone apparatus.—Gell Telegraphic Appliances Syndicate, Ltd.
Telephone apparatus.—Siemens Bros. & Co., Ltd.
Telephone pole-arms (tubular).—Bullers, Ltd.
Telephone bells.—British L. M. Ericsson Mfg. Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Telegraph cable.—B.I. & Helsby Cables, Ltd.; Connolly Bros., Ltd.; Fuller's Wire & Cable Co., Ltd.; General Electric Co., Ltd.; W. T. Glover & Co., Ltd.; Hackettbridge Mfg. Co.; Henley's Telegraph Works Co., Ltd.; L. R. G.F. & Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; London Electric Wire Co. & Smiths, Ltd.; New Gutter-Percha Co., Ltd.; Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Insulators.—Bullers, Ltd.
Electric lamps and fittings.—General Electric Co., Ltd.
Cable distribution plugs.—B.I. & Helsby Cables, Ltd.
Insulator spindles.—Bullers, Ltd.
Test-hole terminals.—L. Herve.
Bronze wire.—T. Bolton & Sons, Ltd.; B.I. & Helsby Cables, Ltd.; Shropshire Iron Co.; P. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.).
Copper wire.—Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.).
Galvanised-iron wire.—Dorman, Long & Co., Ltd.; Johnson & Nephew, Ltd.

INDIA OFFICE STORE DEPARTMENT.

Accumulators.—Pritchett & Gold, Ltd.; J. Stone & Co., Ltd.
Bells.—Peel-Corner Telephone Works.
Cells.—General Electric Co., Ltd.
Tape.—Johnson & Phillips.

Salford.—Electricity Committee. A 10-ton overhead travelling crane: Messrs. Herbert Morris, Ltd., £151.

Southampton.—The British Electric Transformer Co., Ltd., wrote to the T.C. stating that the present market prices of 50 and 20-K.V.A. transformers were £64 5s. and £34 10s. respectively. The prices in the contract to supply the Council were £51 5s. and £27 10s. respectively. The company asked that they should be met in the matter. The T.C. resolved that 50 per cent. of the increased cost be paid on future deliveries.

Taunton.—T.C. Russell's new black vein washed beans coal, 2,600 tons, for the electricity works: Cory Bros., Ltd., Cardiff, £1 9s. 2d. per ton, delivered at the works.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, October 27th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "The Determination of the Saturation Values for Magnetism of Ferromagnetic Metals, Compounds and Alloys, by means of the Kerr Effect," by Mr. S. G. Barker; "The Influence of the Time Element on the Resistance of a Solid Rectifying Contact," by Mr. D. Owen; "On Diffusion in Liquids," by Mr. B. W. Chubb.

Royal Society of Arts.—Fridays, October 27th, November 3rd and 10th. At 5.15 p.m. At John Street, Adelphi. Chadwick Lectures on "Fatigue and its Effect on Industry and Efficiency," by Professor Stirling.

Association of Supervising Electricians.—Tuesday, October 31st. At 7.15 p.m. At St. Paul's Institute, Broad Lane, E.C. Paper on "Electric Cooking and Heating," by Mr. A. P. Berry.

Live-pool Engineering Society.—Wednesday, November 1st. At 8 p.m. At the Royal Institution, Colquhoun Street. Inaugural address by the President.

Chemical Society.—Thursday, November 2nd. At 8 p.m. At Burlington House, Piccadilly. Ordinary scientific meeting.

Greenock Electrical Society.—Thursday, November 2nd. At 7.45 p.m. At 22, West Stewart Street. Ordinary meeting.

Thursday, November 10th. Visit to Glasgow Corporation Dalmarnock electricity station.

Institution of Mechanical Engineers.—Friday, November 3rd. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. The Thomas Hawksley Lecture on "The Gas Engineer of the Last Century," by Mr. H. E. Jones.

NOTES.

Export Prohibitions.—A supplement to the *Board of Trade Journal* of October 26th contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported to various destinations from the Straits Settlements, Hong-Kong, Nigeria, Gold Coast, Jamaica, Barbados, Trinidad and Tobago, and British Guiana.

Inquiries. The makers of the "Veriatt" electric fire are asked for.

Flash-lamps in the U.S.A. A note in the *Electrical World* says that the trade in flash-lamps has grown to a tremendous extent since that time, ever before. Much of this has been for foreign export, although there has been an extraordinary demand from the home market. A considerable part of the export business was to supply the soldiers in the trenches in Europe with lamps, and also for distribution in the British Isles. The air-raid defence regulations curtailed electric lighting to such an extent that there has developed a flourishing demand in England for flash-lamps.

The use of flash-lamps in the United States has been large for more than one reason. Almost every hardware shop, electrical dealer's store, drygoods store, drug store and many others handle and push flash-lamps. The secret is undoubtedly a regular list price, which is well lived up to, and an enormous discount. The profit is in the neighbourhood of 100 per cent. Also, the manufacturer now stands behind his goods, and if a battery proves defective the customer gets from the dealer a new one without cost, and the dealer in turn obtains one free from the manufacturer.

Raw materials are hard to obtain, and for that reason production has been curtailed to some extent. The cases are for the most part made of brass with a nickel finish, and these materials being in the war order class are about the most difficult of the raw products to obtain. Fibre is also used to a considerable extent for cases, and this, too, is 'way behind on delivery. Considering this condition in manufacturing materials, and also considering the labour situation that has prevailed and the volume of business that has developed, deliveries are excellent.

With one or two exceptions, producers have not as yet raised their prices to the domestic consumer in spite of the heavy increase in cost of materials. It is their aim to try to keep prices down by increasing the volume of output. For the export trade, however, it is understood that there have been advances in price. The 1916 output of batteries for flash-lamps have been conservatively estimated at 130,000,000, of which it is estimated 100,000,000 will be taken by the domestic trade and 30,000,000 by the export trade. Since the majority of these batteries are for renewal purposes, these figures give no indication of the number of flash-lamps that will be turned out this year.

There is always a large demand for this class of goods at Christmas time. Should the demand this Christmas come up to expectations, it is estimated that the supply of batteries will amount to not more than 75 per cent., and of cases to not more than 60 per cent. of the demand. For that reason, manufacturers urge the trade to place their orders early, so as to be sure of a sufficient supply.

B.E.A.M.A. Notes.—RESTRICTION OF IMPORTS OF INSULATING MATERIALS.—The B.E.A.M.A. announces that the Department of Import Restrictions (Board of Trade) has granted to the Association a special licence to import insulating materials in certain classes which are included in the list of prohibited imports. Electrical manufacturers, whether members of the Association or not, can avail themselves of this licence by making application to the secretary of the Association. The Department of Import Restrictions desires it to be known that the granting of a licence is a temporary measure to meet present urgent needs. This licence extends to January 16th, 1917, at which time the necessities of the situation will be again reviewed. It is expected that firms in the meantime will make every effort to obtain in this country the supplies of insulating material which they require.

NEW MEMBERS.—The B.E.A.M.A. announces that the following firms have been elected Members of the Association:—

Ashton Frost & Co., Ltd., Blackburn.	Marsden's Engines, Ltd., Heckmondwike.
Bever Doring & Co., Ltd., Bradford.	Newton, Bean & Mitchell, Bradford.
Buckley & Taylor, Ltd., Oldham.	Pelitt & Waggell, Ltd., Sowerby Bridge.
Crutcher Goodfellow & Co., Ltd., Rugeley.	Robey & Co., Ltd., Lincoln.
Davy Bros., Ltd., Sheffield.	Scott & Hodgson, Ltd., Manchester.
Edgerton, Hodgkiss & Barclay, Ltd., Paisley.	S. S. Stott & Co., Haslingden.
Goldbeck & Co., Ltd., Manchester.	Smalley Conduits, Ltd., Birmingham.
Glennfield & Kennedy, Ltd., Kilmarnock.	Tyer & Co., Ltd., London.
Lillehall Co., Ltd., Salop.	Woodhouse & Mitchell, Ltd., Brighouse.
	Yates & Thom, Ltd., Blackburn.

EXCESS PROFITS DUTY CONCESSIONS TO THE ELECTRICAL TRADE. The Board of Referees have issued the following Order, dated October 18th, under the Finance (No. 2) Act of 1915, Part III, Excess Profits Duty (Section 12 (1)).

"The British Electrical and Allied Manufacturers' Association having made application under the Act to the Commissioners of Inland Revenue for an increase of the statutory percentage as respects the trade or business, or classes of trade or business, hereinafter defined, that is to say, the business of manufacturing in the United Kingdom all or any of the following complete machines and/or apparatus used in the generation and/or application of electric power, viz:—

- "1. Electrical generators of current for commercial purposes.
- "2. Electrical motors for the same.
- "3. Electrical switches or controllers for electric lighting or power.
- "4. Electrical arc lamps and/or incandescent lamps.
- "5. Electrical cooking stoves and/or radiators.
- "6. Electrical meters for measuring or indicating electricity for light or power.
- "7. Electrical transformers for lighting or power purposes.
- "8. Electrical lampholders.

"And the Commissioners of Inland Revenue having referred the case to the Board of Referees appointed for the purpose of Part III of this Act by the Treasury, and the Board having heard the

applicants and the Commissioners of Inland Revenue by their duly-appointed representatives upon the merits of the said application, and having dealt with the case:

"The Board doth Order that as from the commencement of this Act the statutory percentage as respects the trade or business or classes of trade or business hereinafter defined shall be increased to 7 per cent. in the case of a trade or business carried on or owned by a company or other body corporate, and to 8 per cent. in the case of any other trade or business."

This means an all-round advantage of 1 per cent. to the electrical industrial concerns to which the decision relates, and in the aggregate it must amount to a substantial sum. We congratulate the B.E.A.M.A. officials who have been responsible for handling the matter upon the success of the negotiations. The increase is an acceptable recognition of the essential national service that is being rendered by the electrical industry.

Appointments Vacant.—Assistant electrician for Sleaford electricity works: fitter-driver (35) for suction gas plant for the Sheffield Corporation Waterworks. See our advertisement pages for particulars.

Accident.—A correspondent states that Francis McDonald, an engine driver at the Aberdeen electricity works, was seriously injured on Saturday by being caught by a revolving shaft.

Wireless Men Wanted.—Electricians and instrument repairers are wanted for the Wireless Section, R.E. A notice regarding the matter appears in our advertisement pages to-day.

Empire Industrial Policy.—The Prime Minister of New Zealand, the Right Hon. W. F. Massey, has promised to speak at a luncheon of the British Empire Producers' Organisation at the Waldorf Hotel on Tuesday next, when Sir Henry Birchenough, K.C.M.G., will preside. The guests will also be addressed by Mr. F. R. Davenport, chairman of the British Electrical and Allied Manufacturers' Association. We are informed that it is the aim of the British Empire Producers' Organisation to co-ordinate the efforts of sectional trade associations and further the gradual formation of a practical Imperial economic system under which British national resources and manufactures will be developed for the benefit of the whole population.

Juvenile Workpeople.—A Memorandum (No. 13) on the subject of juvenile employment, recently issued by the Health of Munition Workers' Committee, contains valuable information on this important matter; we are glad to note that the necessity of supervising the conditions of living, not only in the factory, but also at home, is insisted on. It is recommended that the hours of labour should not exceed 60 per week, that Sunday labour and night work should be avoided, and that the periods of continuous labour should be short. The importance of "Welfare Supervision" in the case of boys and girls is particularly emphasised, and detailed instructions have been issued by the Ministry for the guidance of supervisors. Not the least serious subject is the demoralising effect that may be produced by the high wages now commonly earned by young boys and girls, and the urgent importance of encouraging thrift is pointed out. The Memorandum is of immediate interest to all employers of juvenile labour.

Cutting Cable Trenches by Power.—A recent issue of the *Electrical World* mentions that the Utah Power and Light Co., Salt Lake City, is employing a pneumatic jack hammer, operated from a portable air compressor, for cutting trenches in pavements to lay electric cables. Based on 670 ft. of 4-in. trench cut in concrete 4 in. thick, the energy consumption was 182 kw.-hour per lineal ft. of trench. The same equipment has been used on railroad work for cutting a 6-in. by 10-in. trench in concrete for relaying tracks, and it was estimated that the labour of 10 men was eliminated.

Educational.—Last week the ASSOCIATION OF TECHNICAL INSTITUTIONS passed a resolution instructing the Council to consider and issue a statement to the nation dealing with the immediate necessity of the further development of technical education, subject to the statement receiving the approval of the Association. A further resolution was carried calling upon the Government to prevent any child leaving school before the age of 14, and to compel employers to allow their employees to attend continuation day classes up to the age of 17, for six hours per week.

American Electrical Range Production.—The *Electrical World*, in reviewing the question of electric cooking range production in 1916, which it had been expected would be valued at a million dollars, based on manufacturers' selling prices, now considers that it will exceed two million dollars in value. Prices are tending to increase owing to the increased price of metals and insulating material; resistance wire is difficult to obtain, due, it is said, to difficulty of obtaining suitable diamond dies for drawing the wire. It is remarked as strange, in view of central station clamourings for cheaper ranges, that the greatest demand appears to be for stores retailing at about \$100, and this it is considered argues well for the permanency of electric cooking, and few people would care to scrap a \$100 equipment.

Legal Matters.—The Privy Council, on October 23rd, gave judgment in the case of the Toronto Electric Light Co., Ltd., v. the Corporation of the City of Toronto, which was argued before the Long Vacation. The appeal of the company was dismissed.

At the City of London Quarter Sessions there is now being heard an appeal by the Metropolitan Railway Co. against certain quinquennial assessments of their properties in Kensington, Paddington, and the Holborn Union. Our reports of these matters are held over owing to pressure upon our space this week.

Institution and Lecture Notes.—Greenock Electrical Society.—The following is the programme for the session, which opened on Thursday last week with a paper, by Mr. A. Norwell, on "Steam Turbines" :—

November 2nd, Thursday.—Open night for discussion.
November 4th, Saturday. Visit to Glasgow Corporation, Dalmarnock, electricity station.
November 16th, Thursday.—"A Criticism of the I.E.E. Rules," by H. Piggott.
November 22nd, Thursday.—Visit to Overton Paper Mills.
November 24th, Thursday.—"What is Electricity?" by J. L. Hogg.
December 5th, Thursday.—Visit to J. Drummond & Sons.
December 11th, Thursday.—"The Art of Wiring," by J. Nichol.
December 21st, Thursday.—Open night—papers by junior members.
January 11th, Thursday.—"Factory Installations," by R. T. Paterson.
January 23rd, Thursday.—Open night for discussion.
February 8th, Thursday.—"H.T. Conduit Systems," by H. J. Roberts.
February 17th, Saturday.—Visit to Dellingburn power station.
March 2nd, Thursday.—"Electricity Supply Costs," by P. H. Whysall.
March 26th, Thursday.—"Notes on the High-Speed Engine," by S. V. Thorp.
March 22nd, Thursday.—"Electric Welding," by Duncan Angus.
March 24th, Thursday.—Visit to Gathside Colliery, Cambuslang.

Liverpool Engineering Society.—The new session opens at the Royal Institution, Colquitt Street, Liverpool, on Wednesday next, November 1st, with the presidential address of Mr. T. M. Newell. The programme for following meetings is as under :—

November 15th.—James Glover, "The Civil Engineering Profession and the Economic Problem."
November 29th.—T. L. Norfolk, "Notes on the Construction of Modern Dock Gates."
December 13th.—H. Shephard, "Works Costing Systems."
January 9th, 1917.—Arthur Brooker, "Screw-measuring Apparatus."
January 24th.—Tom R. Thomas, "The Education of Apprentices to Engineering and Allied Trades."
February 7th.—W. Hemming Jones and W. A. Ogilthorpe, "The Gladstone Lock."
February 21st.—Discussion on above.
March 7th.—Prof. S. W. Perrott, "Some Problems on Railway Curves."
March 21st.—L. Leighton, "Equipment of King George Dock, Hull."
Joint meeting with Manchester Section of the Institution of Electrical Engineers.
April 4th.—J. Hamilton Gibson, "The Michell Thrust Block and Journal Bearing."

Belfast Association of Engineers.—This Association held its opening meeting for the session in the Municipal Technical Institute, Belfast, on October 19th, when the new president, Mr. Stanley Johnston, delivered an address. Mr. Johnston referred to the fact that during the term of office of the retiring president, Mr. J. W. Kempster, D.L., M.I.E.E., the status of the Association had been raised enormously. The subject of Mr. Johnston's address was scientific and industrial research. Mr. Kempster and Mr. W. Pleasance, A.M.I.E.E., have been added to the Committee, and Mr. H. Filles, A.M.I.E.E., is secretary. The new president is also an electrical engineer. The programme for the session is as under :—

November 16th.—"Cement Manufacture," F. W. Davis.
December 21st.—"Water Power in Ireland," A. W. Brown.
January 18th, 1917.—"Electric Lifts for Land and Shipboard," C. G. Major.
February 15th.—"Liquid Air," Ed. A. S. Swenson.
March 15th.—An Anticipating Governor for Marine Engines," Andrew Kerr.
April 19th.—"Engineering Notes on a Tour in the Antipodes," J. H. Chambers.

Institution of Civil Engineers.—In addition to the Awards announced in April for papers read at meetings, the Council has made the following Awards for papers published in the *Proceedings* without discussion during the Session 1915-16 :—

Telford Premium to Messrs. Hubert Mawson (Liverpool), T. W. Keele (Sheffield), B. W. Hines (Wellington, N.Z.), W. Fairley (London), J. M. Gresthead (Johannesburg), T. C. Hood (Madras, India) and J. R. Ball (London).
The Manby Premium to Mr. W. C. Cushing, Pittsburg, U.S.A.
The Crumpton Prize to Major C. E. P. Sanky, D.S.O., R.E., London.
The Indian Premium for 1916 has been awarded to Sir John Benton, K.C.I.E., Eastbourne.

Institution of Electrical Engineers.—WESTERN LOCAL SECTION.—The opening meeting of the session was held on Monday evening at Bristol. Mr. D. Roberts, the retiring chairman, installed his successor, Prof. D. Robertson, who proposed a vote of thanks to Mr. W. Collins, the retiring hon. secretary. Mr. W. A. Chamen and Mr. H. Farraday Proctor warmly supported the resolution, which was cordially accepted. (Mr. C. P. Sparks (president I.E.E.) was present, and gave a brief address on the work of the Institution; he stated, in connection with the scheme for training disabled men, that 40 men had already been trained and placed, and it was hoped to place another 40 by Christmas. Applications had been received for 10 to 15 more, and local Committees were to be formed to extend the scope of the work. The number of members serving with H.M. Forces was 1,560, of whom 71 had lost their lives, and 91 had gained distinction. Prof. D. Robertson then delivered his inaugural address, dealing with industrial problems and the necessity of encouraging scientific training in schools and research in industry. Possible new sources of energy were also discussed.

The British Fire Prevention Committee.—The Committee enters its twentieth winter session this month, and to mark the event, it has prepared a list of the collection of "Red Books," "Warnings," &c., that have been issued by the Committee since its formation. The list is obtainable upon application to the Committee's Registrar, at 8, Waterloo Place, London, S.W. The Committee's "Red Books" number 201, and of these 35 deal with general subjects, mainly such as fire-resisting construction and notable fires. The quarto *Journals* generally deal with the fire preventive organisations of foreign countries, notably in France, Russia and Italy. No other such collection of publications dealing with fire protection exists in Europe, and complete files of the Committee's reports have been recently obtained by American Government Departments and by the great Universities and technical libraries of the United States.

Future Advances in Lamp Efficiency.—At the tenth annual convention of the Illuminating Engineering Society, at Philadelphia, Dr. Steinmetz read a presidential address on "Present Aspects of and Future Prospects for Lighting Sources," in the course of which he pointed out that comparatively small further progress in lamp efficiency was to be expected from incandescent sources, but that the greatest promise of approaching the theoretically possible light production of 300 to 400 lumens per watt, lay in the direction of the luminous flame arc and of some form of electro-luminescence. Already an efficiency of 100 lumens per watt (about 8 c.p. per watt, or 0.12 watt per candle) had been achieved in the laboratory with high-power luminous arcs on the one hand, and on the other there had been demonstrated the very high efficiency of luminescence in the case of substances like Willemite, as measured from energy input to light output. Any attempt to improve the efficiency of a light source must centre upon the radiating element which transformed the received electrical energy into light. Here, as elsewhere in physics, if the energy transformation proceeded from a high form of energy to a similar form or to a lower form, extremely high efficiency was possible. On the other hand, transformation from a low form, like heat, to a high form, like mechanical energy, must always be attended by inefficiency, while transformation between two energy forms of similar degree, like magnetic energy and electrical energy, took place easily.

Efficiencies approaching the theoretical limit of 300 to 400 lumens per watt were to be expected ultimately from the unexplored field of electro-luminescence. Willemite, for example, under cathode bombardment exhibited a luminescence closely approaching the firefly's light, showing a broad band entirely in the visible range of the spectrum. Here in this electro-luminescence, the physicist had an energy conversion of the highest efficiency, as measured from input to output, but some efficient method of applying the exciting energy to the luminescent body remained to be discovered. It was, however, in these luminescence phenomena, as well as in the direction of the luminous arc—rather than in incandescent sources, said Dr. Steinmetz—that future radical advances in efficiency might be expected.—*Electrical World.*

The Shares of Siemens Bros.—According to the newspaper Press, Mr. Pretzman says he is considering, in consultation with expert advisers, the British firms, or classes of firms, to whom it is desirable, in the interests of the electrical industry of the country, that the shares of Siemens Bros. & Co. should be sold. He hopes this will shortly be decided, and the Public Trustee will then be in a position to deal with the shares which have been vested in him.

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place, S.W. Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, October 30th.—Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10. Signalling Class. Recruits Drill, 6.25—8.

Tuesday, October 31st.—School of Arms, 6.7. Lecture, 7.15. "The Duties of the N.C.O." by Company Commander Hynam. Range Practice.

Wednesday, November 1st.—Instructional Class, 6.15. Platoon Drill, Platoon No. 1. Range Practice.

Thursday, November 2nd.—Platoon Drill, Platoons Nos. 5 and 6. Range Practice. Lecture by Medical Officer, 6. Marching and the Care of the Feet.

Friday, November 3rd.—Technical for Platoon No. 10, Regency Street. Squad and Platoon Drill, No. 9. Signalling Class. Recruits' Drill, 6.25—8.25.

Saturday, November 4th.—N.C.O.'s Class, 2.30. Company Command, Fleming.

Sunday, November 5th.—Entrenching at Oxford. Parade Victoria (S.E. & C. Railway Booking-office), 8.45 a.m. Uniform, haversacks, water bottles. Mid-day ration to be carried. Railway vouchers will be provided.

(By order) MACLEOD YEARSLEY, Adjutant.

October 28th, 1916.

3RD OLD BOYS (CORPS) BATT. COUNTY OF LONDON VOLUNTEER REGIMENT.—Battalion Orders by Major R. J. C. Eastwood (Commandant), Thursday, October 26th, 1916 :—

Week-end Parades, Saturday. The Battalion will parade at Liverpool Street Station, at 8.40 a.m., for Entrenching Duties, or at 1.20 p.m.

Sunday.—The Battalion will parade at Liverpool Street Station at 9.30 a.m., for Entrenching Duties.

Battalion Parade. The Battalion will parade at the London Scottish Drill Hall, Buckingham Gate, S.W., on Thursday, 26th inst., at 7.30 p.m., for drill under the Commandant. Order: Muffi, without arms.

Recruits will parade at Lord's Cricket Ground on Saturday, 28th inst., at 2.45 p.m., and on Sunday, at 11 a.m. and 2.30 p.m., for Recruit Drill.

G. H. F. DUNCAN, Adjutant.

An Interrupter Interrupted.—The Niagara and Erie Power Co. has obtained an injunction restraining the Seneca Iron and Steel Co. from employing a device to interrupt the electric supply, and thus, by avoiding the provisions of an agreement, to obtain energy at a minimum rate. Under the agreement the Steel Co. was to pay for the average of the highest daily one-minute peaks occurring during the month; greater demands lasting less than a minute were not to be considered. The company, however, installed a device to interrupt the circuit every 50 seconds, so that no peak of one minute's duration occurred, and this the Court has decided against.—*Electrical World.*

Metropolitan Association of Electric Tramways

Managers. A meeting of the members of this Association was held at the Municipal and County Club, Whitehall Court, Whitehall, S.W., on Tuesday last, when there were present—Messrs. Ullmann (East Ham), Sandford (Leyton), Harvey (Ilford), Williams (Erith), Hammond, Mr. Ebert, Mackinnon (L.T.C.), Mason (South Met.), Satterly (West Ham) and Goodlyer (Croydon). Mr. Ullmann was re-elected chairman, Mr. W. E. Hammond was elected vice-chairman, and Mr. T. H. Goodlyer was re-elected hon. secretary. Letters of inability to attend were received from Mr. Bruce (L.C.C.), Mr. Murray (Walthamstow), and Mr. Stokes (Bexley). Various matters of interest were discussed.

Grant to a Tram-Car Driver. The Leeds Tramway Committee has made a grant of £5 to Sam Clayton, in recognition of meritorious conduct whilst driving a runaway car in Beeston Hill.

OUR PERSONAL COLUMN.

The Editors write electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station Officials.—Mr. C. T. ASHBURY has relinquished the post of resident electrical engineer to Atherton U.D.C., having been appointed burgh electrical engineer at Wishaw, in place of Mr. S. Williams, who has resigned on taking up a position in the Navy. Mr. Ashbury has been at Atherton 11 years.

General.—Lance-Corporal H. PERKINS, who previous to the outbreak of war represented Messrs. Falk, Stadelmann & Co., Ltd., electrical department, on the East Coast and the Midlands, and joined the Royal Engineers as a motor dispatch rider, has been made a full corporal.

Mr. D. G. E. BARRIE has relinquished his connection with Messrs. Hogan & Wardrop, and has taken up an appointment with the Enterprise Manufacturing Co., of Gun Street Electrical Works, Bishopsgate, E.C.

A notice of interest to "John Taylor (an electrician)" will be found in our advertisement pages to-day.

London Gazette Notices.—Territorial Force. Royal Garrison Artillery. London Electrical Engineers: Second-Lieutenant (Temporary Lieutenant) R. H. SMITH, O.T.C., Unattached List, T.F., to be Second-Lieutenant. Tyne Electrical Engineers: H. S. WATSON to be Second-Lieutenant (on probation); E. R. BRIGHAM to be Second-Lieutenant (on probation).

We regret to learn that Mr. A. C. SWALES, who has been Secretary of the Junior Institution of Engineers since 1911, has retired from that position owing to ill-health.

Col. Sir H. C. L. HOLDFN, Director of Mechanical Transport, has been elected the Upper Warden of the City Guild of Gunmakers.

Roll of Honour.—Private JOHN FENNEL, who has been killed in action, and Private CHARLES WHITES, who has been wounded for the second time, and is in a London hospital, were employes of the Keighley Corporation electricity works.

Private J. P. KACKLIN, York and Lancaster Regiment, reported killed in action, aged 36, was employed in the Hull Corporation electrical department.

Sapper J. CLARK, R.E., killed in action, aged 27, was an electrical engineer in South Africa.

Gunner H. MASON, R.G.A., who has been awarded the Military Medal for gallantry in the field, was previously employed as an electrician at Messrs. Rowntree's, at York.

Private J. ATHERTON, Lancashire Fusiliers, has won the D.C.M. It is stated that when the telephone wire was cut, and, owing to smoke from bursting shells, visual signalling was impossible, he went out and repaired the broken wire in two places.

Second Lieutenant (Temporary Lieutenant) GAINS DAVY, R.E., has been awarded the Military Cross for conspicuous gallantry during operations. He remained for many days at the exchange, and, by his energy, kept up the communications in spite of the wire being frequently cut by shell-fire. One night he remained out relaying and repairing wires under shell fire.

Sergeant ALBERT CLARKSON, Royal Flying Corps, reported missing, was an electrician with Mr. Calverley, of Burnley.

Sergeant RICHARD BUDWIN, who was on the staff of the Tunbridge Wells Corporation electricity department, has been wounded.

The D.C.M. for gallantry in the field has been granted to Corporal F. ROGERS, South Staffordshire Regiment, who was with the Electric Construction Co., Wolverhampton.

Sergeant D. S. GREENHILL, Grenadier Guards, who has died of wounds received in action, was on the Rugby staff of the British Thomson-Houston Co., Ltd.

Corporal L. DAVIES, R.E., who has fallen in action, was engaged in the chemical laboratory of the British Thomson-Houston Co., Ltd., Rugby.

Bombardier ROBERT HENRY SANDERSON, who joined the Cumberland Artillery whilst on the staff of the Carlisle Municipal electricity department, at the outbreak of war, has received from the King of Serbia a gold medal for services rendered in Gallipoli.

Private R. CLARKE, Lincolnshire Regiment, formerly at Stamford with the Urban Electric Supply Co., who has been missing for more than a year, is now officially presumed to be dead.

Lance-Corporal E. C. RYLES, Royal Fusiliers, who has fallen in action, was engaged with Messrs. Bullers, Ltd., of Hanley.

Private W. SHERWIN, Royal Fusiliers, who was with Messrs. Taylor & Tunncliffe, of Hanley, has been killed in action.

Lieutenant W. H. KEMMER, South Lancashire Regiment, is reported wounded. He was formerly engaged at the British Westinghouse Works.

Private A. COUPLAND, Royal Fusiliers, has been wounded, and is now in the Hurdfield House Hospital, Macclesfield. He was employed with Messrs. Ferranti, Ltd., at their meter testing depot in Clerkenwell.

Sergeant-Instructor HOPE TRAVIS and Company-Sergeant-Major JOE HOLMES, employes of the Oldham tramways, have been recommended for the D.C.M.

With reference to the death at the Front of Private J. LETTS reported in this column last week, we are asked to state that this does not refer to Mr. Arthur Letts, who is station superintendent at the Lincoln Corporation electricity works, and is the only person of the same name that has been employed there.

Second-Lieutenant JOHN SEAR GIBSON, A.M.I.E.E., aged 32 years, has died of wounds.

The following is the Roll of Honour of the St. Marylebone electric supply department down to date. 130 members of the staff have joined H.M. Forces, equal to 45 per cent. of the total male pre-war staff:—

KILLED IN ACTION.
Pte. A. H. Bowen, 24th Co. of London Regt. Stores Dept.
Pte. C. F. Lewis, 10th Gloucester Regt. Lamp-lighter.
Rifleman A. J. Scott, 21st Co. of London Regt. Cost Office.

DIED ON SERVICE.
Pte. A. P. Grover, 18th Co. of London Regt. Generating station

PRISONER OF WAR IN GERMANY.
Pte. A. J. Snow, 13th Co. of London Regt. Sales Dept.

WOUNDED OR BROKEN IN HEALTH.
*Lance-Corporal F. Royal, 3rd Essex Regt. Lamp-lighter.

*Driver W. Curtis, 72nd Brigade R.F.A. Lamp-lighter.
*Rifleman A. C. Lewis, 5th King's Royal Rifle Generating station.

*Pte. G. Gill, 10th Middlesex Regt. Sales Dept.
Sergeant W. Gregory, 1st East Surrey Regt. Lamp-lighter.

*Rifleman B. C. Hartopp, 18th Co. of London Regt. Generating station.
*Sergeant T. Hayes, Army Ordnance Corps Mains Dept.

Pte. W. Higgins, 3rd Middlesex Regt. Mains Dept.
*Sapper G. Lobb, Royal Engineers (Royal Naval Division) Sales Dept.

*Driver G. A. Oliver, 8th Brigade R.F.A. Mains Dept.
Pte. G. R. Bell, 3rd Co. of London Regt. Sales Dept.

*Rifleman F. G. Saw, 9th Co. of London Regt. Sales Dept.
Corporal G. Sell, 21st Co. of London Regt. Stores Dept.
Rifleman A. W. Turner, 2nd Battalion Rifle Brigade Mains Dept.

* Since discharged.
Obituary.—MR. WALTER HANCOCK.—The "Times" "Deaths" Column announces that Mr. Walter Hancock, M.I.E.E., died on October 17th, in his 86th year, at his residence, 10, Upper Chadwell Street, Myddelton Square, E.C.

Wills.—The late Mr. GEORGE KEITH, of the Cuba Submarine and Amazon Telegraph Companies and of the Chile Telephone Co., Ltd., left £60,452 gross and £59,726 net personalty.

The late Mr. LESLIE S. ROBERTSON, who with Lord Kitchener was lost in the *Hampshire*, according to the *Times*, left £10,945.

NEW COMPANIES REGISTERED.

Zinc Producers' Association Proprietary, Ltd. (1,528F.)—Somerset House particulars of the Australian Companies. Particulars of the Zinc Producers' Association Proprietary, Ltd., were filed at Somerset House on October 19th, pursuant to Section 274 of the Companies (Consolidation) Act, 1908. This company was registered in Victoria, Australia, on May 30th, 1916, with a nominal capital of £200,000, in 100,000 shares of £2 each, the first £30,000, and no debentures, to be issued without the prior consent of the board. It is a cardinal principle that the company is to be and remain under British control, and accordingly (a) no alien can be a director or one of the principal officers of the company, (b) no share may be held by or in trust for, or under the control of, any alien or foreign corporation, or any corporation under foreign control, (c) no person whose country of origin is now at war with His Majesty the King may hold office in this company or any share or shares therein. "Alien" means any person who is not British-born subject, or who was not naturalised in a British Possession prior to June 30th, 1905, and "foreign corporation" means any corporation other than a corporation established in some part of His Majesty's Dominions, and having its principal place of business there. "Corporation under foreign control" includes (a) a corporation of which a majority of the directors are aliens, (b) a corporation in which such voting power as, in the opinion of the board of this company, may give reasonable control is in the hands of aliens or foreign corporations, and (c) a corporation the executive of which is a foreign-controlled corporation. The number of directors is not to be more than 15. Each of the following companies may nominate one director, viz.: Broken Hill Associated Smelters Proprietary, Ltd.; Associated Zinc (de Bary's), Ltd.; Broken Hill South Silver Mining Co.; Broken Hill Proprietary Block 10 Co., Ltd.; Broken Hill Proprietary Block 14 Co., Ltd.; Junction North Broken Hill Mine; Broken Hill Proprietary Co., Ltd.; Mount Lyell Mining & Railway Co., Ltd.; Sulphide Corporation, Ltd.; British Broken Hill Proprietary Co., Ltd.; Zinc Corporation, Ltd.; The Burbank Corporation, Ltd., is also mentioned as having power to nominate a director if it become a member of the company. There is to be a London Board, an advisory member of which may be appointed by the Imperial Government. The directors at October 19th, 1916, were: W. L. Baillieu, W. M. Hyndman, M. Cohen, G. A. Grant, A. Campbell, B. Kelly, and J. L. Wharton, all of Melbourne; F. C. Howard and B. A. Moulden, both of Adelaide; D. E. McBryde, North Road, Brighton; F. A. Govett, 30, Corporation Avenue, E.C. 2; F. A. Keating, 22, Bishopsgate, E.C. 4; and W. H. Woodhead, Hyes, Rudwick, Sussex. The British address is at Planer's Hall, Austin Friars, E.C., where W. S. Robinson is authorised to accept service of process and notices on behalf of the company.

Universal Electric Supply Co., Ltd. (145,102).—This company was registered on October 17th, with a capital of £20,000 in 41 shares of £500 each. The company is engaged in the business of dealing in electrical novelties carried on by J. H. Ward, M. H. Goldstone, A. A. Galambos, and L. R. Thompson, who are 87 Great Dixie Street, Manchester, as the Universal Electric Supply Co. The subscribers (with one share each) are: A. Hitter, 7, Linden Grove, Fallowfield, Manchester, provision merchant; T. Milligan, 4, Ambush Street, Higher Openshaw, Manchester, book-keeper. Private company. The number of directors is not to be more than two or more, such as Mr. H. Ward, Mr. A. L. Ward, Mr. J. Milligan (both promoters), and A. Hitter, general manager. Secretary, G. P. Haworth, 19, Chapel Walks, Manchester. Secretary: A. Hitter. Registered office: 19, Chapel Walks, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Manaos Tramways & Light Co., Ltd. (101,081).—Capital, £300,000 in 41 shares of £7,317 each. Registered September 15th, 1916. A. shares taken up, £100 per cent., £291,000. Balance carried forward, £10,000. Dividend, £2,000,000.

Langollen and District Electric Light & Power Co., Ltd. (75,384).—Capital, £10,000 in 41 shares of £243 each. Registered October 14th, 1916. 2,114 shares taken up, £243,000. Balance carried forward, £1,000. Dividend, £2,000,000.

Birmingham District Power & Traction Co., Ltd.—Conveyed, 1916, October 20th, 1916, to the Birmingham District Power & Traction Co., Ltd., charged on certain freehold premises at Twickenham, Staffs. Holders: Halifax Permanent Benefit Building Society, Princess Street, Halifax.

Bullers, Ltd.—Deposit on September 27th, 1916, of deeds of lands, buildings, and hereditaments known as Downfield Side Farm and land forming part of a field known as Horse Moor, both in Norton-in-the-Moors, Staffs., to secure all moneys due or to become due from the company to Barclay & Co., Ltd., 34, Lombard Street, E.C.4., not exceeding £25,000.

Carville Site & Power Co., Ltd.—Issue on October 14th, 1916, of £10,000 in 41 shares of £243 each. Registered October 14th, 1916.

CITY NOTES.

Companies Struck Off the Register.—The following companies have been struck off the register, and they are accordingly dissolved:—

Atlas Anti Friction Metal Co.
Domestic Engineering Press
Eclipse Rail-Track Co.
Electric Ozone Syndicate
International Asbestos Co.
Traffic Indicators.
United Lighting & Maintenance Co.
Wireless Electric Light Co.

Western Telegraph Co., Ltd.—The directors are transferring £100,000 towards the reduction of the amount of capital expenditure in excess of the share capital and debenture stock issued, £100,000 to the general reserve fund, £20,000 to the land and buildings depreciation fund, £100,000 to the provision on account of investment fluctuations, and they recommend a final dividend of 5s. per share, making the total 6 per cent. for the year ended June, 1916, also the payment of a bonus of 4s. per share, both free of income-tax. The balance is to be carried forward.

Consolidated Diesel Engine Manufacturers, Ltd.—In the Companies' Winding-up Court, on Tuesday, Mr. Justice Neville heard an application by Mr. Ellis, a shareholder, for an order against the liquidator of the above company to pay him a first return of 10d. a share on 4,617 shares. The summons was dismissed.

City of Buenos Aires Tramways Co. (1904), Ltd.—Dividend of 1s. 3d. per share (at the rate of 5 per cent. per annum), less income-tax, for the three months to September 30th.

Trafford Park Estates, Ltd.—For the year ended June last the profit was £30,173. A dividend of 4 per cent. is to be paid, and £50,353 carried forward, as against £45,070 brought in.

Norwich Electric Tramways Co.—Dividend, 3 per cent. (6s. per share) for the year, placing £5,000 to reserve and £1,000 to 1914 Act account, carrying £429 forward.

Kaministiquia Power Co.—Dividend of \$1.75 per share (at the rate of 7 per cent. per annum) for the quarter ending October 31st.

J. F. & G. Harris, Ltd.—The net profit during the period ended June, 1916, was £419. The full preference dividend has been paid, and £13 is carried forward.

United Electric Tramways of Caracas, Ltd.—Dividend of 7 per cent. (1s. 4 1/2d. per share), less tax, for the year, carrying £2,328 forward.

Anglo-American Telegraph Co., Ltd.—Interim dividend for the quarter ended September 30th, 15s. per cent. on the ordinary stock and 30s. per cent. on the preferred stock, less income-tax at 5s. in the £.

Marshall, Sons & Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum, less tax, for the half-year ended June 30th.

Brazilian Traction, Light & Power Co., Ltd.—Dividend of 1 per cent. on the issued ordinary capital stock.

Babcock & Wilcox, Ltd.—Interim dividend of 6 per cent., free of tax, for the half-year ended June 30th.

Hurst, Nelson & Co., Ltd.—According to the "Times," the gross profit for the past year has been £73,426, against £61,519. It is proposed to place to general reserve account £25,000, against £15,000, to pay a dividend on the ordinary share capital at the rate of 10 per cent., free of tax, also a bonus at the rate of 2½ per cent. free of tax. There is to be carried forward, subject to payment of excess profits duty, £14,989. For the preceding year the distribution was 10 per cent.

STOCKS AND SHARES.

TUESDAY EVENING.

Stock Exchange markets continue to show a good deal of irregularity, but business is returning to some of the markets from which it was diverted by the issue of the 6 per cent. Exchequer Bonds and the French National Loan. The principal factor is Roumania, and the character of the news received from Bucharest helps to govern the prevailing sentiment from day to day. There is a certain amount of disappointment in the City at the way in which matters have developed in the land of our latest ally, but the increasing pressure of the British and French on the Somme must obviously have its effect in the number of troops which the enemy is able to employ against Roumania, and, after all, the ultimate end to the war is perfectly patent to everyone.

Were the news from Roumania to take a favourable turn—as, of course, it is likely to do at any moment—there would probably be a quick resumption of the buying movement which lifted prices so substantially last month. Meanwhile, the markets as a whole are walking warily, with prices inclining somewhat to the duller side.

The prior-charge stocks of the Home Railway companies are still very depressed. Holders seem anxious to exchange them for one or other of the Government forms of borrowing, with the result that there has been a further shrinkage in debenture, preference, and guaranteed stocks during the past few days. Some of the ordinary stocks, on the other hand, have rallied. The weakness which was so pronounced in the case of low-priced issues, such as Metropolitan and Districts, is less acute. The speculative buyer, however, is not keen on Home Rails at present. Central London assented ordinary is 2 lower. The Underground Electric Railways of London group is steady. Business in the market as a whole remains anything but brisk. District 4 per cent. debenture at 7½ is 3 points down, and the Sixes at 106½ are 2 lower. Metropolitan 3½ per cent. preference has dwindled to 60.

Electric lighting shares tend to shrink from their recent prices. County of London ordinary have weakened 4; there are falls of 4 in City Lights and St. James's, and of 1/16 in Westminster. The market has hardly started to discuss dividend estimates in respect of the current six months, but it is safe to assume that the declarations will reflect still further the increased cost of coal and the more stringent lighting regulations. On the other hand, the electric supply concerns which number amongst their customers large users of power will probably be able to give a good account of themselves.

The West-End undertakings are likely to be badly hit by the various restrictions, although in their cases they have the increased consumption by Government offices by way of partial compensation. The order to close shops at seven o'clock, which comes into force next week, can hardly have a favourable effect upon lighting profits. Rumour in the City went one better, and declared that it was the official intention to enforce the closing of all offices at five o'clock during the winter; the sex of the originator of this rumour is not known.

Brazilian Traction has once more become an active spot, the price fluctuating considerably between the limits of 59 and 55, the latter being the price this, Tuesday, night. The apprehensions as to a possible reduction in the dividend are laid to rest for the time being, and currency has been given to the idea that Brazil may be able to resume cash payments of interest on her bonds—at all events, to some extent—when the moratorium expires in July next. This had a strengthening effect upon most of the securities connected with Brazil, but, apparently, after the first blush of strength had worn off, profit-takers who had bought Brazil Traction cheaply, hastened to take advantage of the rise, and the price reacted abruptly.

Nothing fresh of note has occurred in Mexico, but prices of the utility companies are flat, all the same. Stocks in the various railway companies—which are taken as an index of the Mexican position—have given way a little. The Argentine group also continues dullish, though evidences are becoming stronger that the Republic has at last got over the consequences of the shock produced by the outbreak of war, and is regaining its former sound financial position. Canadian-American utilities are, on the whole, rather better, the movements, however, being narrow. The fall in British Columbia Electric Railway stocks has made further progress; the 4½ per cent. debenture stock shed 24 points.

Marconis have come into prominence as the most lively share in the industrial market. From 21, the price of the ordinary rose to 3 1/16; and although the fraction was lost later, the market continues to show a good deal of strength. There are vague rumours that the amount of compensation to be paid to the company by the Government is being settled, but in reliable quarters this is considered as being

at any rate in 1917. With the price of the parent shares, Americans have been up to 185, and Canadian Marconis are about 175. The latter is a higher society.

The Telegraph market further receded, but during the last few business days buyers have come in. Eastern Extensions fell to 13½, and at 13½ they still show a decline. Anglo-American Telegraph deferred dropped another point. The remainder of the group is noticeably steady. Telegraph Constructions are £1 down, and the yield on the shares has therefore risen to 6 guineas per cent. Allowing for the fact that the dividend is paid free of tax, the return on the money is equivalent to over 8 per cent., with a 5s. tax deducted.

The shares in other manufacturing companies are fairly firm. British Insulated preference at 54 is 10s. lower. Babcock's are steady at 50. A few of the British railway shares are easier. London & Suburban Traction preference, for instance, eased off 10s., and Yorkshire West Riding preference at 42 are about 2s. 6d. lower.

The armament group is inclined to waver a little, and the rubber share market has been sharply upset by the announcement that the excess profits tax will be applied rather more stringently than the market had expected. Probably this would not have had much effect had it not been for the general atmosphere of dullness round the Stock Exchange engendered by the news from the Near East. Prices, however, have given way sharply, and with this reaction business contracted to a considerable extent. It is possible that some people bought themselves rather more rubber shares than they could afford comfortably to carry, with the result that this stock—or, at any rate, some of it—is being marketed under conditions anything but favourable to the sellers.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend	Price	Rise or fall	Yield
	1914. 1915.	Oct. 21, 1916.	this week.	P. C.
Brompton Ordinary	10	10	—	—
Charing Cross Ordinary ..	6	6	—	—
do. do. 4½ Pref. ..	4½	4½	—	—
Chelsea	6	6	—	—
City of London	8	8	—	—
do. do. 6 per cent. Pref. ..	6	6	—	—
County of London	7	7	—	—
do. do. 6 per cent. Pref. ..	6	6	—	—
Kensington Ordinary	8	8	—	—
London Electric	4	4	—	—
do. do. 6 per cent. Pref. ..	6	6	—	—
Metropolitan	4½	4½	—	—
do. do. 4½ per cent. Pref. ..	4½	4½	—	—
St. James' and Pall Mall ..	10	10	—	—
South London	5	5	—	—
South Metropolitan	7	7	—	—
Westminster Ordinary ..	9	9	—	—

TELEGRAPHS AND TELEPHONS.

Anglo-Am. Tel. Pref.	6	6	—	—
do. do. Def.	30½	30½	—	—
Chile Telephone	8	8	—	—
Cuba Sub. Ord.	5	5	—	—
Eastern Extension	7	7	—	—
Eastern Tel. Ord.	7	7	—	—
Globe Tel. and T. Ord. ..	6	6	—	—
do. do. Pref.	6	6	—	—
Great Northern Tel.	22	22	—	—
Irish-European	18	18	—	—
Marconi	10	10	—	—
New York Tel. 4½	4½	4½	—	—
Oriental Telephone Ord. ..	10	10	—	—
United B. Plate Tel.	8	8	—	—
West India and Pan.	1	1	—	—
Western Telegraph	7	7	—	—

HOME RAILS.

Central London, Ord. Assented	4	4	—	—
Metropolitan	12	12	—	—
do. do. District	Nil	Nil	—	—
Underground Electric Ordinary	Nil	Nil	—	—
do. do. "A"	Nil	Nil	—	—
do. do. Income	6	6	—	—

FOREIGN TRAMS, &c.

Adelaide Sup. 6 per cent. Pref.	6	6	—	—
Anglo-Arg. Trams, First Pref.	5½	5½	—	—
do. do. 2nd Pref.	5½	5½	—	—
do. do. 5 Deb.	5	5	—	—
Brazil Tractions	4	4	—	—
Bombay Electric Pref.	6	6	—	—
British Columbia Elec. Ry. Pref.	5	5	—	—
do. do. Deferred	Nil	Nil	—	—
do. do. do.	Nil	Nil	—	—
do. do. do.	4½	4½	—	—
Mexico Trams 5 per cent. Bonds	Nil	Nil	—	—
do. do. 6 per cent. Bonds	Nil	Nil	—	—
Mexican Light Common	Nil	Nil	—	—
do. do. Pref.	Nil	Nil	—	—
do. do. 1st Bonds	Nil	Nil	—	—

MANUFACTURING COMPANIES.

Babcock & Wilcox	14	15	3	5
British Aluminium Ord. ..	15	17½	2½	11
British Insulated Ord. ..	15	17½	2½	11
British Westinghouse Pref. ..	7½	7½	—	—
Callenders	15	20	5	8
do. 5 Pref.	20	25	5	8
Cassner-Kellner	20	25	5	8
Edison & Swan, £3 paid ..	Nil	Nil	—	—
do. do. fully paid	Nil	Nil	—	—
do. do. 1 per cent. Deb. ..	5	5	—	—
Electric Construction	5	5	—	—
Gen. Elec. Pref.	6	6	—	—
do. do.	10	10	—	—
do. do. 4½ Pref.	4½	4½	—	—
India-Rubber	10	10	—	—
Telegraph Con.	20	20	—	—

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, October 25th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/8
a Ammoniac Sal	per ton	275
a Ammonia, Marinate (large crystal)	..	254
a Bisulphide of Carbon .. ..	..	228
a Borax .. ..	..	234
a Copper Sulphate	per lb.	254
a Potash, Chlorate .. ..	..	2/6
a Potash, Chloride .. ..	..	2/6
a Soda, Chlorate	per lb.	12 1/2
a Soda, Chloride	per ton	216
a Sulphur, Sublimed Flowers .. ..	..	41 dec.
a Soda, Chlorate	per lb.	21 inc.
a Soda, Chloride	per ton	12
a Sodium Bichromate, casks ..	per lb.	..

METALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
c Brass (rolled metal 2 to 12 basis)	per lb.	1/8 to 1/8 1/2
c " Tubes (solid drawn) .. ..	..	1/4 to 1/4
c " Wire, basis .. ..	..	1/2 to 1/2
c Copper Tubes (solid drawn) ..	..	1/2 to 1/2
c " Bars (best selected)	per ton	216
c " Sheet .. ..	..	216
c " Rod .. ..	..	216
c " (Electrolytic) Bars .. ..	..	214
d " " Sheets .. ..	..	216
d " " Rods .. ..	..	216
d " " H.C. Wire	per lb.	1/8
f Elephant Rod .. ..	..	2/6
f " Sheet .. ..	..	2/6
f German Silver Wire .. ..	..	3/6
f Gutta-percha, fine .. ..	..	6/10
f India-rubber, Para fine .. ..	..	3/4
f Iron Pig (Cleveland warrants) ..	per ton	Nom.
f " Wire, galv. No. 8, P.O. qual. ..	..	236
f Lead, English, fine	per bot.	£17 12 to £17 15
f Mercury .. ..	..	6d. to 9d.
f Mica (in original cases) small ..	per lb.	8/6 to 6/6
f " " medium .. ..	..	7/6 to 14 s. up.
f Silicium Bronze Wire	per lb.	2/6
f Steel, Magnet, in bars	per ton	216
f Tin, Block (English) .. ..	..	£184 to £145
f " Wire, Nos. 1 to 16	per lb.	2/10

Quotations supplied by—

a G. Boor & Co.	g James & Shakespear.
a Thos. Bolton & Sons, Ltd.	h Edward Tilt & Co.
a Frederick Smith & Son.	i Bolling & Lowe.
a F. Wiggins & Sons.	i Richard Johnson & Nephew, Ltd.
a India-Rubber, Gutta-Percha and	n P. Ormiston & Sons.
Telegraph Works Co., Ltd.	r W. F. Dennis & Co.

Industrial Harmony.—Sir William Lever, Bt., speaking at the Manchester Athenæum on "Harmonising Capital and Labour," said that it must be admitted that, in spite of better conditions of employment and higher wages, the present position occupied by labour was not acceptable to the workers. The workman was no longer a "hand"; Labour to-day was an educated man, and his wants were growing and his outlook was extending. Labour would not be brought to work side by side with and to harmonise with Capital merely by ever higher and higher wages, shorter and shorter hours, combined with better and better welfare conditions. The lesson for the capitalist was that high wages, short hours and good healthy conditions by increasing intelligence and efficiency, increased output and actually reduced costs. And the lesson for Labour was that increased output stimulated consumption and, consequently, demand for production and distributive labour, the fact being that consumers of all classes supplied themselves where they could be best and most economically served. Only by entrance into co-partnership together could Capital and Labour be brought to pull together, and only by co-partnership could they be harmonised. *Daily Telegraph.*

U.S. Central Stations.—On the basis of the earnings for the first half of the current year, 1916 should be a very prosperous year for the U.S. electric light and power industry. According to a compilation made by the *Electrical World* from reports received from over 60 per cent. of the industry, the earnings from the sale of energy during the first six months of 1916 amounted to \$203,500,000, as compared with \$176,300,000 for the first half of 1915. The increase was 15½ per cent. The output for the first half of 1916 increased 24 per cent. over the first half of 1915, being 10,875,000,000 kw.-hrs., as compared with 8,775,000,000 kw.-hrs. for the first half of 1915. Returns for the month of June were particularly good. Throughout the first half of the current year the factor that stood out most prominently was the remarkable growth in the power load. The motor market was swamped with orders, and many of the motors ordered at this time will not come into use until late in the current year; consequently the demand for power will continue to increase considerably for some time to come. The big increase was from new customers, who had formerly been running under their own power. The flood of orders came with such a rush that there was no time to enlarge private plant, and central station service at once became very popular.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING SEPTEMBER, 1916.

THE September returns of electrical exports and imports show a considerable increase in value in comparison with the August totals: the exports, in particular, maintain the relatively high level of the past few months.

The total value of the exports was £573,314, as compared with £553,957 in August, £487,575 in July, and £603,510 in June.

Of the individual sections, cables, machinery, and telephonic materials made a good showing, while business in the miscellaneous sections, such as accessories, fittings, meters, &c., was above the level of the previous month.

The August telegraphic exports were exceptional in amount, which

accounts for the considerable reduction shown in the September total. The imports reached a total value of £237,032, a considerable increase on the August total of £183,151, traceable to the increased amount of American material which entered this country during the month. Holland, due to its lamp industry, again occupies the second place in the list of importers into this country, and it is significant that Japan figures for over £10,000 worth of electrical material sold to us. India was our best customer during the month, while our Australasian colonies and the friendly European countries were also good customers—France in particular, but South American business was on a small scale.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric motors and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Sweden, Norway and Denmark ...	7,407	1,790	67	3,011	...	5,449	13,514	1,051	690	272	86	4,111	37,448
Netherlands, Java and Dutch Indies ...	833	17,314	1,284	...	62	33	5,011	...	93	62	1,980	720	27,392
Belgian Congo ...	...	...	...	...	...	...	...	...	153	...	...	47	208
France ...	11,642	786	293	...	661	212	22,072	7,207	165	846	8,787	4,293	56,964
Portugal ...	340	1,276	82	239	341	...	347	...	132	...	493	451	3,701
Spain, Canary Isles and Spanish N. Africa ...	1,486	...	368	145	...	830	16,166	2,488	275	31	653	1,530	23,972
Switzerland, Italy and Austria-Hungary ...	884	...	260	...	...	34	6,178	...	...	...	7,454	134	14,944
Greece, Roumania, Turkey and Bulgaria ...	...	138	...	...	...	34	...	...	...	...	...	...	172
Channel Isles, Gibraltar, Malta and Cyprus ...	93	68	...	18	...	32	125	76	...	17	...	11,391	11,820
U.S.A., Philippines and Cuba ...	372	...	51	...	...	126	3,437	...	...	22	...	50	4,058
Canada and Newfoundland ...	1,110	...	993	...	597	...	1,934	700	1,519	...	105	...	6,958
British West Indies and British Guiana ...	39	...	26	99	...	...	147	...	185	7	19	71	596
Mexico and Central America ...	67	97	...	20	...	...	28	...	...	...	...	...	240
Peru and Uruguay ...	13	...	116	90	...	...	325	167	609	...	...	21	1,674
Chile ...	510	3,204	248	357	18	867	2,274	325	31	25	12	260	8,140
Brazil ...	588	582	86	136	...	20	777	1,338	...	149	...	247	3,923
Argentina ...	1,270	3,270	336	191	16	1,504	1,198	2,854	941	95	798	176	12,649
Colombia, Venezuela, Ecuador and Bolivia ...	175	21	10	353	...	240	10	2,640	...	26	15	275	3,765
Egypt, Tunis and Morocco ...	518	757	3	170	...	71	1,856	217	928	15	3,479	640	8,654
British West Africa ...	74	1,424	53	55	...	22	3,000	...	...	...	57	141	4,826
Rhodesia, O.R.C. and Transvaal ...	2,444	2,931	148	950	...	279	1,698	237	646	131	68	5	9,537
Cape of Good Hope ...	1,405	11,362	492	761	...	3,008	19	...	523	45	7,179	177	24,971
Natal ...	...	9,782	752	259	...	252	3,554	8,523	21	...	253	226	23,622
Zanzibar, Brit. E. Africa, Mauritius & Aden ...	386	372	176	280	12	...	37	32	...	...	259	760	2,314
Azores, Madeira and Portuguese Africa ...	409	299	87	87	...	...	530	...	...	5	...	346	1,763
French African Colonies and Madagascar ...	224	...	...	...	...	...	36	...	...	...	...	17	277
Persia ...	1,219	2,226	...	...	...	...	...	...	...	...	...	...	3,445
China and Siam ...	2,223	6,068	2,251	1,008	12	1,377	4,375	1,965	133	160	29	1,100	20,692
Japan and Korea ...	...	182	37	98	...	1,070	3,555	...	3,857	...	...	45	8,935
India ...	4,634	23,190	4,447	1,879	34	1,538	25,871	3,355	4,429	356	4,726	1,234	75,693
Ceylon ...	406	1,914	231	162	...	120	97	70	213	...	1,336	179	4,728
Straits Settlements, Fed. Malay States and Sarawak ...	945	1,564	504	524	31	446	2,112	1,621	251	47	1,578	130	9,753
Hong Kong ...	73	2,488	526	...	...	686	1,516	...	59	...	438	904	6,690
West Australia ...	189	578	494	28	...	309	715	73	15	...	1,118	...	3,519
South Australia ...	242	2,681	161	175	...	...	1,824	257	765	29	861	32	7,127
Victoria ...	2,317	36,459	5,737	604	...	652	10,151	797	746	28	1,987	497	59,975
New South Wales ...	1,561	20,647	2,101	1,445	...	2,061	6,023	1,135	3,016	186	2,972	805	41,952
Queensland ...	397	3,591	109	116	...	15	371	933	939	...	1,512	105	8,088
Tasmania ...	328	700	19	29	...	...	60	...	...	...	...	...	1,136
New Zealand and Fiji Islands ...	1,094	10,914	2,105	1,062	...	277	2,926	1,568	1,670	21	2,830	2,526	26,993
Total, £	48,008	168,675	24,983	14,351	1,784	21,564	148,869	39,729	23,032	2,575	51,083	33,661	573,314

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark	...	721	...	250	1,683	...	14,730	884	1,695	...	867	29,830
Holland	...	1,020	...	135	25,737	7,651	...	57	654	...	...	35,254
France	...	160	...	251	311	755	2,000	50	4,838	3,196	2,008	11,769
Switzerland	...	3,304	...	18	121	...	2,463	7,368	...	96	1,060	102
Italy	...	2,404	...	...	...	...	...	1,182	...	...	...	3,586
United States	...	11,383	10,932	5,431	3,031	296	1,452	10,540	68,597	10,669	8,900	6,943
Japan	...	2,460	...	3,555	3,090	695	...	...	...	617	...	10,417
Total, £	18,028	14,356	9,139	32,480	10,636	4,670	32,838	70,770	18,569	13,156	9,920	234,562

Additional imports.—Spain, carbons, £1,316. Hong-Kong, electrical goods, £114. Canada, glow lamps, £248; electrically-driven machinery, £124; batteries and accumulators, £106; telephone and telegraph appliances, £562.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	1,229	1,376	...	4,062	177	3,870	5,175	...	380	207	2,120	18,596
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TOTAL EXPORTS: £573,314

TOTAL RE-EXPORTS: £18,596

TOTAL IMPORTS: £237,032

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned which is not necessarily the country of origin.

FRENCH AND ITALIAN ELECTRICAL INDUSTRY AND THE RUSSIAN MARKET.

IN no branch of industry did the Russian market depend so much on importation as in the electrical; and as our readers are aware, with the cessation of the normal importation, the Russian electrotechnical market experienced serious difficulties. The question as to where quickest and cheapest to procure the necessary electrotechnical goods will become still more difficult until the conclusion of peace, owing to the preoccupation of the electrical industry in all countries with war requirements. In many cases, too, the works that are free to cater for the private market are working only for immediate requirements, because of the dearth of raw material, the lack of labour, and other circumstances. Therefore all stocks are completely exhausted, and in order to replenish them, whilst satisfying current requirements, which will grow immensely after the war, great quantities of electrical goods will be required.

In a previous article in the *Elektrichestvo*, last year, from which we quoted very fully, Engineer P. Gurievitch considered to what extent Russian buyers of electrical goods might rely on the English electrical industry for supplies. Using the official statistical data entitled "Tableau Général du Commerce et de Navigation de la France" and the

electrotechnical work, chiefly electrodes which are sent mostly into Switzerland, Sweden and Norway, where the demand for electrodes for the highly developed electrochemical and electro-metallurgical industries is very great. For Russia, however, with its hitherto feebly-used water power, and the absence of important electrochemical factories, French electrodes cannot serve as an article of importation.

But all the remaining French electrotechnical articles have been exported hitherto only in very limited quantities, so that it is useless to count upon them particularly, the more so as one-sixth of the total French export of electrical manufactures has gone hitherto to the French Colonies, Algiers, Tunis, and Indo-China. The balance of the exports was naturally distributed amongst countries contiguous to France. The principal customer for French electrotechnical goods was Belgium; then Switzerland, particularly the Western French Cantons; then Spain. The exportation of electrical goods into Russia was so insignificant that the French official statistics specified it only in regard to electrical apparatus and accumulators.

The exportation of meters into Russia is, however, specially mentioned; but in the French statistics it is registered in a group including gas and water meters, so that is difficult to say what part is played in this group by electrical meters. The total exportation of meters of all kinds from France made the important sum of 14,087,000 fr.

TABLE I.

	In France.				Exports to various countries in quintals.						
	Total im- portation.	Total ex- portation.	Export to French Colonies.	Export to other countries.	Belgium.	Switzer- land.	Sweden and Norway.	Germany.	England.	Russia.	Other Countries.
Electrical apparatus	18,892,000	14,585,000	2,853,000	11,732,000	1,330	283		758	336	220	870
Carbons for electricity	1,056,000	8,564,000	33,000	8,531,000	8,695	10,885	13,916	3,389	1,966		2,871
Dynamo machines	9,052,000	4,116,000	1,475,000	2,641,000	4,120	439	871	3,005	322		2,012
Armatures for electrical machines and parts for electrical apparatus	4,611,000	2,461,000	258,000	2,203,000	1,037	219		151	106		945
Incandescent lamps	2,622,000	2,230,000	548,000	1,682,000	96	21		62	176		253
Arc lamps	80,000	248,000	112,000	136,000	17			13			72
Conductors and cables	1,017,000	3,421,000	705,000	2,716,000	7,406	452		316	567		3,849
Porcelain goods for electricity		612,000	198,000	414,000	207	1,487					835
Glass goods		450,000	133,000	317,000	—	1,331					80
Accumulators	179,000	523,000	162,000	361,000	258				811	497	146

"Movimento Commerciale del Regno d'Italia" for 1913, he now in the same journal dwells on the electrotechnical industry of two other countries allied to Russia—namely, France and Italy—showing their position in the world's markets and their exportation into Russia. The French importation and exportation of electrical goods in 1913 are shown in Table I.

M. Gurievitch says that if we consider the data of the table submitted from the point of view of the possibility of Russia receiving some electrical goods from France in greater quantities than before the war, we must observe that as an exporter of electrical goods France stood far behind Germany, England, and the United States, as can be seen in Table II, which shows the export of electrical products from these countries in 1913:—

TABLE II.

Exporting countries.	Total exportation of electrical goods in francs.	Total exportation of electrical ma- chines, francs.	Per cent. of total.	Total exportation of cables, francs.	Per cent. of total.	Export to Russia, francs.	Per cent. of total export.
Germany	407,550,000	70,218,000	24	48,496,000	11.9	42,614,000	10.5
England	398,800,000	56,736,000	30	90,165,000	17.0	2,435,000	1.3
United States...	146,340,000	32,650,000	21.7	6,356,000	4.4	(3)	(2)
France...	37,210,000	4,116,000	11.1	3,421,000	9.1	(2)	(2)
Switzerland...	30,162,000	20,353,000	67.5	1,403,000	4.6	3,682,000	12.2
Italy	10,294,000	2,855,000	27.7	7,028,000	68.0	34,000	0.3

Whilst in the case of other countries by far the most important articles exported are either electrical machines or cables, in France the export of these two groups plays only a subordinate part, making only about 10 per cent. of the total exportation. In the French exports the most important position after electrical apparatus is occupied by carbons for

in 1913, whilst the total of meters of all sorts exported into Russia made approximately 790,000 fr.

Thanks to a large export of carbons for electrotechnical work, the French exportation of products of the electrotechnical industry only about equalled the level of the importation of such goods. The French electrical industry therefore has, first of all, to see to it that it can supply the requirements of its own market, before thinking of exporting to Russia.

As to Italy, its electrotechnical industry is still too feebly developed for it to compete on the Russian market with other countries. As an exporter of electrical goods, the Italian industry began operations only five years ago. The first position in the Italian export of these goods, of a total value of 10,294,000 lire, in the year 1913, was taken by electrical conductors and cables, the exportation of which reached 7,028,000 lire, or 68 per cent. of the total export of electrotechnical goods. As, however, was observed by M. Gurievitch in reviewing the English exports, Russia is least of all in want of cables. The second place in the Italian export of these goods is occupied by dynamo machines. Already in the year 1910 the export of these goods was valued at 139,000 lire; in 1911 it rose to 1,265,000 lire; in 1912 to 1,865,000 lire; and in 1913 to 2,046,000 lire. The exportation of heavy dynamo machines, of which the Russian market stands particularly in need, was, on the other hand, particularly small—no more than 205,000 lire. Italy exported transformers to the value of 231,000 lire in 1913, and parts of electrical machines to the value of 373,000 lire. But to Russia she exported only small machines and motors to the value of 32,000 lire. The chief foreign market for the sale of Italian electrotechnical goods was South America (Argentina and Brazil), where Italy sent electrical machines and transformers to the value

of 1,148,000 lire. The export of other electrical goods from Italy was insignificant. Her exportation of electrical apparatus amounted to only 166,000 lire, and of accumulators to 38,000 lire.

Of machines used in the electrotechnical industry, Italy exported in 1913 to the value of 4,758,000 lire, internal combustion motors, including 594,000 lire value for Russia; to the value of 553,000 lire, (of which 41,000 lire for Russia) in steam engines, and to the value of 144,000 lire (of which 15,000 lire for Russia) in water motors.

It is necessary to observe, however, that Italy, to a greater extent even than France, depends on importation for electrical goods, which were valued at 31,955,000 lire in 1913, thus exceeding Italy's export of such goods by three times. With the increase in the development in Italy of hydro-electrical installations, the demand for electrical goods grows there at a great rate, and cannot be satisfied by the Italian electrical engineering shops. Of electrical machines and transformers alone Italy imported in 1913 to the value of 13,501,000 lire, of electrical apparatus, 4,988,000 lire, and of incandescent lamps 9,094,000 lire.

It remains to be said, in conclusion, that French industrial circles, even more than the English, consider the high Russian Customs duties to be an insuperable obstacle to successfully reaching the Russian market. Not hoping by their own strength to struggle with the competition of other countries in Russia, they would like to have a special exemption tariff for themselves that would give them a preference over other countries. Such measures do not find supporters in leading Russian circles, and the Russian Commercial Attaché in Paris, being at the same time the President of the Russo-French Chamber of Commerce, in his reports to the Special French Committee of Economic Inquiry and the Committee for Encouraging Franco-Russian Business Relations, showed more than once that French industry, with goodwill and sufficient energy, may operate on the Russian market on conditions identical with those of other countries. Evidence of this will be found in the powerful invasion of the Russian market by German industry, although it had not an advantage in Customs duties, and certainly no preferences, compared with other countries. All depends principally on the energy of the exporting country and its readiness to meet the Russian buyer by offering him low prices and concessions.

Besides energy and the will to meet the requirements of the buyers, a cardinal part is played in export, however, by the productivity of the exporting industry, and its power to throw on the world's market a great quantity of goods at low prices. In this respect French electrotechnical industry, unfortunately, lags far behind its competitors.

Even for its own market, in France, it is not in a position to supply all the requirements. Whilst a large importation of these goods into England may be explained by the fact that the absence of import duties did not sufficiently protect the English industry from German competition, the important importation into France cannot be so explained, as France, after Russia, is one of the most protectionist countries. It is undoubted, therefore, says M. Gurievitch, that France cannot think of playing an important part in the supply to Russia of electrical goods.

As has, however, been more than once shown in the *Commercial and Industrial Gazette* and in the *Government Gazette*, issued by the Ministry of Finance, with the new trend of Russian trading policy after the war, we must first (says the writer) see to the development of the productive power of Russia; but in the sphere of electrotechnics we must deal with the earliest possible use of the water power of the country, which is an essential factor in view of the chronic scarcity of coal. In the second place, from the financial point of view, we must endeavour to reach a favourable trade balance. The question, however, with whom we shall trade, plays only a subordinate rôle of third-class importance, and it should be referred to a back position depending on whether any particular trade is profitable or unprofitable for Russia. The goods of one country may, and should be, exchanged with our own or with the goods of another country, only if such is profitable to the economic progress of Russia. The refusal of any goods only because they are of one or other origin cannot be a healthy principle for a trading policy in time of peace,

THE USE OF COKE-OVEN GAS UNDER BOILERS.

At the present time a great amount of attention is being given to the more efficient utilisation of our national fuel resources, a subject which so far as it affects central station practice, points very strongly to the future use of gas firing for boilers.

Some of the features of present-day practice in this connection were outlined by a coke-oven manager in an article which recently appeared in the *Iron and Coal Trades Review*, the fuel in question being coke-oven gas. He pointed out that by-product ovens are of two general types, waste-heat and regenerative. In the former the gas, after the by-products have been extracted, is conducted to combustion chambers between the oven retorts and mixed with air of atmospheric or slightly higher temperature, the products of combustion escaping to the chimney through a waste-heat flue, the internal appearance of which serves as a guide to the working of the ovens, as it indicates whether correct combustion is taking place. While with the waste-heat oven the hot gas passing to the chimney is first conducted through the flues of a boiler for steam raising, in the regenerative oven, the heat of the gas is retained or stored in chequer brick-work (in the regenerator), and the escaping gases are, or should be, at so low a temperature that no valuable heat is lost.

The regenerators are, of course, used to preheat the air before it enters the combustion chamber, being used alternatively to store heat from the gas and deliver this heat to the air, by means of flue dampers which give the required flue connections.

With the latter arrangement only 45 to 50 per cent. of the gas is required for oven heating, as against 85 to 100 per cent. with the waste-heat oven, and consequently a considerable amount of gas is available for other use. Some 80 per cent. or more of the coke-oven gas is used for steam raising.

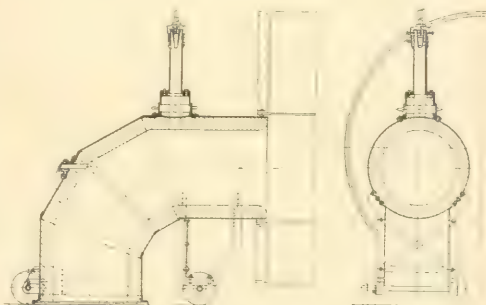


FIG. 1.—WASTE-HEAT BEND.

At first glance the simpler and cheaper waste-heat oven would appear to be most suitable for this purpose, but owing to the necessity of avoiding heat losses from long flues, it is necessary to place the boilers close to the ovens, which may be disadvantageous in other ways. With the regenerative oven the cool gas, with by-products extracted, can be conducted any distance, and steam generated where it is required. Some steam is required on every coke-oven plant for its own use, and in practice a certain number of waste-heat and a proportionate number of regenerative ovens are installed, to meet both requirements; a method now often adopted with waste-heat ovens is to obtain all the steam possible on the site and convert it to electrical energy for distribution where required.

The waste-heat flue usually passes across the front of the boilers below ground, and flue connections are provided to the fronts of the boilers, being either fixed or movable. These connections are of steel plate lined with firebrick. A typical fixed connection is provided with a damper, to cut off the waste-heat flue, and is of sufficient size to receive a grate so that solid fuel may be used in emergency, fire and ash doors being provided in the casing, also a hole for the introduction of live gas. This arrangement renders the boiler front inaccessible, and presents a large surface for heat radiation.

A more compact arrangement is the movable waste-heat bend shown in fig. 1, designed by the Koppers Co., which is mounted on wheels and can be entirely withdrawn. As in most waste-heat ovens 10 to 15 per cent. of live gas is to spare, this is introduced through a Bunsen burner mounted vertically on the bend. When in position the joints are luted up with fireclay. The use of live gas for boiler heating presents a more difficult problem in maintaining high efficiency and at the same time avoiding explosion.

The light and heat of a burning gas flame depend upon the conditions under which combustion takes place. There are but few cases nowadays of heating boilers with a lighting gas

flame, or, in fact, the gas escaping from the burner without previously adding air to it, but old works still retain examples.

An improvement upon the old arrangement is shown in fig. 2, where the gas is introduced through a series of 2-in. pipes direct into the furnaces; the gas pipes *a* are held in air channels *b*, and cover *d* regulates air admission. A fire is maintained on the grates to keep the gas ignited if its supply is not absolutely constant.

The modern method of burning gas is on the Bunsen system, giving a non-lighting flame; the principle is well known, but the original Bunsen arrangement has been further developed, and the Meker burner is an improved form in which the efficiency of the burner as an injector is largely increased, so that it draws through more numerous and enlarged air holes a greater amount of air as compared with the ordinary type, and yields greater heat. The Meker

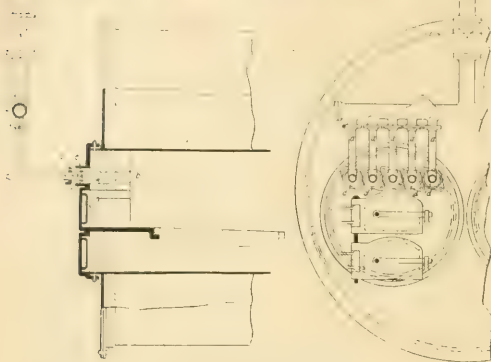


FIG. 2.—HAND-FIRED BOILER WITH ORDINARY GAS-JET ATTACHMENT.

burner gives a homogeneous mass of flame at practically the same temperature throughout, and at a higher temperature than the hottest portion of the ordinary Bunsen flame.

The most common form of Bunsen burner for boilers is shown in fig. 3, where *c* is the gas nozzle, passing through a bell-shaped end *d*, with adjustable primary air slots *e*; *f* is the mixing tube, which where it joins the furnace front is provided with additional slots, for a secondary air supply at the point of ignition. This burner is in use on a number of water-tube boilers, but it has in common with the ordinary Bunsen burner the disadvantage that the mixing tube is rather small in diameter, and offers great frictional resistance to the gas, so that its action as an air injector is somewhat checked, and by not drawing in sufficient air for combustion its efficiency is comparatively low and its gas consumption high.

The type shown is unsuitable for a Cornish or Lancashire boiler if hand firing has to be provided for, as the horizontal burners interfere with stoking, and where provision for hand firing is essential vertical Bunsen burners as shown in fig. 4 are used.

This mainly differs from the previous form in the air

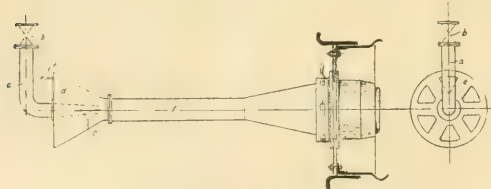


FIG. 3.—BUNSEN BURNER FOR BOILER.

chamber *a*; the end of the gas nozzle *c* just passes the air holes *d*, which can be adjusted by a loose ring *e*. The mixing tube *f* connects the air chamber to a bend *g* which reaches the furnace above the fire doors. A horizontal internal air inlet pipe *h* provides the secondary air for ignition; a slide *i* at the end of the inlet pipe allows of adjustment and the inspection of combustion in the furnace. A somewhat similar burner is shown on the bend in fig. 1; such a burner in an inverted position is very apt to back-fire, and great efficiency cannot be expected. In connection with waste-heat bends, however, it is so placed to avoid protruding too far.

With the general preference given to the regenerative oven it was a natural result to endeavour to construct gas burners with a much higher efficiency than could hitherto be attained. Among the many attempts which have been made in this direction are the Altenheim, the Terbeck, and the Wefer burners, so-called after their respective inventors.

The Altenheim burner (fig. 5), made by Messrs. Altenheim and Wilson, of Maryport, is of recent construction, and

resembles in many ways the Meker burner. The mixing pipe *a* of the burner is tapered and reduced in diameter towards its delivery end in order to reduce the tendency to back-fire. The gas is supplied by means of an angular piece *b*, and the primary air is supplied partly by tube *c*, and partly by means of a series of inlet ports formed around the end of the mixing tube, and further by a series of slots arranged on the outer side of the burner practically in line with the end of the gas-inlet pipe *b*. Near the delivery end of the

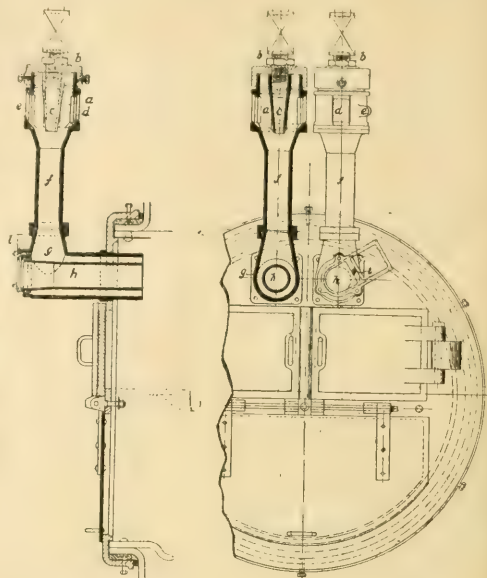


FIG. 4.—BUNSEN BURNERS ON HAND-FIRED BOILER.

burner the admission of the secondary air is provided for by a series of slots with a movable ring with corresponding openings. Fig. 5 represents the type of burner suitable for Lancashire and Cornish boilers; fig. 6 shows the construction as adopted for use in connection with water-tube boilers.

This form of construction gives the advantage that the mixing tube does not offer much frictional resistance owing to its comparatively large diameter. Consequently the injector effect of the burner is a good one, and back-firing does not take place even with an excessive amount of primary air added. The makers claim that an efficiency of 80 per cent. can easily be obtained. Fig. 7 shows an installation of these burners.

In the Terbeck burner the Bunsen system of forcing in gas through a nozzle and drawing in air is reversed; a great

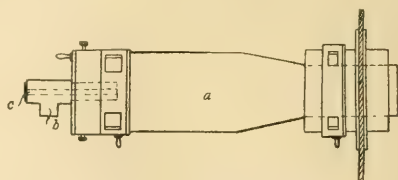


FIG. 5.—ALTENHEIM BURNER FOR LANCASHIRE BOILER.

number of these burners are working satisfactorily on the Continent, and some are in use at the Old Silkstone Colliery.

The Wefer burner, fig. 8, is designed to prevent an accumulation of explosive gas in the mixing tube, which with Bunsen burners, if they have not been lit up carefully, may cause serious explosions or tendency to back-fire. In the Wefer burner the gas enters a distributing chamber *a* which on its front end is closed by an inclined door *b*, hinged from the top. The door acts as a safety valve, as in case of back-firing or explosion the pressure is relieved by the door opening and no harm done. To keep a gas-tight joint, a lead strip is fastened to the frame of the chamber against which the inner face of the lid is pressed by its own weight. In the distributing chamber are a number (generally 25) of pipes *c*, through which the gas travels to the boiler. The front plate of the boiler holds a carbon block *d*, which has a hole for every gas tube *c*, provided in such a way that the tubes are completely surrounded by an air space. The tubes *c* only reach three-quarters of the way into the carbon body *d*,

the last quarter being used to form small mixing chambers for air and gas. The space between the gas chamber *a*, and the carbon body *d*, is taken up by an air chamber *e*. This is provided with a circular row of slots *f*, surrounded by a loose ring by which the air supply to the burner is regulated. Above the burner two inspection holes *g* are arranged, below is a hinged door *h* for the removal of flue dust. While the gas travels through the pipes *c*, the air coming from the air chamber meets it at the outlet of the tubes in the last quarter of the carbon channels. On the end of the latter the mixture is ignited. As the velocity of the gas in this burner is naturally slow, the gas flame burns immediately on the end of the carbon block, which gets hot at the end. The carbon is not a good heat conductor, so that the rest

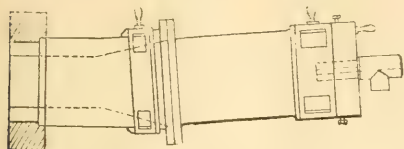


FIG. 6.—ALTENHEIN BURNER FOR WATER-TUBE BOILER.

of the carbon block remains comparatively cool. The carbon is also so fire-resisting that it does not burn away easily. On the other hand, should the gas supply not be quite constant and short interruptions take place, the heat of the burner mouth is sufficient to reignite the gas and thus avoid explosions.

There is always a certain amount of danger connected with boilers solely heated by gas. The greatest danger is an intermittent gas supply due to variations in pressure or water accumulations in the supply pipes. In case of frequent variations of pressure, a governor should be provided in the gas-supply pipe to the boilers. With too high a pressure on a Bunsen burner, the air supply of which is suitable for a normal velocity of the gas, it easily happens that not sufficient air for combustion is injected, and the gas flare is suddenly extinguished through lack of air. If this happens to a whole series of burners at the same time it is not so serious. One has only to turn off the gas, wait a while until the gas mixture is drawn away by the chimney, and then the burners can be lighted again. But if only one part of the burners are extinguished and others kept burning, or if hand-fired boilers are in the same range, the combustible mixture from the extinguished burners may be ignited in the back flues and cause a serious explosion.

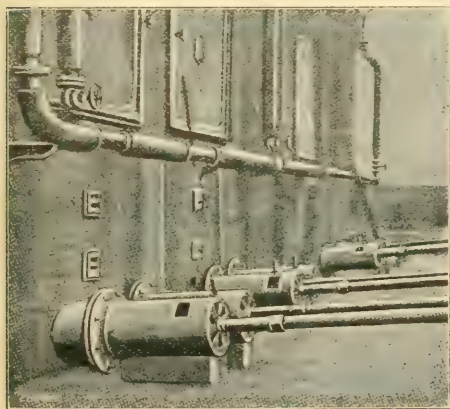


FIG. 7.—INSTALLATION OF ALTENHEIN BURNERS.

Great attention must be paid to the regulating of the air, especially the primary air supply, as with too little air part of the gas leaves the boiler unburnt, and besides the waste of gas through this cause, explosions in the flues at the back of the boilers may result. With too much primary air most Bunsen burners are apt to back-fire, so that the gas burns in the mixing tube.

In case of the gas having accidentally been extinguished in the boiler flue, in some boilers a little gas flare is kept burning, receiving its gas from an independent gas supply which acts like the small by-pass flame in a street lamp and relights the gas. If the gas goes out for want of air for combustion, this flame will also go out, and for such cases the arrangement cannot be called reliable. Undoubtedly the

safest way is to keep a small fire burning under the burner, if possible.

The combustion of live gas in waste-heat boilers as shown in fig. 1 is safe, as the live gas is always kept ignited.

Experience has shown that the Bunsen flame has a cutting effect on tubes, and these are generally protected by a brick baffle, which gets very hot and will relight the gas flames if not too long extinguished. The indirect heating of boilers

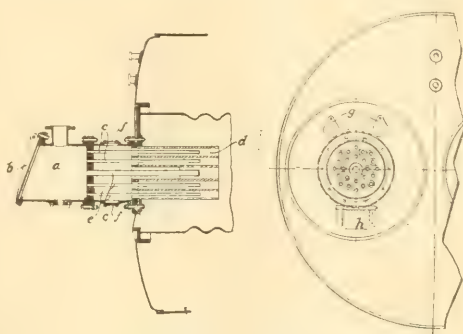


FIG. 8.—THE WEFER BURNER.

has led to the introduction of the Bonecourt surface combustion boiler, which has been described in our columns, but which, owing to its short body and tubes, is not available for alternative hand firing, and for this reason is not used on coke-oven plants.

While, no doubt, much may be learned from present practice in gas firing of boilers in coke-oven and similar installations, it is probable that the adoption of this system of

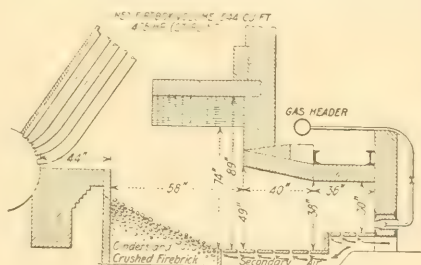


FIG. 9.—DUTCH-OVEN GRATE FOR GAS-FIRING.

generating steam for electrical purposes will result in a good deal of experimental work to meet the peculiar conditions of central-station practice. An instance of the kind was recently recorded in our American contemporary *Power*, which discussed the steps taken by the Toledo Railway and Light Co. in adopting coke-oven gas as fuel at its Water Street station. Due to lack of boiler capacity it was decided

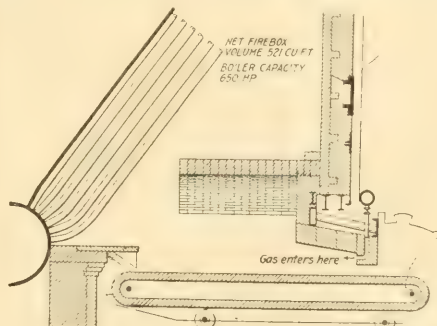


FIG. 10.—COMBINED GAS AND COAL-FIRING ON CHAIN GRATE.

to develop a scheme for burning the gas which would give flexibility in operation, maximum capacity, and efficiency.

The gas was to be burned under six Stirling boilers with Green chain grates. The first arrangement, which did not give the high capacity and flexibility desired, consisted in covering the grate with sheet asbestos, except for a space

Asbestos at port, crushed brick, egg size, was spread over the asbestos varying from 2½ in. at the front to 7 in. at the back of the grate (at the bridge wall) in depth. This deflected the flame so as not to strike the tubes directly.

The burners consisted of a 6-in. air mixer, 14 in. long, swaged down to 5 in. at the outlet. Gas was delivered to the burner through a 1½-in. pipe capped at the end and projecting into the air mixer about 4 in. In the face of the cap seven ¾-in. holes were drilled, one in the centre and six equally distant round it. This arrangement being found unsatisfactory, the grates were removed in one boiler and the Dutch-oven arrangement shown in fig. 9 was adopted. It was then easy to get 1,250 H.P., or 263 per cent. rating, and the boiler has been operated continuously at 210 per cent. rating ever since; the arrangement, however, was absolutely inflexible, and was not extended.

The most satisfactory plan offering was to burn the gas directly above the coal and in combination with it. A special tile with a 5-in. hole was developed, and set so that the gas when introduced into the fire-box was directed down against the coal. This tile was placed in the ignition arch next the grate; the gas was introduced through a 1½-in. pipe and cap drilled as previously described. All primary air was shut off and the gas introduced into the furnace, using the secondary air coming through the fuel bed for combustion. The boiler used for this experiment was a 425-H.P. Heine boiler equipped with Green grates. It was on the low-pressure end of the plant and could be spared. No attempt was made to determine ratings, but the gas was accurately metered and the flue gases were analysed.

Depth of fuel bed, in.	4½	4½	4½
With of chain grate, ft.	10	10	10
Chain speed, ft. per hour	16	22.5	25
Grate surface per hour, sq. ft. .	160	225	250
B.T.U. in gas	600	600	600
Gas used per hour, cu. ft.	38,400	32,300	25,500

When the gas was fired above the coal the entire firebox was completely filled with flame so intense that it was impossible to see through it even with the aid of a blue glass. As the gas runs high in hydrogen its combustion is rapid, so that it is an ideal fuel for combination burning. Another successful feature of this combination is the fact that there is practically no combustible in the ash, even when the chains are running at maximum speed.

On the strength of the results obtained from this boiler, equipment has been ordered and is now being installed in the 16 Stirling boilers comprising the high-pressure end of the boiler room. Fig. 10 shows the new arrangement adapted to a Stirling boiler. It is considered this design will give absolute flexibility of boiler operation, added capacity by burning the gas in addition to the coal, and higher economy because no combustible reaches the ashpit.

Upon the completion of this work, evaporation tests will be run and the more complete data will be published later.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 14,312. "Plug for telephone switchboards, &c." P. P. CRAVEN. October 9th.
- 14,325. "Protecting devices for multiphase alternating-current apparatus." J. R. BEARD & MESSRS. ELECTRICAL IMPROVEMENTS, LTD. October 9th.
- 14,345. "Electric machines." H. CHITTY. October 9th.
- 14,348. "Processes for electro-deposition of lead." S. O. COWPER-COLES. October 9th.
- 14,351. "Coating metallic sheets, &c., with lead." S. O. COWPER-COLES. October 9th.
- 14,355. "Sound-operated circuit controller." SUBMARINE WIRELESS CO. October 9th. (U.S.A., May 19th.)
- 14,371. "Preparation of material applicable for varnish, insulating, &c." W. T. RANKIN-BRIDGES & A. W. WEAVER. October 10th.
- 14,383. "Device for collection of electric currents from revolving apparatus." B. A. M. BOYCE & THE BRUSH ELECTRICAL ENGINEERING CO. October 10th.
- 14,416. "Electric condensers." G. GILES. October 10th. (Switzerland, October 13th, 1915.)
- 14,417. "Electric motors." C. W. DURNFORD & THE SUBMERSIBLE AND P. L. MOTORS, LTD. October 10th.
- 14,422. "Combined pumps and electric motors." C. W. DURNFORD AND THE SUBMERSIBLE & J. L. MOTORS, LTD. October 10th.
- 14,423. "Electric motors." C. W. DURNFORD AND THE SUBMERSIBLE & J. L. MOTORS, LTD. October 10th.
- 14,439. "Electrodes for storage batteries." R. SAVILLE. October 11th.
- 14,466. "Electric furnaces." J. W. MOFFAT. October 11th.
- 14,467. "Processes for the production of acid from acid solutions." F. E. SHEET. October 11th.
- 14,509. "Electrical connections." A. F. BERRY, THE BRITISH ELECTRIC TRANSFORMER CO. & E. ELLWOOD. October 12th.
- 14,518. "Electric ship propulsion." THE BRITISH THOMSON-HOUSTON CO. (General Electric Co.) October 12th.
- 14,521. "Electric commutators." SYKES INTERLOCKING SIGNAL CO. & R. W. TARRANT. October 12th.
- 14,522. "Electric commutators." SYKES INTERLOCKING SIGNAL CO. & R. W. TARRANT. October 12th.
- 14,524. "Apparatus for electrically sterilising foods." J. HANSEN. October 12th. (Norway, October 12th, 1915.)

- 14,540. "Dialyze circuits." WESTERN ELECTRIC CO. October 12th. (U.S.A., October 13th, 1915.)
- 14,566. "Magnetic controlling devices." C. MARSHALL. October 13th.
- 14,593. "Spark plug." W. C. MATTHEWS. October 13th.
- 14,629. "Electro-magnetic separator." A. F. HALLIMOND. October 14th.
- 14,661. "Electrochemical treatment of organic and inorganic substances." G. CARACIO. October 14th.
- 14,645. "Incandescent lamps filled with argon." ALL-ENTENTE ELECTRICITIES GES. October 14th. (Germany, November 11th, 1915.)

PUBLISHED SPECIFICATIONS.

1915.

- 9,344. MEANS FOR PRODUCING AND DEFLECTING A JET OF LIQUID AND FOR MAGNETISING AND UTILISING SUCH DEFLECTION. A. F. SYKES & S. FORD. June 25th. (Cognate applications, 11,855/15, 633/16, and 1,001/16.)
- 12,193. INSULATORS FOR ELECTRICAL RESISTANCES AND CONDUCTORS. A. E. WOODHOUSE. August 24th.
- 12,404. THERMISTOR SYSTEMS. I. V. DREZDNER. August 28th.
- 13,614. ELECTRIC SELECTIVE DEVICES. A. H. MORSE & Indo-European Telegraph Co., Ltd. September 24th.
- 13,801. REGULATION OF DYNAMO-ELECTRIC MACHINES IN CONTINUOUS-CURRENT SUPPLY SYSTEMS FOR "SERIES" OPERATION. R. THURY. September 28th. (Convention date, June 16th, 1915, Switzerland.)
- 13,902. THERMIC TELEPHONES. Naamloze Vennootschap de Nederlandsche Thermische Telefoon Maatschappij. September 30th. (Convention date, April 26th, 1915, Germany.)
- 14,043. ELECTRIC BATH BLANKET. H. D. PARKER. October 4th.
- 15,471. APPARATUS FOR ADJUSTABLY HOLDING X-RAY TUBES. E. H. HANSON AND HARRY W. COX & CO. November 2nd.
- 16,094. ELECTRIC ARC LAMPS. A. H. RADING & A. E. ANGOLD. November 2nd.
- 17,185. THERMO-ELECTRIC COUPLE. C. E. FOSTER. December 7th.
- 17,330. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. S. A. NEWMAN (H. C. NEWMAN, British Expeditionary Force). December 9th.

1916.

The numbers in brackets are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

- 1,724. ELECTRICAL RESISTANCES. Clarke, Chapman & Co. and R. C. Harris. February 4th, 1916. [101,498.]
- 3,817. EXPLOSION ENGINES COUPLED TO DYNAMO-ELECTRIC MACHINES. Soc. Anon. des Etablissements L. Bleriot. April 10th, 1915. (Addition to 11,566/15.) [100,268.]
- 7,100. TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. July 19th, 1915. [100,941.]
- 8,754. MEANS FOR CONTROLLING AND REGULATING ELECTRIC MOTORS. Igranice Electric Co. (Cutler-Hammer Manufacturing Co.). January 28th. (Divided application on 1,374/16.) [101,523.]

Electrolytic Treatment of Zinc Ores.—The *Queensland Government Mining Journal* (Brisbane) of August 15th reports in the local Press an announcement to the effect that works are to be erected at Bowen, Queensland, for the electrolytic treatment of zinc ores. It is understood that the company concerned has for some time past been considering the advisability of putting up such works at either Townsville or Bowen. Evidently the decision has turned in favour of Bowen, and an application has been made to the Lands Department for the lease of an area of land at that place suitable for the proposed works.

The Operation of Electric Excavators.—Some unusual and interesting schemes have been developed in connection with the utilisation of energy for operating excavators in the Little River Drainage District near Cape Girardeau, Mo. The excavators are being used to construct a 30-mile diversion channel and levees along the system. When the project was first started each excavator was supplied with energy from two 100-KW. transformers, carried on wide-tired trucks alongside a transmission line paralleling the channel route. Wet and muddy paths that hindered moving the trucks were encountered so frequently, however, that it was decided to transport the transformers on small barges built on the job. The high-tension lines leading to the barge are held above the ground and at the proper distance apart by insulators attached to the top of posts. The vertical jumpers connecting these lines with the transformers are supported at intermediate points by insulators attached to a short cross-arm and to the barge railing. To permit moving the transformer barge without adjusting the branch line tap each time, it is connected with the line by an ingenious roller-contact device, consisting of two ordinary sash pulleys attached to a piece of sheet steel bent to form a rider similar to a barn-door hanger. From the rider is suspended an insulator attached to a rope which is employed to move the rider along the line when the barge is moved. When the end of a span is reached the transmission line is de-energised long enough to permit setting the rider on the adjacent span in the direction of excavation.

Energy at the voltage required for operating the excavator motors is conducted from the transformers to the machines through flexible insulated cables. Since these are allowed to lie on the earth between the barge and the excavator, they have to be dragged on the ground when the excavator is moved. To facilitate performing this operation without receiving shocks through insulation which may be worn thin, shovel handles are provided with hooks bolted to the end. On one of the dredges electric fans have been used with satisfactory effects in the daytime to keep mosquitoes from annoying the operators. At night, however, the damp draughts produced by the fans are almost as unbearable as the mosquitoes.—*Electrical World*.

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ELECTRICAL REVIEW. ON MAXIMUM EFFICIENCY.

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UNDER the stress of the present unprecedented emergency our national life is being shaken up from top to bottom. Not only does the situation increasingly demand that every man and woman shall be in that position where they can contribute the right kind of service to the Allied effort for the successful prosecution of the war; it equally demands that when we have found our right place we shall contribute the utmost that lies within our power of that right kind of service. We need not refer to the part that is being contributed by the actual fighting forces, nor to those who behind the lines or at the base are rendering non-combatant service of different kinds; we do not pretend to be in a position to say whether the places of the latter could be filled with equal effectiveness by others while some of these are released for actual fighting, for the point lies beyond our particular scope. But we are directly concerned in the efficient utilisation of the non-combatant forces at home.

Two events of the past week have again brought very emphatically to mind the importance of every worker and every machine being utilised in such a place and in such a way as to contribute maximum efficiency. There is no room for either idle men or idle machinery to-day; the principal difficulty in the way of securing the maximum from all lies in the reconciliation of the different interests which contribute to the success of our Arms. It has been one of our great problems ever since the demands for men and munitions first began to reach unexpected dimensions, but to-day the problem is more acute than it has been at any previous stage of the war, and readjustment of our national resources demands of us all that we shall be prepared to seriously consider our own personal relation to the world-conflict, whether we are masters or men, whether we are professional classes or workmen, whether we are brain-workers or tradesmen, technical, commercial, or clerical. Personal interests are to be subordinated to national, whether we like it or not, and the only door at which we can fairly lay the blame is that of those who aimed at the Prussian Domination of the World. We agree absolutely with the Army Council in its very definite conviction that this is a young man's war, and we believe that it has the great bulk of the nation behind it in its efforts to secure the right men for the fighting line by drawing off the millions from work which can be performed by others. But we believe that this process would be more easily carried through if every worker recognised the pressing need for him to do his best work when he has found out what that work is. Mr. Asquith told the representatives of the coal-mining industry that by abandoning what is euphemistically called avoidable "absenteeism" we could increase our coal output by 15,000,000 tons per annum. Coal is one of the vital factors in the war, necessary for the Fleet, for the mercantile marine which brings in our food, for the tens of thousands of factories making munitions and manufactured exports; it is a vital necessity for our Allies, and its exportation to them is essential on financial grounds. But those requirements cannot all be properly met because there is 5 per cent. avoidable "absenteeism." Situated here, at the hub of things, and eagerly following each development of the war from day to day, we ordinary mortals may think that it should only re-

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quire every colliery worker to be apprised of the fact for him conscientiously to examine himself and solemnly resolve that, inasmuch as he believed in the righteousness of the Allied cause and wished his children never to come under the terrible heel of the Hun, he would produce more coal per hour than ever before from now until the end of the war. We trust that the representatives of the men who gave Mr. Asquith an undertaking will be able to secure the hearty co-operation of the men themselves.

But is it only to workers in the collieries of the land that the urgent counsel to abandon avoidable "absenteeism" should come? Are there not some other departments of essential activity in which the same warning should be given for the sake of the allied cause? Are there not many of us in many vocations who, by only a slightly increased effort, could increase our individual production, and so release part of a worker for something else? We need not particularise, but there are still forces or influences at work amongst us which stand in the way of a general contribution of maximum efficiency all round. And the things that hinder must be put aside, whatever they be, if the emergency is as great as our advisers represent it to be. The Ministry of Munitions and the Military authorities are exercising their powers by searchingly scrutinising our industries and our occupations, and the Board of Trade decides what may or may not be imported. We certainly cannot afford to have our labour, our ships, our railways, and our factories occupied with things that we can do without, and we shall be little the worse if we put hindrances in the way of those who want to spend recklessly their unaccustomed riches, or if we generally simplify our standard of requirements for the period of the war. Measures to these ends may not be very pleasing, but we must blame the situation in which the nation stands, when it is still necessary to concentrate all our efforts on securing the defeat of an embittered enemy who finds his cherished ambitions frustrated and his chances of victory almost gone.

Engineers are accustomed to think much of "efficiencies," and they know only too well that neither machinery nor individuals can be expected to produce their maximum output continuously. Overload capacity of machine and man has very definite limits. The experience of the war has taught us many lessons regarding overtime, fatigue, Sunday labour, the importance of rest periods, holidays, and so on, but when these matters have been carefully taken into account in developing our measures, "avoidable absenteeism" on the part of anybody to whom the State is looking to-day for his best is an unpardonable sin. We may be suffering from the physical and mental consequences of war-weariness, but this is no time for lessening our efforts, and we have to utilise the industrial ability of man and machine to the full in order to keep the Forces supplied with munitions, to keep our Allies supplied with coal, and to maintain our financial credit as far as is reasonably possible by exportation of goods and materials which occupy the minimum of labour in proportion to their value.

As part of this matter there is the need for the utilisation of the whole of the suitable machinery that is within these islands. Any machine that is lying idle represents so much waste, if in the hands of the Ministry of Munitions it could be turned to good account for the purposes of the war. Therefore, we cannot but welcome the announcement issued by that Department concerning the mobilisation of idle machinery. It has established a central clearing-house organisation for the purpose of tracing and registering *machinery which is idle or is about to become idle*. It will be the object of the organisation—

(a) To ensure that contracts placed by the Ministry are directed towards any unoccupied manufacturing capacity which might exist in the country.

(b) To place engineering contractors who have suitable facilities for particular supplies in touch with the Ministry and with other Government departments requiring these supplies, and to help contractors who are able to undertake additional or more suitable work now or at a future date to maintain continuous employment of their machinery and labour.

An invitation is given to manufacturers possessing idle resources and desiring to be placed in touch with Government Contracting Departments to communicate with the Central Clearing House, Ministry of Munitions, 8-9, Northumberland Street, W., when further particulars will be sent to them.

Manufacturers who know the state of the markets of the world, and want to do something to retain their hold on foreign trade, maintaining connections, as far as is reasonable, to serve the national interests, will, we are sure, recognise the need for co-operating with the Ministry of Munitions in this matter. As the financial aspects of the war change as it is more and more prolonged, the importance of exports does not grow less, but we have reached that pass when we must all see that everything in reason should be done to bring the war to an entirely victorious issue at the earliest possible moment. Whatever effort on the part of skilled or unskilled labour the national cause demands it must have, whatever dilution or substitution the situation really demands in order that we may put the best men in the Field, must be accorded, and we must adapt ourselves to the altering conditions as readily and conveniently as we can. But after all the readjustment and all the mobilising, much will still depend upon the efficiency of the individual. Let Labour and Capital, man and machine, all alike give "A long pull; a strong pull; and a pull all together" to bring about the Victory.

The Future of Japanese Electrical Industry.

We have on several occasions referred to the enterprising development of Japanese electrical industry. This enterprise is not a new growth, for there was a full appreciation of electrical possibilities among engineers in Japan before the war; but the condition of affairs consequent upon the state of war has given our alert Ally an opportunity that she was not slow to recognise. The cutting off of German supplies from various world markets led Japanese electrical works to pursue energetically those particular lines of manufacture for which the available labour and supplies of material were most readily adaptable. Manufacturing facilities have been established which might not have been considered necessary so long as Germany was able to send her manufactures abroad pretty well as she pleased. But after the war, what about this manufacturing capacity?—will it have scope when—if ever—Germany resumes her old Hunnish dumping practices in markets for which Japan is now catering? This and other considerations have led electro-industrial authorities to see what steps they must take in order to be prepared for future possibilities, and there, as here, organisation—if need be combination—is found to be one of the main essentials. Industrial banking and credit facilities are other essentials of the situation if Japan is to secure a firm hold in markets where Germany in her past days has exercised those privileges to the utmost of her power. The future financial position of Germany is so uncertain and hazardous a problem that one wonders how far her firms are likely to be able to use the old financial weapon; if we mistake not, that weapon is failing in her hand, and must inevitably do so more and more until the end comes. But whatever happens in respect of Germany, Japan, like ourselves, appreciates the need for better financing arrangements for industry, especially in China where, from all that one hears, the German contract-getting menace is already showing an activity which is remarkable

considering the state of affairs in Europe. The *Japan Weekly Chronicle* quotes from the *Mainichi* some interesting comments on the proposals regarding the future of electrical industry which have been advanced by Mr. Munasuye, the Director of the Electric Bureau in the Department of Communications. This gentleman has several times summoned representatives of the Shibaura, Mitsubishi, Sumitomo, Hidachi, Kuhara, and other manufacturers of electrical machinery and apparatus, and urged upon them the advisability of making a combination to promote their mutual interests. Mr. Munasuye says:—"It is true that since the outbreak of the European war, Japan's export trade in electrical machinery and apparatus has been increasingly satisfactory, but nevertheless it is necessary that measures should be taken to ensure the development of the industry. This object may be attained along the lines of establishing a combination of manufacturers, as has been done in Germany, in order to avoid fratricidal competition among themselves, to unify the industry, and to secure more financial facilities than are possible under the present plan. The manufacturers should not only sell their products, say, in China, but should also undertake installation and all other works necessary for the commencement of electric business. In this case, transactions will be necessarily on long credit, and the manufacturers should get into special relations with bankers." Mr. Munasuye goes on to say that in Germany, bankers accord the most complete facilities to two large combinations of electrical manufacturers, and have thus largely assisted them in realising their worldwide development, and he puts his finger upon a characteristic that has also been touched nearer home when he says: "Japanese manufacturers, however, are too individualistic and not amenable to co-operative combination. This failing should be overcome in order to promote Japan's export trade in electrical machinery and apparatus, and to that end I shall exert myself with further consultation with the leading manufacturers."

Construction Contracts and the War. A CASE which illustrates in a remarkable way the effect of the war on contracts of construction was decided recently by Mr. Justice Bray. Some time before August 1st, 1914, Messrs. Dick, Kerr & Co. had undertaken to erect certain waterworks for the Metropolitan Water Board at a cost of £673,000. The contract, it may be presumed, contained the usual clauses vesting material brought on to the site in the employers, and giving power to the employers' engineer to extend the time for completion. The work was discontinued in accordance with an order by the Ministry of Munitions, who also decided that certain plant and materials on the site should be sold, both parts of the order being duly carried out by the contractors. In these circumstances the Metropolitan Water Board brought an action claiming a declaration that the contract was still valid and subsisting; that they were entitled to the plant and tools on the site in so far as they had not been sold pursuant to the above order; and that as to the tools, &c., sold, the contractors were bound to account to the Board. Mr. Justice Bray held that the order of the Ministry not having made the performance of the contract illegal or commercially impossible, having regard to the engineer's power to extend the time, the plaintiffs were entitled to a declaration to this effect. He also held that they were entitled to the tools, &c., on the site but that the defendants need not account to them for the tools sold.

It would seem that the result of this decision is that when that dim and distant epoch "after the war" commences, Messrs. Dick, Kerr & Co. must

needs collect their scattered workmen and carry out this formidable contract. It is to be observed, however, that the engineer having, by operation of law, been forced to extend the time, he will also be compelled (if the contract is drawn upon customary lines) to make due allowance to the contractors for the altered conditions which must obtain when work is resumed. Such, at any rate, would probably be the result of a forced suspension of a building contract drawn in the form sanctioned by the Royal Institute of British Architects, clause 25 of which provides that: "If in the opinion of the architect the works be delayed by *force majeure* . . . the architect shall make a fair and reasonable extension of time for completion in respect thereof." We say "probably" because even that elaborate form of contract makes no provision for alteration of schedule prices in the event of delay. But it could be argued with great force that by reason of the enforced delay, and as a direct consequence of the intervention of the Ministry of Munitions, the whole substratum of the contract was altered, and that in law, as well as in equity, the basis of remuneration must be changed. We anticipate that when the war comes to an end the time of the judges will be fully occupied in considering questions of this kind.

The Present Position of Electroculture.

IN the present issue we publish the conclusion of an article on the use of ionised air in agriculture by Mr. Ingvar Jorgensen, who has for some years devoted considerable attention to the investigation of the subject.

If Mr. Jorgensen's brief survey does nothing else, it at least indicates that great possibilities lie ahead of a thorough investigation of the subject, which in common with a good many other branches of scientific research has been neglected in the past.

Previous to the war, some half-dozen experimental areas were in use in England and Scotland, but none of these, so far as we are aware, were regarded as really of sufficient extent to justify commercial conclusions being drawn from the results obtained.

The results, in themselves, appear to be most promising, the experimental electrification of growing oats, by Miss Dudgeon in 1915, resulting in an increase of grain by 30 per cent., and of straw by 58 per cent., while this year, we understand that even these increases have been doubled—the value of the extra crop so obtained being about £6 per acre. When it is remembered that an installation of the most recent type indicated in the article should not cost more than, say, £100 for 20 acres, it will be conceded that there is a very profitable side to the question.

The recent report by Mr. Middleton of the Board of Agriculture, on the comparative position of German and British agriculture, contained a recommendation that the farmer should be induced to "speed the plough" if greater productiveness of the soil was essential to our well-being. This—shall we say—old-fashioned advice may in the near future give way, in favour of the more scientific recommendation to adopt electroculture.

It is the usually accepted idea that, the apparatus required for electrical discharge purposes is too costly for the farmer, and in any event too intricate for him to handle.

While there may be some truth in the latter suggestion, it can scarcely be contended that the cost, in view of what the farmer is prepared to spend on motor ploughs and tractors, is prohibitive; moreover, we understand that efforts are now being directed to the production of simple, robust, and less costly apparatus specially designed for farm use.

A NEW UNIVERSAL SHUNT.

By HARRY W. BROWN.

THE accompanying sketch of a new type of shunt which I have designed will, I think, interest your readers. Figs. 1 and 2 show the principle and development of it. The principle of it is based on the Wheatstone bridge, as shown in fig. 1. Suppose A, B, C, and D are stretched resistance wires of equal lengths and of uniform and equal resistance,

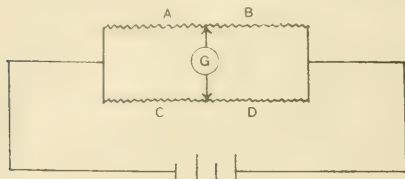


FIG. 1.

then if the galvanometer leads are moved together, either to the right or left, there will be no deflection on the galvanometer, because $A : B :: C : D$.

Now in fig. 2 such is not the case, as there is only one neutral point, which is at the centre; moving the galvano-

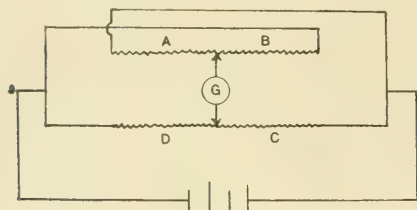


FIG. 2.

meter leads, either to the right or left, will cause a deflection, and this deflection will be increased until the leads reach either extreme. This is due to the cross-connecting of the coils.

Fig. 3 shows the shunt complete, with the exception of the movable switch connecting the respective segments to

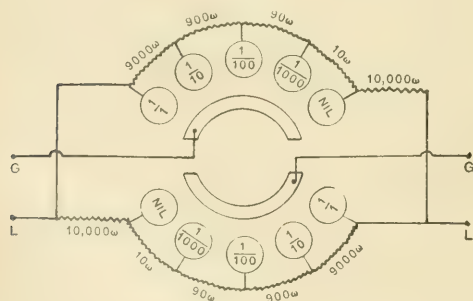


FIG. 3.

their various contact studs. This galvanometer switch will, of course, be double-pole, actuated with one handle. The advantages of this shunt are, first, that the only moving contacts are in the galvanometer circuit; secondly, that the main current is kept constant, no matter what shunt is being used. This shunt-box can be used with any galvanometer, and I think that it can be rightly called a constant-current universal shunt.

ELECTRIC VEHICLE DEVELOPMENT.

A DEFINITE POLICY IN VIENNA.

SUFFICIENT devotion to the development of electric vehicles has hardly figured amongst our achievements of the past two years, but the latest petrol restrictions have compelled attention to the advantages and possibilities of the "electric," the manufacture of which in this country certainly deserves to rank amongst those industries second only to munitions. The enemy has been entirely dependent on internal sources of supply for motor fuel. From these sources immense quantities of benzol and alcohol have been obtained, but the electric vehicle, which can store and utilise energy derived from central stations, has been utilised extensively in its own particular fields of application. According to the *E.T.Z.*, the German and Austrian estimate of the useful limits of electric vehicles corresponds to a journey of 50 miles at 15 to 19 M.P.H. on a single charge, assuming level roads in good condition. This applies to service in and near towns, and covers commercial and industrial vehicles to an even greater extent than private cars. Evidence of lively interest in the development of the electric vehicle in this class of work is to be found in a motion brought before the Vienna City Council a few months ago to the following effect:—"The war, which has changed the standard of practice and economy in so many directions, can, and must, also effect reforms in automobile traffic within the town. At present most of our petrol cars are being used by the military in the war area, and they should not return in their former numbers to contaminate the city air. Vienna has electricity works and an overland station at Zillingsdorf, equipped and operated on the most modern lines, so that there is no excuse for conveying persons and goods within the city and its suburbs by other than electrical means. By erecting charging stations at tramway termini, in garages, and at other selected points, it will be possible to use electric vehicles in a zone extending at least $12\frac{1}{2}$ miles beyond the city boundaries, particularly if Austrian manufacturers will adopt a standard type and size of battery, so that exhausted batteries may simply be exchanged for charged batteries at charging stations. The city would benefit by the cleanliness, smooth running, and safety of electric vehicles, which are smaller, lighter, and of better appearance than petrol cars, besides being cheaper to operate. It is recommended that no more licences be granted to petrol cars for service in the city area, fresh licences being granted only where cars are to be used in long-distance work. Simultaneously with the adoption of this policy, a sufficient number of charging and battery-changing stations must be erected, and manufacturers of cars and batteries must be persuaded to arrange for the use of standard battery units. Finally, the municipal electricity station is to report to the Town Council on the practicability of the contemplated charging stations and on the general and economic advantages of electric road vehicles."

The principal points to be borne in mind when estimating the importance of the definite and progressive policy adopted in this matter by the Viennese authorities, are the bearing of electrical vehicles on national economy, on central-station development, and on public health. In German and Austria (as in this country) large sums have been placed annually to the national debit by importing petrol. The total energy consumption of automobiles is now so considerable that, to provide it wholly, or in part, from native sources (*e.g.*, from coal-fired or hydro-electric central stations), has quite an appreciable effect on national credit and the rate of exchange. As frequently pointed out in these columns, electric vehicles represent an admirable "off-peak" load for central stations, and their extensive use is bound to reduce the average price of energy and lead to all-round benefit to supply undertaking and consumer alike. The superiority of electric over petrol cars from the hygienic point of view is obvious.

The number of electric vehicles now in use in America is variously estimated at between 80,000 and 100,000. At any rate, the number is enormously, and quite disproportionately, in excess of the number used in Europe, and it is

interesting to note that private electric cars greatly outnumber commercial vehicles in the States; due, doubtless, to the fact that most private cars are used in and near cities in America, whereas the shorter distance between towns in Europe encourages touring. A German estimate of the number of electrics in Europe, at the end of 1914, *i.e.*, practically the latest pre-war figures, shows 3,172 vehicles, distributed as follows:—

Germany, 1,691; France, 318; England, 288; Austria-Hungary, 265; Italy, 238; Switzerland, 200; Holland, 115; Denmark, Sweden, Russia, Belgium, Roumania and Spain together, 57. These figures include electric buses and 366 three-wheelers, and are, roughly, equally divided between passenger and commercial vehicles. The applications of the commercial vehicles include transport of goods and materials, fire-engines and escapes, street-cleaning and refuse-collecting, hospital and postal service, &c. There has been a marked increase in the number of heavy electric vehicles in use in this country during the past few years, and an even greater increase in the number of light electrics for delivery service in town and suburban areas. About 700 electric vehicles are now in service in this country, and conditions are very favourable for phenomenal development in the immediate future, if only a vigorous policy is adopted by central stations and manufacturers. There is no longer any possible justification for hesitancy. At the beginning of 1914, there were some 52,000 electrics in use in the United States (18,000 being commercial vehicles), consuming energy to the value of £1,520,000 per annum, and the hope was expressed at a meeting of the National Electric Light Association that there would be 10 million electrics in the States by 1924. That this figure should be reached is hardly possible; but the number of American electric vehicles has, roughly, doubled during the past two years, and there is every probability that future development will be more rapid. In any event, the electric vehicle is certain to be a powerful factor in central-station development, whilst its effect on public health is far from being a mere "talking point."

POWDERED COAL AS A FUEL.

From time to time we have referred in these columns to the use of powdered coal for boiler firing. Up to the present but little real practical work has been accomplished in this direction, but its use for metallurgical furnace heating and cement burning appears to have made considerable progress in the United States. The only steam-raising powdered fuel plant which has made any progress in this country, so far as we are aware, is the Bettington boiler and apparatus, which has been described in our columns.

In the past it was not appreciated that the coal had to burn while floating in the air in the form of dust, and although it was soon found that a flame of intense heat could be obtained, this led to difficulties in connection with the melting down of furnace linings. A paper recently read before the Mining and Metallurgical Section of the *Journal* of the Franklin Institute, by Mr. C. J. Gadd, which discussed modern metallurgical practice as regards the burning of powdered fuel, pointed out that it is the best method of obtaining perfect chemical combination of the air and coal, and enables the highest degree of perfection in combustion to be obtained; its control, however, requires great precision.

Mr. Gadd mentions as essential features (1) that the coal should have a high volatile content, low in ash, (2) that after pulverising, the moisture in the fuel should not exceed three-fourths of 1 per cent., (3) that it be pulverised so that at least 95 per cent. will pass through a 100-mesh sieve and over 83 per cent. through a 200-mesh sieve, (4) that the delivery of the coal to the furnace be uniformly controlled, regardless of the quantity required, (5) that it be delivered in a thoroughly atomised state, and that combustion be completed while the coal is in suspension, and (6) that in the application of this fuel the personal equation be eliminated as far as possible.

Powdered coal fuel requires the use of efficient crushing, drying, pulverising, conveying, and distributing equipment, and ample storage room for coarse coal.

In a paper touching generally on the use of powdered coal fuel, read by Mr. Joseph Harrington before the American Society of Mechanical Engineers in May, the author, referring to objections and difficulties, points out that early experimenters did not appreciate the necessity for fine grinding, nor the influence of furnace design upon the temperature of the resulting gases. The blow-pipe effect of the high-

velocity jet melted the brickwork on which it impinged; a layer of melted lava—fused ash and brick—accumulated in the bottom of the combustion chamber. Later on difficulty arose from the minute particles of liquid slag carried in suspension and deposited upon the water tubes, &c., thus closing up flame space and putting the boiler out of action.

On the other hand, Mr. Harrington points out that only in the case of powdered coal is the actual solid fuel both



FIG. 1.—INTERIOR OF BOILER HOUSE, USING POWDERED COAL.

gasified and completely consumed directly within the chamber desired to be heated. With perfect pulverisation the entire mass is burned in suspension, and in actual practice but a small fraction of 1 per cent. is actually lost in the flue dust or slag pan. In the gas producer there are a series of losses which reduce the available heat considerably, while the mechanical stoker has unavoidable losses due to incomplete combustion. With powdered coal, definite control of the amount of air per unit of coal, due to the method of burning, permits of the most perfect adjustment.

This author does not appear to be very hopeful as to the extensive use of powdered fuel for steam generation, point-

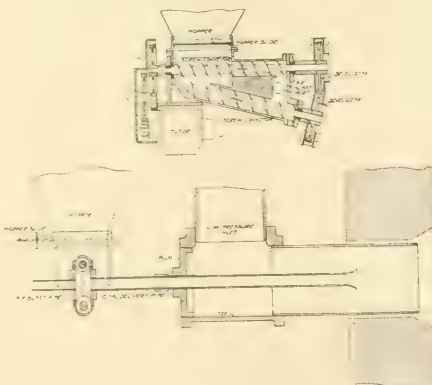


FIG. 2.

ing out that while with powdered fuel the loss in the ashpit and flue does not exceed 1 per cent., with the best mechanical stokers this loss will not exceed 2 per cent. of the coal fired; moreover, a possible advantage of 2 or 3 per cent. in combustion efficiency may be off-set by the cost of coal preparation. As regards this latter, we may quote the previously mentioned paper by Mr. Gadd, who says:—

From the time the coal leaves the dryer to its delivery in the furnace the whole system between these points should be dustproof and the greatest care should be taken to prevent leakage. This should be guarded against systematically,

as leaks, however small, may permit the surrounding air in the rooms to become impregnated with coal dust to such an extent that a serious explosion may result.

Coal, after pulverising, should be handled in bulk. All types of aerial propulsion and transfer in the form of dust clouds should be avoided, for the reason that accidental ignition may at any time wreck the whole system.

Screw conveyors and bucket elevators equipped with dust-proof casings are best adapted to handling powdered coal in bulk. Screw conveyors of 9 in. and 12 in. diameter should not exceed 250 and 300 ft. in length, respectively, if the best results are to be expected. Where transmission lines of greater length are necessary they should be divided.

The storage of powdered coal in large or small quantities

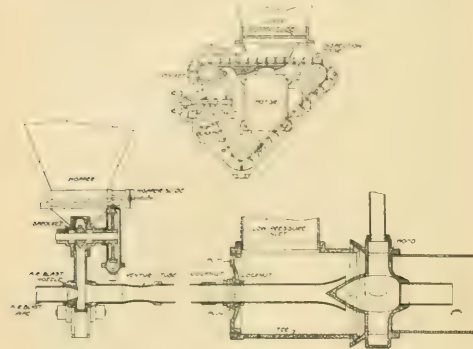


FIG. 3.

for any length of time is not advisable, owing to its tendency to fire, collect moisture, and pack.

Powdered coal in storage, containing about three-quarters of 1 per cent. moisture and 1 per cent. sulphur, will invariably fire within six days. If the moisture be increased to over 1 per cent. and the sulphur to 4 or 5 per cent., spontaneous combustion may occur within 24 hours. Probably the temperature at which powdered coal is delivered to the storage bin, and the sulphur content of the coal, influence the rate of spontaneous combustion rather than moisture.

Owing to the hygroscopic nature of dried powdered coal, long storage is not desirable.

In its normal state powdered coal is light and fluffy; after 43 hours' standing in storage, however, the physical arrangement of the particles produces a dense packed mass. So dense does the fuel become that one's fingers cannot make an im-

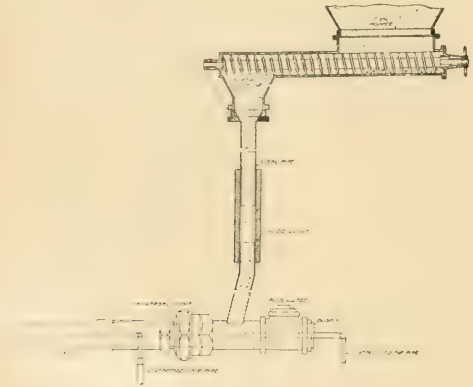


FIG. 4.

pression even one-half inch deep. To meet ideal conditions, powdered coal should be kept in motion.

With properly designed machinery and storage bins, having 12 hours' supply placed at each furnace, the coal may be kept in motion and repairs and adjustments made before the supply becomes exhausted.

The dryer for preparing the coal before pulverising is generally of the revolving cylinder type, with an external furnace and automatic stoker; the power consumed by a complete unit including feeder, fan, stoker, &c., for a 10-ton dryer is about 1-1½ kw.-hours per ton of dried coal. The pulveriser is frequently a type of ball mill; its power consumption for a capacity of about 4½ tons per hour will amount to 10½ kw.-hours per ton of product.

In a plant having an average output of 200 tons of pow-

dered coal per day the cost per gross ton of coal produced (according to Mr. Gadd) is 0.6 dol., the figure being an inclusive one—coal in car to furnace, but with no allowance for overhead and depreciation expenses. Shrinkage in the coal must be allowed for; it amounts to 150-270 lb. per gross ton.

Mr. Gadd goes on to describe the two best known types of powdered coal feeders for furnaces, i.e., the mechanically-operated screw or flight conveyor having variable feed, and the siphon type using low or high-pressure air; some of these are shown in figs. 2, 3, and 4.

On the question of burners, Mr. Harrington says it is generally conceded that the volume of the air should be just sufficient to supply the oxygen necessary for complete combustion; the velocity of the entering jet must be greater than the rate of flame propagation to prevent burning back. The mixture of air and gas, being explosive, must be made close to the furnace; this is also desirable in order to secure uniformity of mixture. The screw feed tends to give pulsating delivery of fuel, and devices have been tried to smooth out the delivery; a constant density of the fuel cloud is important. Mr. Harrington gives tabulated data as to cost of pulverising coal varying from 96.3 cents per ton for 10 tons per day to 30 cents per ton for 250 tons per day, inclusive of interest and sinking fund charges; exclusive of these, the figures are 48.2 and 23.4 cents respectively.

In the discussion on Mr. Harrington's paper, the pulverised fuel installation serving ten 250-H.P. boilers at the Parsons (Kan.) shops of the Missouri, Kansas, and Texas Railway was described; this installation is the largest of the kind, and burns low-grade coals, including lignite, the method being considered the most suitable in view of the ash and moisture content of the raw fuel. The ten boilers will consume about 158,000 lb. of coal in 24 hours, assuming a boiler efficiency of 70 per cent. operating full capacity for ten hours, and half

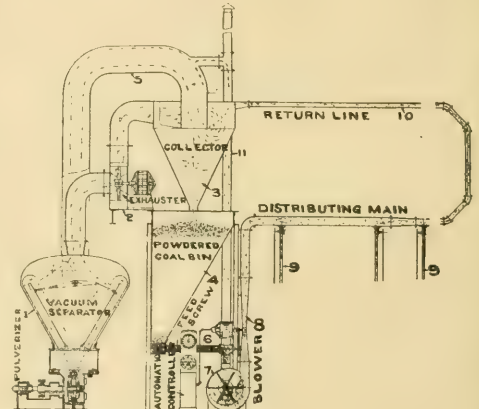


FIG. 5.—DIAGRAM OF HOLBECK POWDERED COAL SYSTEM.

capacity for 14 hours. The coal is dumped into a hopper and passed through a 20 in. × 24 in. crusher, to break down lumps, then conveyed by belt to a pair of 24 in. × 18 in. corrugated rolls, the crushed fuel being elevated and discharged through a screw conveyor into a 40-ton bin, allowing five hours' storage for the drier and mills. From the bin a screw conveyor feeds the coal to an indirect-fired rotary drier, from which it is led to a 45-ton bin, serving two pulverisers. The pulverised coal is elevated and carried by a screw conveyor to the boiler house, the conveyor extending the full length over the bins in front of the boilers, a distance of 216 ft. One bin serves two boilers, a separate feeder being provided to each of the latter; each half bin with its hopper bottom holds 10 tons of pulverised coal, or sufficient for 30 hours running at full capacity. Each bin is filled through three separate gates and spouts from the conveyor.

Under the bin, between the hoppers, is placed a motor-driven fan, supplying air through twin 7-in. pipes, each leading down to a burner nozzle (see fig. 1). The fan supplies the air needed in feeding the coal (4,200 cu. ft. per min.) at 3 oz. static pressure to a burner nozzle in front of each boiler. The hopper bottoms each contain a 4-in. screw feeder, to feed the fuel to the burner, through a 3-in. down pipe. The burner consists of a 14-in. cylindrical pipe, projecting into the furnace; the 7-in. blast pipe projects into this from 12 to 18 in., and is fitted with a cone forming a valve to regulate the air. The powdered fuel is introduced directly over the discharge end of the blast pipe, allowing thorough mixing of the air and fuel; the burner will induce a large quantity of air in addition to that supplied by the fan.

At normal rating on a basis of 70 per cent. efficiency, and with feed water at 208 deg. F., these boilers will each consume 985 lb. of coal per hour, requiring 3,200 cu. ft. of air per min.; half the fan capacity is utilised through the blast pipe, and the remaining air induced through the burner.

The furnace in use consists of a Dutch oven, of 6 cu. ft. capacity, built in front of each pair of boilers, with vertical

baffles. No slag is formed, and the ash is readily blown off the floor of the rear chamber with an air hose once a week. No part of the refractory lining is subjected to an excessive temperature even at overload, and it is stated that the operation is quite flexible, and that highly gratifying results are being obtained.

Our view, fig. 1, of the interior of this boiler house using powdered coal, is from *Metallurgical and Chemical Engineering*, which journal also published the diagrammatic scheme of a powdered-fuel plant shown in fig. 5. This is the Holbeck system, made by the Bonnot Co., of Canton, Ohio.

Bituminous crushed, nut or slack coal is stored in a bin, preferably made of steel or concrete. The coal passes from the bin and an automatic feeder regulates the amount of coal fed to the pulveriser, shown at the extreme left. As the coal becomes pulverised it is thrown up into the vacuum separator 1 by the action of the pulveriser. This separator separates the fine particles of coal dust from the coarse, the finest being drawn into the exhauster 2, and the coarse falling down into the pulveriser.

From the exhauster 2 the powdered coal is blown into the collector 3. The expansion of the air as it enters the collector permits the coal dust that is carried in suspension to fall to the bottom of the collector and into the coal storage tank 4. The air that enters the collector returns through pipe 5 to the pulveriser to be used over again.

The coal dust is taken from the storage tank 4 by the feed screw 6, and delivered into the suction side of a high-pressure blower 7. It is then blown into the distributing main 8, and carried to the furnace through the distributing pipes 9.

The coal which is not used is returned through the return line 10 to the collector 3, where it is extracted from the air and falls into the coal storage tank 4 to be used over again.

The air after the coal is extracted is returned to the suction side of the blower through pipe 11.

BURNING COKE BREEZE.

At the present time considerable attention is being given to the utilisation of coke for steam raising, and in one or two cases encouraging results have been obtained in connection with central-station boiler plants.

The subject is allied to that of gas firing, as the coke or semi-coke resulting from the gasification process will have to be disposed of in some way.

Similar efforts have been made in the States to utilise coke breeze, and the following description of a system of coke firing for boilers, with coke breeze obtained from coke ovens, recently appeared in our contemporary *Power*:

The average coke breeze produced contains from 25 to 35 per cent. of sand, sulphur, and fire-clay, leading to considerable clinker formation, and to handle this material an over-fed stoking system was developed.

The principle of the stoker system is that the fuel flows through the hopper (fig. 1) by gravity on to a pusher plate,

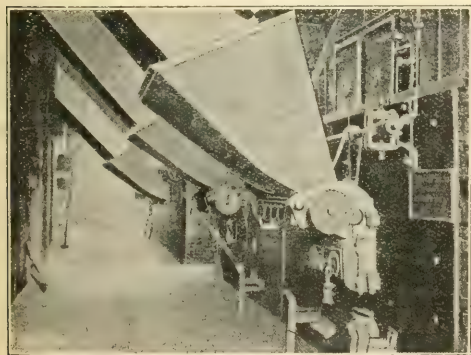


FIG. 1.

whence it is precipitated into an impelling chamber by the pusher, which is operated by a rocking arm in contact with a cam, or from an eccentric attached to the rocking arm. The impellers distribute the fuel over the fuel bed at any required amount up to that necessary to operate the boiler greatly in excess of its normal rating. Fig. 2 shows a front view of the stoker.

To handle the clinkers produced in burning coke-breeze fuel, a specially designed rocking, cutting, and dumping grate is used (fig. 3). The fuel bed is carried about 8 in. thick at the front of the furnace, and as the grates are pitched, a

depth of 18 in. is carried at the bridge wall. At intervals the grates are operated for shaking; that is, the points of the grates are dropped about 3 in., and as the clearing space between the bars remains the same, nothing but fine ashes is sifted to the ashpit. The shaking movement is so slight that

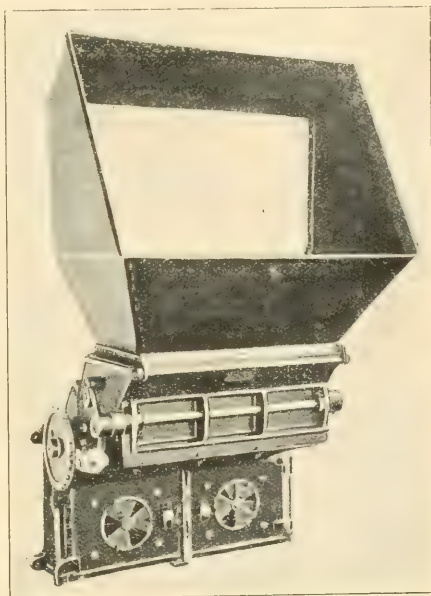


FIG. 2.

the fire bed is not disturbed to any great extent. This movement also prevents the amalgamation of clinker-forming impurities.

The fuel bed as carried by this system is divided into three zones (fig. 4). The first is about 5 in. thick at the front to 15 in. at the back. This residue formation diffuses the air over the grate area and prevents blow-holes in the fire that would be caused by an unequal air pressure. The second fuel zone is carried about 3 in. thick all over the grate surface,



FIG. 3.

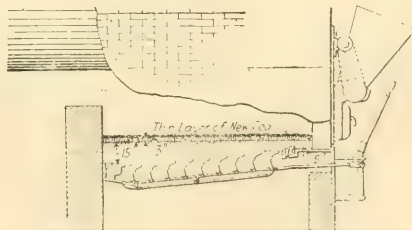


FIG. 4.

and is composed of the incandescent particles of carbon in the fuel. The third zone is the green fuel that is continually sprinkled over the second zone. The moisture in the fuel is evaporated by the heat from below and by reflected heat from the arch above. During the process of combustion the impurities are separated from the combustible and work their way through the layer of residue forming the first zone, where they come in contact with the cold air and are chilled

other, the former mixed in large quantities with one another.

If it is necessary to operate the cut off movement of the grates about every two hours, which rests on the bottom of the residue at each stroke. In this way the fires are cleaned without disturbing the fuel bed and without the use of fire tools. The grates are 10 per cent. an space, and sufficient steam is obtained to ensure the chemical decomposition of the clinker-forming properties.

With by-product oven breeze a turbo-blower is used, because it is not necessary to saturate the air with steam to the same extent as with beehive breeze. Tests showed that 5.96 lb. of water were evaporated per lb. of fuel, from and at 212 deg. F.; the efficiency of the boiler and furnace averaged 53.48 per cent. The intensity of the fire is governed by the stoker speed and steam jet, and an intense heat is obtained.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Woodhouse Patent Automatic Clutch.

Where the squirrel-cage motor possesses many advantages over the wound motor, and over the V.C. motor with a wound rotor, it has a disadvantage under one great handicap, the difficulty of starting with a load, and the very heavy starting current taken. However, if the motor can be run up to full speed before the load is thrown on, this difficulty disappears, the motor is then running under normal conditions, and can exert a large torque without taking an excessive current. To carry out this plan a new type of automatic clutch has been devised by Mr. A. E. Woodhouse, and is supplied by the VICTORIA DYNAMO & MOTOR CO., of Green House, Kingsway, W.C. This clutch, which is illustrated herewith, is characterised



FIG. 1. WOODHOUSE CLUTCH APPLIED TO MOTOR PULLEY.

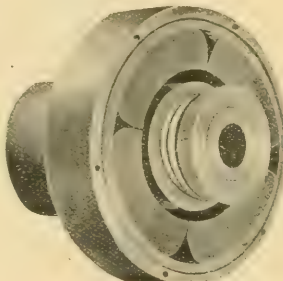


FIG. 2. CLUTCH WITH COVER REMOVED.

by extreme simplicity and reliability, small number of parts and smoothness of operation.

Fig. 1 shows the clutch combined with a pulley, fig. 2 shows the parts in position, with the cover removed, and fig. 3 is a part section through the clutch, in the position assumed when running at full speed.

The essential features of the device are four cast-iron blocks A turned on the exterior to a cylindrical surface, and on the interior

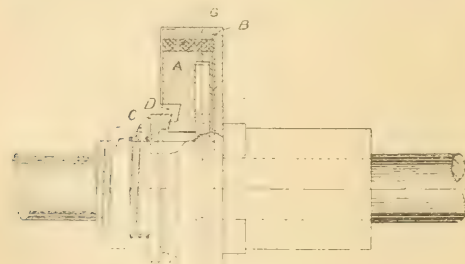


FIG. 3. SECTION THROUGH WOODHOUSE CLUTCH USED AS A COUPLING.

to the shape shown at B in fig. 2. Segment F is pressed against the blocks by a spring E, controlled by an adjusting nut C on a screwed sleeve which is secured to the shaft, the pulley, of course, running loose on the sleeve. The pulley carries an overhung cylindrical casing B lined with felt, the segments being at G.

When the motor is at rest, the four blocks are drawn radially inwards by the pressure of the collar on their coned surfaces, and the rotor is free to run up to speed without load. When a predetermined speed is attained the centrifugal force of the blocks overcomes the action of the spring and the collar slips off the cone allowing the blocks, which slide on radial studs, to fly out and apply themselves to the casing, with sufficient friction to bring the rotor and the driven load up to speed in a few revolutions, yet without any shock. The frictional grip of the clutch enables it to carry a load 50 per cent. in excess of full load, and there is no perceptible slip between the parts, hence no heating and very little wear, except when taking up the load. The accuracy of adjustment is such that the clutch can be regulated to operate at a few revolutions below full speed, and, once set, the nut can be fixed in position with a grub screw. When the current is shut off the motor, the clutch does not release until the motor is on the point of stopping; the steeper cone, shown on the blocks in fig. 3, then comes into play, the collar draws the blocks inwards and slips on to the inner cone, restoring the clutch to its normal position before the rotor comes to rest. All parts of the clutch are perfectly balanced, so that no vibration is set up. It can be used either as a pulley or coupling, or both; as a slip-ring, commutator, and an expensive starting switch are dispensed with, the cost of the motor with this clutch is less than that of the apparatus otherwise required; moreover a heavy load can be started up with a smaller motor. We understand that some of these clutches have been running for three years with satisfactory results.

Looping-in Distributing Mains.

The localisation of faults in distributing cables is a troublesome matter, even when disconnecting boxes are provided in the network, and usually involves a good deal of inconvenience to consumers whose supply has to be cut off while the fault is found and repaired. To obviate this trouble and to provide a ready means of running a fault "to earth" quickly and with the minimum of annoyance to consumers, Mr. F. E. FRAMPTON, engineer to the

Paignton Electric Light & Power Co., in conjunction with MESSRS. CALLENDER'S CABLE AND CONSTRUCTION CO., LTD., of Hamilton House, Victoria Embankment, W.C., has patented an ingenious method of looping the mains into consumers' premises, where they can be disconnected and tested with ease, and with little interference with the supply. As shown in the accompanying figure, which applies to a three-wire system, one of the conductors is cut at each distributing point or service box and the ends are connected to a pair of terminals in any suitable house, lamp pillar or similar fuse box; these terminals are connected together by a removable link which forms one terminal of the circuit supplied, the other terminal being connected to a service lead in the ordinary way. By disconnecting the link from one of the loop terminals, the distributing cable can be cut, whilst the supply—if connected to the sound side of the cable—to the consuming circuit is maintained, and by repeating the process at the next service taken off the same cable, the intervening portion of cable can be isolated and repaired at leisure, whilst the supply is maintained to all the consumers (if the cable is fed from both ends). If desired, the links can be constructed to act as fuses, so that a fault on the distributing cable will be automatically isolated. By graduating the section of the fuses the length of cable thus isolated can be restricted to the minimum. Obviously, with the

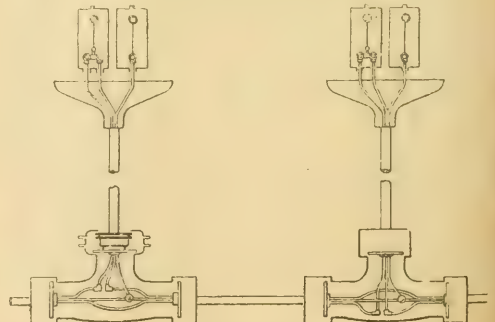


FIG. 1. FRAMPTON-CALLENDER SYSTEM OF LOOPING-IN SERVICES.

aid of the links, any part of a distributing system can be isolated and tested at any time. The invention is applicable to systems other than the three-wire system, and should prove useful to supply station engineers.

Catalogues Wanted in Italy.—MESSRS. ALEXANDER HAMILTON & SONS, of Messina, who have been established in Italy since 1880 are asking for catalogues and price lists of British engineering and electrical manufactures.

WILLANS SURFACE-CONDENSER TESTS.

The following test results were obtained on one of five surface-condensing plants, embodying the Willans & Robinson rotary air-pump system, and recently installed at the London and South-Western Railway Co.'s Durnsford Road power station.

The station contains five identical plants, each of the same capacity, in addition to two similar plants of smaller size.

The main feature of this system is that the circulating water is passed through an ejector, which is shown on the accompanying drawing at A, and takes the place of the ordinary air pump. A separate pump C is provided to withdraw the condensed steam from the surface-condenser, and to return this to the hot well. An automatic non-return valve A is placed between the air ejector and the main condenser body, so as to prevent water being drawn into the condenser in case of failure of the ejector.

There are three common forms of application of the system known as the "series," the "shunt," and the "separate pump" types respectively.

In the case of the "series" type of plant, the whole body of the circulating water is passed through the air ejector before entering the condenser; that is to say, the circulating pump is designed for the normal quantity of water required by the condenser, but allowance is made in calculating the head for the necessary drop across the air ejector.

In the case of the second, or "shunt" system, the cooling water for the condenser and the ejector water are delivered in parallel, and the ejector water is returned to the source of supply or to the circulating water suction. In other words, the circulating pump is designed for the normal head required by the lay-out of the plant, with allowance for condenser friction, and the quantity delivered is that needed for the condenser itself, plus the necessary water for the air ejector.

The third, or "separate pump" type, of which the L. & S.W. installation is an example, differs from the "shunt" system only in that a separate pump is provided for delivering the air-ejector water, apart from the main circulating-water pump which supplies the condenser in the ordinary way.

In the present installation, both the main circulating pump and the ejector pump draw their water by means of a common suction pipe from the main suction culvert, which runs the full length of the engine room. The water coming from the condenser itself is, of course, heated and passed to the delivery culvert, but the air-ejector water is returned to the suction or inlet culvert.

It will be noted that in this instance the circulating pump is driven by means of a continuous-current motor, whereas the ejector pump D and condensate extraction pump C are driven by a small steam turbine.

The tests show that the vacuum attained is substantially above that guaranteed, and particular attention may be drawn to the very low difference between the circulation-water outlet and vacuum temperatures.

Trial number.	1.	2.	Guaranteed.
Duration of test	60 minutes	60 minutes	
Load, lb. of steam per hour	68,176	68,389	68,000
Vacuum at steam inlet to condenser, corrected to 30 barometer	28.73	28.76	28.5
Corresponding steam temperature	86° F.	86° F.	92° F.
Condensate temperature	82° F.	82.5° F.	87° F.
Difference between condensate and vacuum temperatures	4.6° F.	3.5° F.	5° F.
Circulating water inlet temperature	58.5° F.	58.5° F.	65° F.
Circulating water outlet temperature	80.8° F.	81.1° F.	83° F.
Difference between circulating water outlet and vacuum temperature	5.8° F.	4.9° F.	9° F.
Cooling water, gallons per hour	318,000	317,600	396,600

The test was carried out after the plant had been in service for a considerable period, in the presence of the representatives of the consulting engineers, Messrs. Kennedy & Donkin, and of Mr. Herbert Jones, chief electrical engineer to the London and South-Western Railway Co.

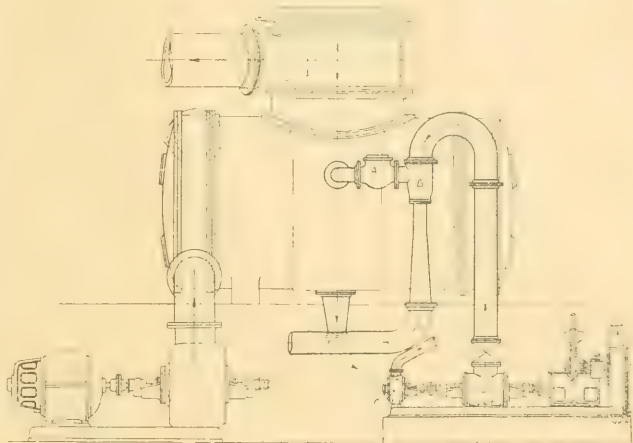
LEGAL.

ASSESSMENT APPEAL BY THE METROPOLITAN RAILWAY CO.

At the County of London Quarter Sessions, at Clerkenwell, Sir Robert Wallace (the Chairman), began the hearing of an appeal by the above company against certain quinquennial assessments of their properties in Kensington, Paddington, and the Holborn Union.

Mr. Walter Ryde, K.C., and Mr. E. M. Konstam represented the appellants, Mr. Page, K.C., and Mr. Cecil Whiteley were counsel for the Royal Borough of Kensington, while Mr. Clavell Salter, K.C., M.P., with Mr. Bethune and Mr. W. J. Jeeves, represented the Borough of Paddington and the Holborn Union.

In opening, MR. WALTER RYDE said that in Kensington a rateable value of £9,000 was appealed against, and the Railway Co. claimed that the amount should be £3,750. In Paddington it was contended that the figures, instead of being £7,314, should be £3,732 and in the Holborn Union £16,000, instead of £21,800. Dealing first with the Kensington case, counsel said the railway was worked generally by means of electric traction, and for the purpose of supplying electricity the company had erected from time to time, and now used, a generating station at Neasden, 10 electrical sub-stations, and other large and extensive works. All these works were not directly productive of profit, and all of them, with the exception of a sub-station at Gloucester Road, were out-



ARRANGEMENT OF WILLANS CONDENSING PLANT, L. & S.W.R. POWER STATION.

side the borough. Appellants contended that the assessment, so far as it consisted of directly-productive portions of the undertaking, was excessive in proportion to the value of the whole undertaking. It was submitted, further, that the value of the property had diminished, and was diminishing, owing to the increasingly severe competition of other railway companies, tramway and motor-omnibus undertakings, and other methods of transit. Moreover, working expenses had largely increased during recent years, and that increase was likely to continue. They submitted that the rateable value of running line in Kensington—of a total length of 1 mile 75 chains—should not be more than £594, and that the rateable value of other hereditaments, consisting of station, booking offices, and refreshment rooms at Notting Hill Gate, and portions of the Stations at Kensington High Street, Gloucester Road, and South Kensington, should not be more than £3,156. That would make a total assessment of £3,750, against the £9,000 at which it had been assessed. As to the property in Paddington, where the appellants submitted that the rateable value should be £3,732 instead of £7,314, much the same arguments applied as in the Kensington case.

THE CHAIRMAN: There is no question of stations in Paddington. MR. RYDE: No; but I observe, on glancing at the respondents' case, that they say the assessment in force in 1915 was £4,440 for lines, and £3,700 for stations and sub-stations. Counsel went on to say that the case in the Holborn Union concerned an area in Clerkenwell, and included part of Farringdon Road Station. Appellants contended that an assessment of £21,800 should be reduced by £5,800. He believed the Metropolitan Railway Co. had the unfortunate distinction of having the smallest receipts per train-mile of any considerable line in the country, and that, of course, was brought about by two important causes. In the first place, there was the enormous percentage of third-class traffic; and, secondly, the enormously high percentage of workmen's tickets. The year 1913 was the last complete year for which gross receipts earned and train-miles run could be ascertained by actual calculation, owing to the Government having assumed control of the railways, but counsel submitted that on evidence he should call, it would be seen that in 1915 there had been a drop of 9.76 per cent. in the traffic over the three districts in question. It was said on the other side that they must adhere blindly to the accounts

Germany's Iron and Steel Production.—The Amsterdam correspondent of the *Morning Post* says that at a meeting of the German Stahlwerksverband, held recently at Düsseldorf, it was stated definitely that the export of iron and steel to neutral countries had been stopped until further notice, home requirements and the demands of the German army and the Prussian railways being so great that only very small quantities were available for external trade.

for 1913, the appellants contended that they must look to what had happened since.

The first witness was Mr. R. H. SELBIL, the general manager of the Metropolitan Railway.

On behalf of the appellants it was contended that the railway lines which were used wholly for electric traction should be treated as a minus quantity, or capable of only nominal assessment. Surveys who gave evidence on appellants' behalf stated that they had made their calculations on the basis of the published accounts for the year 1913, but amended to include the extra cost of wages and materials as between the years 1913 and 1915. In Kensington, it was submitted, the net rateable value should be £3,750 instead of £9,000 fixed by the Assessment Committee; in Paddington, £3,732 instead of £7,314; and in the Holborn Union a reduction of over £8,000 was suggested in an assessment of £21,800.

Among the witnesses for the appellants were Mr. W. A. Agnew, chief mechanical engineer of the District Railway; Mr. Theodore Stevens, consulting engineer, of London House, E.C.; Mr. G. W. Partridge, chief engineer of the London Electric Supply Corporation; Mr. William Willox, permanent way engineer of the Metropolitan Railway; Mr. C. L. Morgan, chief engineer of the London, Brighton and South Coast Railway; and Mr. Crister Peter Sandberg, consulting and inspecting engineer, of Westminster.

Mr. G. W. PARTRIDGE said he had examined the motors of the Metropolitan Railway at their works, in conjunction with Mr. Theodore Stevens. The stock was worth 85 per cent. of the total replacement cost, or more than that. He agreed with Mr. Stevens that if they spent 15 per cent. on it they would have a stock up to the 100 per cent. standard.

The case on behalf of the Kensington Assessment Committee was opened first, and MR. PAGE, K.C., submitted that it was ridiculous for the other side to suggest that the running lines should bear no part of the local burdens.

SIR ROBERT WALLACE: I observe it said that the rateable value of line in Kensington is a minus quantity of about £3,000.

Witnesses called in support of the Kensington assessment based their calculations on the local receipts of £52,506 for 1913, and arrived at a margin of rateable value of £5,000 and £6,000.

SIR JOHN SNELL, who had been retained by the various Assessment Committees concerned, next gave evidence. Examined by Mr. CLAVELL SALTER, K.C., M.P., Sir John said he had made a careful examination and inspection of the generating and sub-stations and rolling stock of the Metropolitan Railway, excluding the Great Northern and City, and submitted a mass of figures dealing with estimated cost of repairs, maintenance, renewals, and various other matters. He estimated the total renewals and maintenance of rolling stock at £63,511; the annual repairs and maintenance at £23,513, and the average life at 16½ years. The result of his calculations was to allow the railway £86,000 a year in respect of electric current, instead of the £64,000 which the company actually spent in 1913. The electric installation generally was comparatively new, and on that ground he had allowed for repair and renewal a much larger sum than was actually expended in 1913. The company were entitled to claim what would prove to be the average on the year. The working expenses he had increased from £73,000 to £95,000. The company's abstract gave locomotive running expenses as 16½ per cent. of the traffic receipts; he had changed that to nearly 19½ per cent. The agreed replacement-cost of electric rolling stock was £875,842. He put the annual depreciation at £39,998; the average age, 7.47; amount of depreciation, £300,773; value at December 31st, 1913, £575,076.

In cross-examination by MR. RYDE, K.C., SIR JOHN SNELL said he believed £80,000 worth of stock was added in 1914.

MR. RYDE: If I give you the life of a machine you have never seen, you could ascertain, as you have done here, the depreciation per annum?

SIR JOHN SNELL: Certainly.

MR. RYDE: Although you had never seen it? I could not.

SIR JOHN SNELL: Why not? Because you are not an engineer.

In further cross-examination, SIR JOHN said they could not take the renewals of rolling stock by themselves or maintenance by itself, and if he could prove the amount he had allowed to cover both those items, then he met all the points upon which counsel was trying to cross-examine him. He, personally, made a valuation of Neasden power house, and was actually in the power house for an hour. He made an inventory some years ago, and only had to see the additions. In his calculations he had taken steel rods at £7 a ton, which was the 1913 rate.

MR. RYDE: Is that likely to be the ruling rate after the war is over?

SIR JOHN: That is an awkward question. I cannot say.

At the conclusion of, Sir John's cross-examination, SIR ROBERT WALLACE said he did not want to hear any further evidence. He was perfectly satisfied that the rateable value appealed against was lower than its true value. His Lordship added that in all the years he had sat in the Court he had never heard an appeal which was more unjustifiable than this one. The appeal would be dismissed, with costs.

The hour for the rising of the Court had been reached, and MR. CLAVELL SALTER inquired if Mr. Ryde proposed to go on with the appeals in respect of the property in Paddington and the Holborn Union.

SIR ROBERT WALLACE said he did not think Mr. Ryde ought to be asked that question. He thought the better way would be to give counsel an opportunity to confer together in regard to the remaining cases.

His LORDSHIP subsequently fixed the next Court for November 14th.

TORONTO ELECTRIC LIGHT CO., LTD., a CORPORATION OF THE CITY OF TORONTO.

IN the Privy Council, on October 23rd, judgment was given in this case, which was argued just before the Long Vacation.

The Board consisted of Viscount Haldane and Lords Atkinson, Shaw and Parmoor.

The action was brought by the appellant company for an injunction to restrain the Corporation from interfering with the appellants' plant by cutting down, removing, or otherwise interfering with their poles and wires upon the streets and other public places in the city.

Sir John Simon, K.C., Mr. Hellmuth, K.C., and Mr. Auglin, instructed by Messrs. Blake and Redden, appeared in support of the appeal; Sir Robert Finlay, K.C., and Mr. G. R. Geary, K.C., instructed by Freshfields, for the respondent Corporation.

LORD ATKINSON, in delivering the considered opinion of the Board, said that the appeal was from a judgment of the First Appellate Division of the Supreme Court of Ontario, whereby a judgment of the trial judge in favour of the plaintiff company was set aside, and it was ordered that, subject to certain declarations, the action should be dismissed with costs. The case was not free from difficulty, for some important transactions which took place between the parties were not in writing. The company was incorporated by Letters Patent in 1883, by an Act which purported to confer the power, *inter alia*, of manufacturing electric light and power, and the erection of plant and all machinery necessary for lighting the streets and houses of the city. In exercise of this power the company established an extensive system for the distribution of electricity over almost the entire City of Toronto. It supplied current to private customers and to the respondent Corporation for the lighting of the street lamps. The system in 1912 was a composite one—partly overhead, partly underground—but intercommunicating. Much the larger part was overhead. It then covered 370 street-miles, the wires being carried on 15,705 poles erected on the streets and public places of the city. These poles carried 1,450 miles of wire. The underground system then consisted of about 350 miles of single conduit laid in 28 to 30 street-miles. The two systems were so "interlaced" that if the overhead construction were removed, the underground in some instances would have no connection with the terminal stations or sub-stations of the company, or with any source of power. It was not disputed that the cost of constructing underground conduits so far exceeded that of carrying wires overhead on poles that, having regard for the prices obtained for the current, the former system was only commercially possible of adoption in a limited and favoured area in the city where customers were both large and numerous.

In this state of things the Corporation on February 6th, 1912, passed a resolution denying, among other things, (1) the right of the company to lay any underground conduits outside the limits of the city as they existed in November, 1889, when an agreement was entered into between the company and the Corporation; and (2) its right to construct pole lines within the city, save for the purpose of implementing its contract with the Corporation for street lighting. They followed this up about the middle of October, 1912, by preventing by force the company from erecting additional poles and wires, and also removed certain poles, part of the company's overhead system which had been in actual use some three years.

The action was then instituted by the company, claiming an injunction, damages, and further relief.

As stated above, the injunction granted at the trial was set aside on appeal.

HIS LORDSHIP then referred to the various agreements which had been entered into between the parties. In reviewing these, their Lordships thought that the provision touching the purchase of overhead plant contained in the agreement of November, 1889, meant no more than this: that the Corporation should be entitled to purchase, when they purchased the underground systems, such poles and plant of the overhead system as might be then found lawfully erected on the streets and public places of the city. No estoppel arose in this case, as there was no evidence whatever that both the contracting parties were not fully aware of their respective legal rights. It might well be that the company never anticipated that the respondents would insist upon the removal of the poles carrying wires erected with their implied consent, but not in pursuance of any formal agreement. With the hardships (if any) or the moralities of the case, the Board had no concern. It dealt alone with the legal rights of the parties, and having regard solely to them, their Lordships were, on the whole case, of opinion that the judgment appealed from was right, and should be affirmed, and this appeal of the company dismissed with costs.

BRITISH THOMSON-HOUSTON CO., LTD., v. DURAM, LTD.

MR. JUSTICE ASTBURY in the Chancery Division, on the application of counsel, fixed December 4th next for the hearing of this action.

COUNSEL said the case was a heavy one, and the defendants as much as the plaintiffs wanted time to get it ready.

Bayonet Key Switch Holders.—THE ELECTRICAL SUPPLIES CO., of Tottenham Court Road, inform us that they have brought out a patent key switch holder, with shade carrier and cord grip, and are carrying extensive stocks at their London stores.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Electrical Market in India.

At present there are several big cities in India being electrified and this has created a very big demand for electrical goods in that country. I believe that if the British manufacturers let this opportunity slip, the whole Indian market will go to the Americans for ever.

After a long stay in America and in this country, I am going back to my country, India, where I am intending to take up electrical business. I shall be pleased to be brought into touch with British manufacturers of small ice-making machines, small wheat-mill grinding machines, small printing machines and pumps, to be driven by continuous current, and other electrical specialities.

J. Khanna, B.Sc., E.E.

12, Highbury Hill, London, N.
October 25th, 1916.

The Cost of Daylight v. Electric Light.

There is so much misapprehension about daylight costing nothing, that I wish you would give me sufficient space in your columns to publish the following letter by Mr. M. Luckiesh, of the National Electric Lamp Association Laboratories, Cleveland, in a recent number of the *Lighting Journal*:

"In lighting discussions, it is not uncommon to hear such statements as this: 'A great virtue of daylight is that it costs nothing.' Outdoors this is usually true, but in the vast field of human activities, where artificial light aids and competes with natural light, such a statement is absurd. From the standpoint of construction, openings such as windows and skylights are not costless. In other words, interest upon a permanent investment as well as a maintenance cost must be charged to the day lighting, and therefore at once it ceases to be free from cost. Furthermore, when the value of land, especially in large cities, is considered, a light court in the middle of a multi-storied building adds to the cost of daylight. In such a case a large area of rental space is sacrificed for the purpose of admitting daylight, and it appears that the cost of daylight would not be inconsiderable. Of course, light courts provide ventilation, but it seems possible that ventilation could be provided without such a great sacrifice of space."

F. Willcox.

London, E.C., October 26th, 1916.

WAR ITEMS.

Exports to China.—The "London Gazette" for October 27th contains a further list of persons and bodies to whom exports to China and Siam may be consigned.

Lord Balfour's Committee.—The Prime Minister has appointed Mr. Richard Hazleton, M.P., Sir William McCormick, Mr. A. McDowell, and John O'Neill to be members of Lord Balfour of Burleigh's Committee on Commercial and Industrial Policy.

Air-raid Warnings.—The Highways Committee of the L.C.C. reports that, at the request of the Commissioner of Police of the Metropolis, it has arranged a scheme for warning drivers and conductors of trams of possible hostile air raids. The expenditure involved is estimated at £624.

The *Times* says that tramcar drivers will receive a signal from the power stations, when they will at once slow down and shut off on approaching certain points where flashing would ordinarily be produced by crossing.

Enemy Interests in British Companies.—In reply to a question asked in the House of Commons by Sir John Lonsdale, Mr. Pretyman said that the returns made by British companies to the Public Trustee showed a total nominal amount of £31,691,724 of ordinary, preference, and debenture capital held by enemies. This total, which included a considerable amount of capital in companies registered in the Dominions, was estimated to represent not more than $\frac{1}{4}$ per cent. of the capital of British companies as a whole. These enemy securities were not as a general rule being sold, except where the particular company was within the provisions of Section 1 of the Trading with the Enemy Amendment Act, 1916, when the company was dealt with either by winding up or by the alternative method of vesting the shares in the custodian for the purpose of sale.

Dilution and Man Power.—The "Times" publishes the following statement issued from the office of the Labour Adviser to His Majesty's Government after the conference held on October 27th:—

"A conference of representatives of skilled trades connected with the engineering and shipbuilding industries was held. The Right Hon. Arthur Henderson, M.P., who presided, said the conference was one of several to be held in connection with the office of the Labour Adviser, at the request of the Man-Power Distribution Board, to consider their proposal that dilution should be extended to private and commercial work in controlled and non-controlled establishments. Hitherto such dilution as had been secured had been limited, speak-

ing generally, to war work. It was now essential that substitution and dilution should become much more general. This was called for by the urgent need of securing for general military service all the men available and eligible up to the limits of the Military Service Acts, by the great demands for skilled workmen for the technical units of the Army, and for the production of munitions and ships, and by the vital importance of continuing our export trade in order to maintain the financial strength of the British Empire and our Allies."

"The present unsatisfied demands of the technical units of the Army and of munitions, skilled and unskilled, are 160,000, and the skilled requirements alone were 32,000. It was the desire of the Government, as recently stated by the Prime Minister to the engineering trades deputation, that the skill of the workmen should be utilised to the best interests of the nation. This could not be secured without further dilution, and this conference had been called to consider the best means of securing this."

"After a full discussion the conference decided to adjourn in order to obtain from the Man-Power Distribution Board information as to the best means of preventing the enlistment of skilled men, which still continues, and of securing better methods of debadging, and to await a report as to the local machinery contemplated by the Man-Power Board for giving effect to dilution on private and commercial work."

Exemption Applications.—At Bermondsey, Mr. W. E. J. Heenan, engineer-in-charge of the Bermondsey Borough Council electrical works, applied for the exemption of a boiler cleaner and repairer. He stated that the man was in the employment of the Council before the outbreak of war, and joined the Expeditionary Forces at the commencement of the war, serving about 14 months in France, and was discharged as a time-expired man in February. They could not get men to do this kind of work. They had 11 boilers, and 700 joints had to be made on each boiler. He had applied for a badge for the man, but it had been refused. This was the only man he had appealed for. Ald. Wills: You had a complaint from consumers that the voltage was low, and that was due to boiler difficulties? Mr. Heenan: It was due to boiler difficulties. At present we have two boilers down. Coun. Shearing said that the man was doing work of national importance. Six months' temporary exemption was granted.

At the Aberdeen Military Tribunal, Messrs. Bell & Lyon asked to retain the services of David L. Mitchell, electrical engineer. Conditional exemption was given while badged.

At the Rhyl Tribunal, Mr. E. H. Wright, the electrical engineer, secured three months' exemption for D. Kingston, 39, married, engine-driver and switchboard attendant at the electricity works, and T. J. Parry, 41, married, cable joiner. Both were considered absolutely indispensable to the electricity department, and Mr. Wright added that in other districts there was no difficulty in retaining such men altogether.

At the Brighton Tribunal, the West Pier Co. applied for their electrician and their blacksmith, who had been given time previously. It was explained that a man engaged in pier repair work has to be somewhat of a sailor as well as an electrician, because the action of the water was apt to make him dizzy. Repairs had to be done to the pier, amounting roughly to a large sum of money, before the spring, and these men could not be replaced. They could not get men to work under the pier. The electrician was given two months, final, and the blacksmith three months.

At the Dundee Tribunal, Prof. Peddie, of the Chair of Physics, University College, made a statement with regard to J. Robinson (22), instrument maker. He said that Robinson's work was fundamentally necessary in the work of the college. He was engaged in the making of optical, electrical, mechanical, and other scientific instruments, to which he had served seven years apprenticeship before he came to the college, and since then he had had three years' experience of construction work, and had acquired special scientific training. All the departments would suffer if Robinson was taken away. He was the only skilled mechanic in the college. Lord Provost Don said that in view of what the Tribunal was doing with some other cases they must sustain the military appeal that Robinson should go to the Army.

The manager of the Darlington tramways, when appealing for the exemption of a mechanic, single, aged 33, who had been passed for general service, said the man was the only skilled person on the system. If he had to go into the Army it would mean that gradually the trams would come off, and there would be no service. Exemption to the end of the year on the ground of public utility.

At Maidenhead, the electrical engineer (Mr. Milton) appealed for E. G. Pink (35), shift engineer; G. A. Cox (32), shift engineer; W. T. Shervell (25), engine-driver and fitter; A. R. Mills (20), driver and stoker; W. J. Mundy (23), cable fitter; and W. L. Chubb (32), foreman. The Tribunal's investigator reported that there were only 14 skilled men engaged at the works, which revealed the fact that the works were much understaffed. He deprecated young men being employed in highly technical work, and he hoped that those who had been passed for general service would be released as soon as possible. He recommended conditional exemption until February 1st, the manager to do his best to release those classified "A" from time to time as he was able. Mr. Milton said it was possible they might be able to carry on with less men after Christmas. The recommendation of the investigator was agreed to.

Book Notices.—"British Opportunities in Russia." By L. A. Rojansky. London: Anglo-Russian Translations Bureau, 2d. In this pamphlet the author refers generally to the large extent of the Russian market and the possibilities of trade. A table is given of imports to Russia from Germany, Austria-Hungary and the United Kingdom.

"Principles of Alternating-Current Machinery." By R. R. Lawrence. London: Hill Publishing Co. Price 18s. 9d. net.

"Principles of the Telephone." Part I, Subscribers' Apparatus. By C. M. Jansky and D. C. Faber. London: Hill Publishing Co. Price 6s. 3d. net.

"Post Office Electrical Engineers' Journal." Vol. IX, Part 3, October, 1916. London: H. Alabaster. Gatchhouses Co. Price 1s. net.

The Institution of Electrical Engineers has issued a "Supplement" to the List of Members. It gives the names of the Council and officers for the session, the Committees of Local Sections and Centres, the local honorary secretaries abroad, names of new members, and a list of former members who have ceased their membership under Article 41.

"The Journal of the Tramways and Light Railways Association" for October contains a notice respecting the obtaining of certificates from the Ministry of Munitions before purchasing steel, the conclusions (and map) of the National Electric Power Supply Joint Committee, and other matters.

"Scientific Papers of the Bureau of Standards." No. 285. "Summary of Experiments on the Silver Voltmeter at the Bureau of Standards, and Proposed Specifications." Washington: Department of Commerce.

"Circular of the Bureau of Standards." No. 60. "Electric Units and Standards." Washington: Department of Commerce.

For Sale. The Manchester Corporation Electricity Committee has for disposal one 1,800-KW. D.C. generator, direct-coupled to a vertical cross-compound steam engine, and one 3,750-KW. three-phase A.C. alternator, direct-coupled to a vertical triple-expansion steam engine.

The Borough of Salford Electricity Committee has for disposal a quantity of low-pressure cast-iron piping.

Messrs. Shirlaw, Allan & Co., Keith Street, Hamilton, the agents for the Controllers appointed by the B. of T., will sell by auction on Friday, November 10th, at Glasgow, the stock of electrical machinery, office fittings, &c., of the Phoenix Electrical Co., and the Caledon Electrical Co. Particulars appear in our advertisement pages to-day.

Dissolutions and Liquidations.—UNITED CARBORUNDUM AND ELECTRITE WORKS, LTD.—Creditors must send particulars of their debts, &c., to Mr. C. Eves, 62, New Broad Street, E.C., the controller, by November 27th.

ELECTRO-STEEL FOUNDRIES, LTD., Darlaston.—Liquidator (H. E. Burgess) released October 19th, 1916.

GENERAL ENGINEERING ACCESSORIES, LTD.—This company is winding up voluntarily, with Mr. H. Chapman, 2, Farley Road, Catford, S.E., as liquidator.

LIVERPOOL LIGHTING & HEATING CO., LTD.—This company is winding up voluntarily, with Mr. E. J. Butcher, 344, Gray's Inn Road, W.C., as liquidator.

WESTERN LIGHTING AND HEATING CO., LTD.—This company is winding up voluntarily, with Mr. E. J. Butcher (as above) as liquidator.

KINGSTON LIGHTING CO., LTD.—This company is winding up voluntarily, with Mr. Butcher (as above) as liquidator.

ELECTRICAL OIL REFINING CO., LTD.—A meeting is to be held on December 4th at 29, Great St. Helens, E.C., to hear an account of the winding-up from the liquidator, Mr. J. E. Frost.

Messrs. R. Stephenson, A. Drewser and C. R. Curtis, carrying on business as electrical consulting and contracting engineers at 27, Chancery Lane, London, as DREWSEY, STEPHENSON & Co. have dissolved partnership. Mr. Stephenson retires from the firm. Debts, &c., will be attended to by the remaining partners, who will continue the business under the same style.

Catalogues and Lists.—BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—New list (No. 4,591) of 16 pages, in the company's standard style and size, giving particulars, prices, shipping diagrams and dimensions, &c., of instrument transformers for circuits up to 12,000 volts.

WESTINGHOUSE COOPER HEWITT CO., LTD., 80, York Road, King's Cross, London, N.—Nos. 1 and 2 of a well-produced pamphlet, entitled "Lighting in Photography." The articles contained therein deal with "Lighting the Subject in Portraiture," "Light Source for Enlarging," "Artificial Illuminants for use in Practical Photography," "Control of Expression and Attitude," all going to show the important part played by illumination in photographic art.

GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—New Osram folder price list (No. OS 2,061) for enclosure with correspondence or for carrying in the pocket. Correspondence post-cards (in which a small-sized elephant successfully tries a balancing trick on a large-sized Osram, illustrating, of course, the latter's strength), have also been issued for use by the company's customers.

POPE'S ELECTRIC LAMP CO., LTD., Hythe Road, Willesden, N.W.—New booklet, entitled "My Life," in which their mascot, "The Elasta Man," is seen in all sorts of situations, each situation pointing a moral to the virtues of "Pope's Elasta British-made wire lamps." Contractors can be supplied with printed copies upon request.

MESSRS. BELLING & Co. have issued a handy pocket pamphlet, entitled, "Coal Economised: All Druggery Housework Saved," in which they give small illustrations and prices of a number of patterns of their electric fires, of which over 30,000 have been supplied for ordinary domestic use during the last four years.

MESSRS. CREDENDA CONDUITS, LTD., Chester Street, Aston, Birmingham.—Folder, giving illustrations and price particulars of a number of their designs of electric fires, heaters, convectors, and heating and cooking appliances.

Electrical Imports of the Argentine Republic.—The value of the electrical goods imported into the Argentine Republic during the first half of the current year is officially returned at £853,000, practically the same total as during the first six months of 1915.

Australian Inquiries.—The B. of T. Department of Commercial Intelligence (73, Basinghall Street, E.C.) has received information respecting firms in New South Wales who desire to take up agencies for British makers of porcelain insulators, insulator pins, electrical fuses, cut-outs, switches, and other accessories: also are lamps and accessories, miners' safety lamps, smokeless furnaces, air compressors, air-lift pumps, &c. The reference numbers are 370 and 376.

LIGHTING AND POWER NOTES.

Argentina.—The Municipality of Veduggia (Capital of Rio Negro Territory) has decided to install a service of public electric lighting, and has placed the order for the equipment with the Anglo-Argentine General Electric Co., Buenos Aires.

Barking.—**YEAR'S WORKING.**—For the year ended March 31st last, the revenue of the Council's electricity undertaking amounted to £12,663, the working and management expenses were £11,217, and, after meeting all financial charges, there was a deficit of £2,998 on the year. A total of 1,263,944 units were sold, being 160,390 less than in 1914-15.

Belfast.—**PROPOSED EXTENSIONS.**—The Tramways and Electricity Committee at its last meeting considered the increasing demands being made on the electricity department, and the steps to be taken to meet the same. After full consideration, the Committee recommended that the Council should authorise the Committee to take up again the matter of the extension scheme, part of which could be put in hand as soon as the necessary Treasury sanction to the expenditure can be obtained.

Bradford.—The Guardians are to extend the electric mains for the purpose of lighting the whole of the laundry and garage block.

Christchurch.—**PRICE INCREASE.**—With reference to the demand of the Bournemouth and Poole Electricity Supply Co. for an increased charge for current, the B. of G. has decided to pay in accordance with the terms of the contract only.

Continental. ITALY. VOLCANIC HEAT STATIONS.—Although, in view of the high cost of coal in Italy, there exists a great stimulation to search for other and more economical sources of energy, it is novel and interesting to learn that the internal heat of the earth in a volcanic district is now being utilised for the generation of electrical energy. From the *Rassegna Mineraria*, of Rome, we learn that a thermo-electric generating plant is already in operation at Larderello, about 12 miles from Volterra. The idea of utilising the available volcanic heat was first put into practice in 1903 by Prince Ginori Conti. At Larderello the heat issues from the earth in the form of jets of steam, which the Prince first attempted to utilise by causing the jets to impinge on bucket wheels. Later, arrangements were made to use the steam directly in a reciprocating engine coupled to a dynamo. Encouraged by the results, he made use of a small part of the steam issuing from one of the largest jets at a pressure of 75 lb. per sq. in., and by this means obtained some 40 H.P. The steam from the jet in question issues at a temperature of about 160° C., and at the rate of 11,000 lb. per hour. The general results were quite satisfactory, except that it was found the acids present in the steam had a corroding effect on the engine. In the meantime, while these experiments were in progress, prospecting operations for new sources of steam were also in progress, with the result that several giving good results were found, including one which furnished steam at a pressure of from 30 to 45 lb., and at the rate of 55,000 lb. per hour, this being utilised to operate a 300-H.P. turbine and alternator, which furnished current to light the borax works at Larderello. This was the position at the commencement of the war, which, owing to the resulting greatly increased cost of coal in Italy, gave an impetus to the further use of the volcanic steam. Indeed, so successful had the experiments been that the Prince placed an order with the well-known Italian engineering firm, Messrs. Tosi & Co., for three steam turbines, each of 5,000-H.P. capacity, coupled to 3,000-KW. alternators. Two of these sets are already installed and in operation, while the third will shortly be added. In this case, however, the steam is not utilised directly, but is used to heat multitubular boilers. The current generated is transformed up to a pressure of 36,000 volts, at which it is transmitted by five different lines to the towns in the neighbourhood.

RUSSIA.—The "Donetz Basin" Co. has commenced the erection of an electric station near the Loboff Kopy station of the Ekaterinsk Railway, to supply current to the mines, factories, towns and industrial centres of the Donetz Basin. The station will serve a radius of 100 versts, and develop 20,000 kW.

FRANCE.—The Societe Hydroelectrique Drac-Rhone is the title of a company formed at Grenoble to develop more particularly a hydro-

construction is to be erected above the watermeet of the Drie and the Rijnbeek. The capital of the company is £6,000,000.

France.—The Société Française des Forces Hydrauliques du Rhodanais has been increased from 1,000,000 to 3,000,000 fr., in consequence of certain financial arrangements with the Société Industrielle de l'Est.

Norway.—A new carbide manufacturing company, with a capital of 200,000 kr., has recently raised to 2,000,000 kr., under the style of the A/S. Kvina Carbide Smelteverk, is announced in the register of new firms. Its works are to be situated between the Fekke and Fekke fjords, but power is to be derived from the Trolands waterfall. The output is estimated at first at 6,000 tons yearly.

Dewsbury.—**PLANT EXTENSIONS.**—The Electricity and Tramways Committee has submitted to the Council an estimate of work to be carried out after the war, prepared by Mr. R. H. Campion, the electrical engineer and amounting to £35,880. The principal items are: two 2,000-kw. turbo-alternators and condensers, £11,000; two 500-kw. rotary converters, £4,000; two 250-kw. ditto, £1,250; switchboard, £1,600; cables, £8,400. Mr. Campion also states that when the load exceeds 2,000 kw. an extra boiler will be required at a cost of £3,000; an additional cooling tower, £2,000; and coal conveyors, £1,500.

East Ham.—**YEAR'S WORKING.**—Mr. W. C. Ullmann, the Corporation electrical engineer and manager, in his analysis of the electric lighting accounts for the year ended March 31st, 1916, shows a total revenue amounting to £26,709, total operating costs amounting to £20,053, and a gross profit of £6,556. After meeting interest and special charges, £1,575, and sinking fund, Acc. £5,705, there is a deficit on the year's working of £3,424, as compared with a profit of £1,130 in 1915. The total number of units sold was 4,162,750: fuel cost, 61d. per unit, as compared with 45d. per unit in the previous year. The total operating costs were 1.16d. per unit sold, as compared with 97d. in 1915. The maximum load was 1,890 kw., and the load factor 27.6 per cent.

Epsom.—The U.D.C. has authorised the electrical engineer to experiment with tar oil for the Diesel engine, owing to its becoming increasingly difficult to obtain American oil.

Glasgow.—**DALMARNOCK EXTENSIONS.**—In connection with the decision of the T.C. Committee to proceed with a portion of the new generating station at Dalmarnock, the chief engineer (Mr. W. W. Luckie) reported that in 1914-15, the maximum demand for electric power was 53,000 H.P., and in 1915-16 61,000 H.P.; that for 1916-17 he estimated the maximum demand at 67,000 H.P.; that the normal rate of increase in demand was between 7,000 and 9,000 H.P. per annum; that the limit of the capacity of the boiler and turbine rooms at the existing stations had been reached; and that it was absolutely essential to put down additional plant, which plant would take two years to construct and erect, to meet the demand for the winter of 1918-19. He further reported that the department had on its books 200 applications for supplies not yet connected, which represented an aggregate of 17,000 H.P., and that 15 of these were from very large engineering and shipbuilding works, who asked supplies representing over 8,000 H.P. He thereafter referred to the plans submitted showing the lay-out of the station, and stated that arrangements should be made forthwith for erecting and installing the following works and plant:—(1) Buildings, consisting of boiler house, part of turbine room and switch house, together with concrete work in connection with coal storage yard and coal tipping chute, the estimated total cost being £105,000. (2) Machinery for (a) generating station—the first installation of boilers and boiler room accessories, two 20,000-kw. turbo-alternators, relative switchgear, travelling crane and coal-conveying and ash-removing plant, the estimated total cost being £235,100; (b) sub-stations—transforming plant to the extent of 18,000 kw., for six sub-stations, the estimated total cost being £72,000; total, £432,100. In addition to the foregoing buildings and plant, the engineer mentioned that it would be necessary (a) to put down H.T. mains and cables between the new Dalmarnock Works and the two existing generating stations at Port Dundas and St. Andrew's Cross, at an estimated cost of £60,000; (b) to put down low-tension mains during the next three years at an estimated cost of £150,000, and branch mains during the next three years, at an estimated cost of £21,000; and (c) to purchase meters for new consumers during the next three years at an estimated cost of £13,500; total, £244,500. He further stated that the major portion of the foregoing expenditure would not be due for payment until the year 1918, and that the unexhausted borrowing powers of the department at May 31st, 1916, amounted to approximately £100,000. The Town Council was authorised to apply for the necessary authorisation for the Corporation to construct the foregoing works, and for authority to borrow £500,000, which, with the present unexhausted borrowing powers, will meet the requirements of the department for the next three years.

Heywood.—The Electricity and Tramways Committee has decided to grant an extension of the supply of energy from November 1st to February 28th to the Albert New Mill Co., Ltd., and is also in negotiation with the Roe Acre Dyeing and Felting Co. for supplying extra-high-tension energy to its premises.

Kilmarnock.—**REPORT.**—Sir A. R. W. Kennedy has reported to the T.C. on the advisability of developing the electricity undertaking to supply the area. He confirms the charges made for power, and suggests the advisability of ordering a 3,000-kw. turbine plant, in view of the delay which may occur in obtaining delivery of plant.

Kingston-on-Thames.—In connection with the failure of the compressor of one of the Diesel engines at the electricity works, the insurance company has agreed to pay £40 a week compensation, dating from seven days after the accident until the plant is in running order.

Leek.—The U.D.C. has authorised the levying of a supplementary general district rate of 6d. in the £ to defray that portion of the cost of the new plant of the electricity generating station which has to be paid during the current financial year.

Leigh.—In view of the position which it is placed in by reason of the refusal of the L.G.B. and other controlling authority to sanction a loan for the extension of the electricity works, the Corporation has decided to inform the B. of T. that it reluctantly gives its consent to the Lancs. Electric Power Co. supplying the West Leigh Collieries with electricity, subject to the order proposed to be made by the Board being in the terms set forth in the model form which has been submitted.

London.—**ISLINGTON.**—In consequence of the employees of the electricity undertaking being dissatisfied with a suggested increase in wages, the men are appealing to the Munitions Court for leaving certificates.

Hammersmith.—**BULK SUPPLY.**—The Electricity Committee reports the receipt of the B. of T.'s formal order permitting the B.C. to supply electricity in bulk to the Chiswick Electric Supply Corporation.

L.C.C.—The Finance Committee reports that it has agreed to make loans in accordance with the terms of the sanction of the Council of £3,728 to the Battersea B.C. for electricity purposes, and of £650 to the Hammersmith B.C. for the purchase of a site for electricity purposes.

Luton.—**LINKING-UP.**—The borough electrical engineer is to act as convener for the South Midlands area in regard to arrangements for interconnection of electric supply undertakings.

Richmond (Surrey).—The B. of G. has considered the proposal of the Richmond Electric Light and Power Co., Ltd., to fix 4½d. as the new standard rate for the lighting supply. It was decided to take no action in the matter.

South Africa.—The Rand Mines Power Supply Co. has made application to the Extraordinary Water Court of the Rand Water Board, to be heard at Johannesburg on Monday, December 11th, for authority to store, and/or use, up to 650 million gallons of water in the storage accommodation to be created by the barrage about to be built by the Rand Water Board.

Stockport.—**BOXES.**—The manual workers at the electricity works and in the tramway department, whose wages do not exceed 35s. per week, are to be granted a bonus of 2s. a week for the period of the war.

Todmorden.—The abstract of accounts of the Corporation's trading undertakings for the year ending March 31st—issued last week—shows that the departments have not, as a whole, experienced a particularly good year: the electrical undertaking showed a deficit of £1,580. The department which has saved the situation on the year has been that of the motor-buses, whose surplus is £1,898, and the net profit on the undertakings, as a whole, including gas, water and markets, is about £70.

West Bromwich.—**ASH PLANT.**—The Electricity Committee has had under consideration the present method of dealing with removal of ashes, and has decided in favour of a runway being erected in the boiler house, on which the body of a side-tip wagon could be carried. This would be filled with ashes in the boiler house, placed on a truck outside, and carried on a light railway to the ash mound, thus obviating any rehandling. The estimated cost of the scheme, complete with second-hand tip-wagons and light railway, is £256. The Committee has further decided, subject to the usual sanction, to purchase the materials.

Wimbledon.—The Electricity Committee has recommended that the B. of T. be asked if it considers there is a *prima facie* case for the promotion of the application for a prov. order empowering the Council to supply electricity within the parish of Cuddington.

The electrical engineer has been instructed to keep the Electricity Committee informed of any action taken in regard to the interconnection of electricity supply undertakings which might affect Wimbledon.

Workshop.—The Special Committee appointed to investigate the staffing of the electricity works, reported that the staff now engaged was the minimum number which could be employed to carry on the works efficiently.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—**ELECTRIC COAL-TIPPING WAGON.**—At a meeting of the Corporation Electricity Committee, the question of purchasing an electric coal-tipping wagon was remitted to a Sub-Committee. It was reported that during September 90,820 more units had been generated, as compared with September last year.

Blackburn.—The T.C. has invited the Accrington T.C. to discuss the rate per car-mile paid to Blackburn Corporation in respect of Blackburn cars running on the Accrington section, with

the suggestion that the present rate should be increased by a reasonable amount. The Accrington Tramways Committee has given instructions for the preparation of a report on the cost and revenue concerned.

Croydon.—As it is not possible to get new rails until some time next year, it has been resolved, having regard to the condition of the tramway track in a portion of the Selhurst Road, to take up rails from the Whitehorse Road section and utilise them in constructing a double line between Selhurst New Road and Selhurst Railway Bridge. The original cost of the work when it was believed new rails could be obtained was £2,156.

East Ham.—The tramway interrupting agreement with West Ham being about to expire, it has been arranged that, pending the execution of a new agreement, the present through-running arrangement shall be continued between the L.C.C. the West Ham Corporation, the East Ham Corporation, and the Leyton U.D.C. Women conductors are to be engaged at 30s. per week net.

YEAR'S WORKING.—The analysis of the Corporation's tramway accounts by Mr. W. C. Ullmann, the engineer and manager, for the year ended March 31st, shows a total revenue of £66,884, total operating costs amounting to £53,485, and a gross profit of £13,399. After meeting interest, £4,905, and sinking fund charges, £6,542, there was a credit balance of £1,952, as compared with a deficit of £3,524 in the previous year. The total car-miles run was 1,626,104, an increase of 39,120 miles; the passengers carried numbered 20,427,941, an increase of 1,510,970.

Glasgow.—In reply to complaints by workers as to inadequate car service, the general manager has informed the Tramways Committee that additional cars were being put into service.

Hull.—The tramway manager (Mr. McCubber) reported that the receipts from April 1st to October 21st amounted to £91,645, an increase of £1,468 over the corresponding period of last year. A motion that during the winter months the cars cease running from Vincent Square, on week-days, at 10.45 p.m., and on Sundays at 10.30 p.m., was referred to the manager for report.

Newcastle-on-Tyne.—**YEAR'S WORKING.**—The report of Mr. E. Hutton, the general manager of the Corporation Tramways for the year ended March 31st last, shows that 73,000,000 passengers were carried, being an increase of 7½ millions over 1914-15. The gross receipts were £321,498, as compared with £291,195; working costs amounted to £188,128, as compared with £155,177, and the net surplus was £23,860, which has been carried to reserve and renewals fund, which now stands at £77,464.

Since 1907 to the present year the city rates have been relieved by £74,164 directly, and £14,934 indirectly, from the tramways. The female staff in the traffic department now numbers 342. Up to the date of the issue of the report 12 employees had lost their lives in the war, and 370 had enlisted. During the year £13,144 had been provided for war allowances, an increase of £8,500 on the previous year.

South Africa.—The Pretoria (T.) Municipality ran a tramcar for coloured persons only, on all routes for two months. The results showed that the takings had not amounted to one-fifth of the operating cost or one-eighth of the total cost, and instead of increasing they were decreasing. The rate of loss was £2,000 per car per annum. Under the circumstances the service has been discontinued.

A report from the general manager of tramways dealing with the working of the new system of fares, states that the loss due to the altered fares and stages is over £7,000 per annum.

Wolverhampton.—**ELECTRIC VEHICLES.** For the purpose of providing a more efficient means of transit over the tramway system for breakdown work, repairs, testing and supervision, the manager has been authorised to purchase an electric lorry and car at an estimated cost of £370 and £217 10s. respectively.

TELEGRAPH and TELEPHONE NOTES.

Cape-to-Cairo Wire.—British East Africa is now directly connected with South Africa by wire through German East Africa, *via* General Northey's route. One link is the German line from Kilossa to Itranzi.

French Colonial Cables.—The French Government has laid before the Chamber a Bill to approve an agreement concluded with the Compagnie des Câbles Télégraphiques with the object of prolonging the convention of September 30th, 1889, in relation to the Guyane (Guiana) cable. The convention lapsed on August 3rd, 1916, but, under existing circumstances, it has been impossible to consider the establishment of a wireless combination, and the convention has consequently been extended to December 31st, 1924. This date, according to the preamble to the Bill, is also that upon which will expire the convention signed on June 7th, 1889, for the West Indies, so that the three French Colonies of Guadeloupe, Martinique and Guyane will simultaneously be released in relation to the company which provides their telegraphic communication.

Rules for Cabling.—An American Commercial Attaché has received from the Russian War Censor of Telegraphs a statement containing instructions to Americans who wish to avoid

trouble and delays in cabling to Russia. These instructions, which may be useful to others, are—

1. Make your messages absolutely clear, so that a perfect stranger can make sense of them.
2. Do not use too many figures in comparison with the amount of text. A cipher story can be told in figures.
3. Do not send anonymous telegrams. Sign your full name or the name of your firm.
4. Do not be laconic. Short messages sound very mysterious to the censor. Spend a little more money, and make the story complete.
5. Do not use highly-technical terms—*i.e.*, words not generally known or which cannot be readily found in the dictionary.

Spain.—A wireless service between Germany and Spain has been set up from the central station at Aranjuez to Koenigswusterhausen. The rate charged for messages is 0.25 peseta per word, the same as the ordinary telegraph rate. Messages will be accepted for transmission at any of the Spanish wireless and telegraph stations. Wireless communication has also been recently established between Budapest and Madrid.

Sweden.—It is reported that some of the crew of a German submarine operating in the Bothnian Gulf landed on a lighthouse, and, seizing the telephone, tried to find out the movements of several vessels from Finnish ports, but without success. The *Dagens Nyheter* complains that the Royal Decree of September last forbidding to foreign vessels the use of wireless apparatus while in Swedish territorial waters is not being strictly obeyed. German merchantmen have lately reported the movements of passing Finland traders to submarines, with the result that the ships were immediately caught and sunk.—*Morning Post*.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. SYDNEY. —January 22nd, 1917. Electrical plant (converter, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.*

January 8th. Municipal Council Electric Lighting Department, 33,000-volt switchgear. E.L. Department, Town Hall. Specification 10s. 6d.*

MELBOURNE. —December 11th. City Council. Supply and erection of coal transporter plant. See "Official Notices" September 15th.

PERTH. —November 8th. P.M.G. Accumulator parts (Schedule 527 W.A.).*

NEW SOUTH WALES. Time for sending in tenders for 50-ton electric overhead travelling crane for Yarra Street power-house, Newcastle, extended to January 3rd.*

Bradford. —November 11th. Stores for the Tramways Department. Tramway Offices, 7, Hall Ings. Deposit £1 is, (returnable).

Durban. January 3rd. Corporation. One 3,000-kw. steam turbine, alternator, and condensing plant. Specification No. 8, 238; drawing No. P. 597, both at the office of the Borough Electrical Engineer, Municipal Buildings. Deposit £2 2s.

Grenada. —Government. Time for sending in tenders for electric supply at St. George's and suburbs is extended to December 31st. Tenders to Colonial Secretary, Grenada, British West Indies.

Johannesburg. —November 13th. South African Railways Administration. 71,778 tungsten drawn-wire lamps, 19,741 solid-drawn tungsten lamps, and 2,412 carbon-filament lamps.*

November 20th. Corporation. 500 or 1,000 trolley wheels for tramcars (Contract No. 181).*

November 27th. Corporation. 1,000 sets of single-pole, ironclad house-service cut-outs (Contract No. 187).*

November 27th. Corporation. 250 field coils for tramcar motors (Contract No. 192).*

December 20th. Corporation. Automatic pressure regulators for the A.C. turbo-generators at the power station.*

January 3rd. Corporation. Iron axles and bushes.

December 9th. Corporation. A.C. and D.C. electricity meters and time-switches. Specification (21s. deposit) from Mr. E. T. Price, General Manager's Office, Electricity Supply and Tramways Department, President Street, Johannesburg, W.

Manchester. November 8th. Corporation Electricity Committee. Spec. 64: Valves, &c., for Bloom Street station. Spec. 66: One hydraulic wagon tipper at Stuart Street station. Specifications, Secretary, Electricity Committee, Town Hall.

November 14th. Corporation Tramways. A steam disinfecter. Specifications, Mr. J. M. McElroy, 55, Piccadilly, Manchester.

Newport. —November 6th. Corporation. Rotary converters and switchgear. See "Official Notices" October 27th.

New Zealand. —DUNEDIN. —January 24th, 1917. Motor-generator, accessories and spares. City Electrical Engineer, Market Street Dunedin.*

Rotherham. —November 16th. Tramways Committee. Six electric double-deck top-covered cars. See "Official Notices" to-day.

Stalybridge.—The Ways and Electricity Board, Water-works, has received orders for stokers and cooling towers. See "Official Notices."

Stretford.—N. 1001 of 21st Corporation Electricity Works. The Corporation supply of best Lancashire rough slack was accepted at a special tender of 12 millions. Tenders to Chairman of Electricity Committee, Council Offices, Old Trafford.

Walsall.—November 1th, Corporation. Stores for the Ways and Department. Particulars from the Tramway Manager.

Specifications for the items marked "a" to be sent to the Board of Trade, Commercial Intelligence Department in London.

CLOSED.

Glasgow.—The Tramways Committee has recommended acceptance of orders from the British Westinghouse Co. and the Manchester Armature Repair Co. for motor armature coils. The Thomson-Knox Co. have secured the contract for bells and telephones at ten to a hundred, baths and wash-houses.

Ilford.—U.D.C. Chapman & Co., Ltd., £267 Hrs., 1240 ft. motor and starting panel.

London.—L.C.C. During the three months ended September 30th, the Fire Brigade Committee accepted the offer of the Chloride Electrical Storage Co., Ltd., to supply a battery for use in connection with electrically-propelled fire appliances, at £222, also that of Woodmough Lang Ltd., for two motor-generators, at £18, and that of the Jackson Electric Stove Co., Ltd., for 26 radiators, at £58.

The Highways Committee purchased about 33,893 tons of coal for use at the Greenwich generating station, at a cost of £51,987, during the quarter ended September 30th.

The Committee has accepted the offer of the British Westinghouse E. & M. Co., Ltd., for the alteration of existing low-tension wiring, and the provision of a portion of the switchgear for the third additional turbo-generator at the Greenwich generating station, at £2,694; also the tender of the Morgan Crucible Co., Ltd., for the supply of carbon brushes (Class T items, Nos. 1 and 2) during 1916-17.

Hammersmith.—Electricity Committee. 25-H.P. motor; Pooley and Austin, £123.

Newcastle-on-Tyne.—City Council. Hadfield's, Ltd., Tramway junction at Northumberland Street, Blackett Street and Pilgrim Street, £2,250.

Salford.—Corporation. Electricity Department:—J. Wadstenholme & Son, Ltd., Steam exhaust and feed water pump.

Tramways Committee.—Haley's Industrial Motors, Ltd., A Hanes two-ton chassis, £55; Briggs, Jones & Gibson, Ltd., Uniform clothing for inspectors, motormen, and made conductors for 12 months, £2,101.

Shanghai.—The Municipal Council of the International Settlement has ordered Osram lamps for use for street lighting throughout that Settlement, and the agents of the General Electric Co., Ltd., have just secured this year's contract from the Municipal Council of the French Settlement also.

Walthamstow.—U.D.C. Verner Time Switches, Ltd., 72 10-amp switches at £4 each, and 80 1-amp switches at £2 4s. each.

Wolverhampton.—Electricity Committee:—Ferranti, Ltd., and Reyrolle & Co.—Extra-h.t. switchgear, £270 and £170 respectively.

Herbert Morris, Ltd.—Crane rails, sole plates, &c., £135.
Reyrolle & Co.—5,000-aw. generator switch-panel, £550.
Gibbons Bros., Ltd.—Additional steelwork for the roof of boiler house, £90.
W. Harrison, Ltd.—Coal and slack to September, 1917.

Tramways Committee:—
1. Allen & Co., Special steelwork for the track in Queen Square, £35.

FORTHCOMING EVENTS.

Royal Society of Arts.—Friday, November 10th. At 5.15 p.m. At John Street, Adelphi. Chadwick Lectures on "Fatigue and its Effect on Industry and Efficiency," by Professor Stearns.

Institution of Mechanical Engineers.—Friday, November 3rd. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. The President's Lecture on "The Gas Engines of the Last Century," by Mr. H. J. Jones.

Salford Technical and Engineering Association.—Saturday, November 4th. At 7.30 p.m. At the Salford Technical Institute. Short papers by Mr. W. G. L. Jones, on "The Cold metal-clip by Mr. W. G. L. Jones."

Society of Engineers.—Monday, November 6th. At 5.30 p.m. At Cannon Road, Newcastle-on-Tyne. Paper on "Heating and Ventilating Private Dwelling-houses," by Mr. C. T. A. Hansen.

Institution of Civil Engineers.—Tuesday, November 7th. At 5.30 p.m. At Great George Street, Westminster, S.W. Address by the President, Sir Maurice Fitzmaurice, C.M.G., and presentation of medals awarded by the Council.

Rontgen Society.—Tuesday, November 7th. At 8.15 p.m. At the Institution of Electrical Engineers, Victoria Embankment, W.C. Presidential address.

Institution of Automobile Engineers.—Wednesday, November 8th. At 8 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. Paper on "Electrical Car Equipment," by Mr. A. Ludlow Clayton.

Faraday Society.—Wednesday, November 8th. At 5.30 p.m. At the Institution of Electrical Engineers, Victoria Embankment, W.C. General discussion on "Refractory Materials."

Institution of Electrical Engineers.—Thursday, November 9th. At 8 p.m. At Cannon Road, Newcastle-on-Tyne. Paper on "The Electric Lamp," by Mr. A. Russell.

Yorkshire Local Section.—Wednesday, November 9th. At 7 p.m. At the Metropolitan, Leeds. Opening meeting.

NOTES.

By-product Steam Boiler. We have received from Mr. George Wilkinson, borough electrical engineer of Harrogate, a letter the contents of which appear to be of such general interest, that we have obtained his permission to publish the essential portions.

Mr. Wilkinson after explaining that the Harrogate electricity works are situated in a 300-acre farm, a portion of which is likely to come into the building market after the war, goes on as follows:

"The large chimney at the electricity works is an eyesore to the estate, and it is thus removed it is reasonable to assume that the value of the land will appreciate an average 6d. per sq. yd., which represents over £30,000. Under these circumstances, the Corporation some time ago requested me to devote attention to smokeless combustion, and as a result of careful investigation and experiment, I have been able to design a boiler with the following characteristics:

"1. The coal is distilled, tar and ammoniacal liquor being extracted as by-products.

"2. The coke obtained from the coal while incandescent gravitates into the furnace, and is there consumed without smoke.

"3. The gas after being deprived of the by-products is also passed into the furnace under considerable pressure with the necessary air, and burns with a smokeless flame until it enters the retort flue, where it is transformed into radiant heat. This radiant heat is absorbed partly by the retort and partly by the water in the boiler.

"Thus very active steaming surfaces are produced not only in the furnace but upon the whole flue surface. On an average I expect to get from 20 to 25 lb. evaporation per sq. ft. of heating surface. The boiler is automatically fed with coal, which passes through the various stages of distillation and combustion automatically.

"It is expected the boiler will furnish superheated steam by reason of a special arrangement inserted in the boiler itself. The boiler makers' opinion of the boiler is favourable, especially as regards its simplicity and cheapness of construction.

"I have little doubt when the boiler is built and successfully tested, the Corporation will be quite prepared to put in two boilers in place of the large Lancashire boiler which we have recently sold. I calculate that twice or three times the amount of steam produced by the ordinary shell-type boilers per sq. ft. of boiler floor will be furnished by my boiler. Due to the smokeless combustion, no chimney stack will be required; induced draught fans will be employed instead of a chimney stack.

"I am aware there are schemes spoken of for the distillation of coal in large power houses, but under the present methods the capital outlay necessary to provide plant which is now in the market is absolutely prohibitive, having regard to the commercial aspect of the question.

"Electrical and mechanical engineers, as a rule, know little of the subject of the distillation of coal, while gas engineers, who are skilled in the art, know little of boiler-house practice. Thus it comes about that there is no plant at present available for coal distillation and steam raising at a reasonable price or of convenient and efficient design.

"Furthermore, the prevailing idea that coal distillation and steam production can be economically carried out successfully on a very large scale only, will be dispelled when closer attention is given to the problem, provided the power-station engineer is wise enough to dispose of his crude products to firms who prepare the various useful commodities therefrom for which there is a ready and increasing demand.

"When this possibility is realised, there will be less fuss made about 'linking-up,' which is the fashionable subject of the hour, and which is largely based upon the assumption that super-stations, preferably established on the coalfields themselves, are alone able to produce economical results, by-products of coal, and low costs of production.

Linking-up of Electrical Undertakings.—A meeting of representatives of municipal and private electrical undertakings of Yorkshire, in connection with the B. of T. interconnection scheme, was held at the Leeds Philosophical Hall on Wednesday last week. Mr. Thos. Roles (Bradford) presiding; 38 of the 40 Yorkshire undertakings were represented, and of the 40, 30 are municipally managed. The County Committee appointed consisted of Messrs. E. Cross (Rotherham), S. E. Fedden (Sheffield), C. N. Hedford (Leeds), Jewell (Yorkshire West Riding Electric Tramways, Wakefield), S. D. Jones (Batley), H. A. Nevill (Wakefield), E. S. Rayner (Doncaster, also representing Barnsley), T. Roles (Bradford), H. Webber (Keighley), Geo. Wilkinson (Harrogate), W. B. Woodhouse (Yorks. Electric Power Co.), and Mr. W. M. Rogerson (Halifax) as hon. secretary. The Leeds and Bradford Corporations favour the scheme; the Shipley Council has signified its inability to see any advantage to Shipley, but was represented at the meeting.

Inquiries.—Makers of red ebomite rod are asked for.

Copper Prices.—Messrs. F. Smith & Co. and Messrs. James & Shakespeare report: November 1st. No change in prices quoted last week.

Some Switching Problems.—Messrs. A. P. Lundberg and Sons, Liverpool Road, Holloway, London, N., send us the following interesting problems in electric-light switching. Any of our readers who care to work out the answers, and post copies of them to Messrs. Lundberg at any time during this month, will be informed by them as to the success or failure of their efforts.

The answers may be worked out with the help of any book on lighting or wiring that bears on the subject; and over-sea readers may send in their answers at any time.

PROBLEMS.

1. A single-way switch controls four lamps—1, 2, 3 and 4. What alteration would you make to enable either 1 and 3, or 2 and 4, or all the lamps, to be switched on?

2. A pendant lamp hangs from a rose in the centre of the ceiling, and is controlled by a switch in its holder. It is now desired to dispense with the holder switch and operate the lamp from two pendant two-way switches. In thus converting the control from single-way to two-way, it will be necessary to alter the ceiling-rose. No other disturbance of the fixed wiring will be necessary, since the two switches are to be connected by flex, all the way to the rose, the flex, passing through insulated screw-eyes. Sketch the circuit.

3. Two three-light pendants are controlled by a "Twinob." switch. One arm of the switch turns on a lamp in each pendant. The other arm lights the other two lamps in each pendant. All the lamps are alight when both arms of the "Twinob" are on.

(a) Sketch the connections in a simple diagram.

(b) Show the same connections in the plan of a room.

4. A lamp A is controlled by an ordinary or single-way switch, A.S. and another lamp B by a similar switch, B.S. It is required to replace A.S. and B.S. by two-way switches, so that A and B can be turned on and off together at either switching point. Make a diagram showing how you would effect this alteration in the control with the least possible alteration of the original wiring.

5. In the adjacent sketch of a hall and stairway, S.S. represent switches and L.L. lamps. What different arrangements would be



possible with these switches and lamps, and what would be their relative advantages?

6. A contractor once wrote saying that, though he had connected the wires at an intermediate switch both crossed and uncrossed, he was unable to get it to work properly. Explain carefully what mistake was made.

7. When an ordinary two-pin plug connection is fixed low down on a wall or on a skirting board, why is it better to place it with the pins and sockets in a vertical line, instead of in a horizontal line?

8. A room with a door at each end is to be fitted with two-way intermediate control from three points. A switch is to be fixed by each door, and a pendant switch midway. Map out the wiring between the switches on the assumption that it is preferred to have the pendant switch two-way instead of intermediate.

The Smithfield Fire.—Our reporter who attended the sitting of the City of London Tribunal when the applications of the Smithfield Markets Electric Supply Co., Ltd., for exemption of a number of members of the staff were heard, was apparently hard of hearing, or else he confused his shorthand signs for "dozens" and "thousands." In our last issue he led us to credit Mr. S. M. Powell, the manager and secretary of the company, with saying that the electrical papers contained "thousands" of advertisements for shift engineers. We, of course, were aware of central station chiefs' difficulties when the military authorities have cast envious eyes at the robust figures of their staffs, and we recognised that large numbers of them were wanting experienced men whom they could not secure, but thinking that "thousands" was a little extravagant, unless you added all the journals for a year together, we ventured parenthetically to express our unbelief. Of course, we were quite prepared to hear that we were not the only pebble on the beach, and that we had overlooked the small advertisements appearing in our contemporaries—it is so easy to do so at any time, and particularly in these days when one is busy. However, we learn now that neither was Mr. Powell's statement extravagant, nor were we guilty of "overlooking," for what Mr. Powell really said was "dozens," and not "thousands" at all. As he, in writing to us, says:—"The word used was dozens, a number obviously as true as the larger one is absurd." Of course, dozens is far nearer to the mark, and we regret that Mr. Powell should, in days when deaf men are in demand for the Army, have been misheard. Mr. Powell also asks us to correct the statement made in our issue of October 20th respecting the fire at the station. We stated that an explosion occurred, but we are now informed that that was not so. Our information was based on the statements appearing in the *Met Trades Journal*, from which we quoted.

Excess Profits Duty.—The *London Gazette* for October 31st contains a number of Orders issued under the Finance (No. 2) Act, 1915 Part III, Excess Profits Duty (Sec. 12 (1)). One relates

to the application of the Tramways and Light Railways Association for an increase in the statutory percentage as respects the trade or business of tramways and light railways in Great Britain and Ireland where such tramways or light railways are running wholly or in large part over public roads or streets. The Commissioners of Inland Revenue order an increase to $\frac{7}{8}$ per cent. in the case of companies or other bodies corporate, and $\frac{8}{9}$ per cent. in the case of any other trade or business. In respect of two applications made by the Melbourne Electric Supply Co., Ltd., and another respecting electricity supply and tramways in Victoria, the same figures— $\frac{7}{8}$ per cent. and $\frac{8}{9}$ per cent.—are conceded; and in the case of electricity supply and electric traction in India (Mr. Sydney Morse's application), the figures are increased to 7 per cent. and 8 per cent. respectively.

As already notified in these columns, the electric supply companies of the country are appealing to the Board of Referees on the ground that, as a class, they are entitled to special consideration on account of the limitations and restrictions under which they are working, and the fact that in the early stages of the undertakings it is impossible to earn an adequate return upon the capital expenditure involved, it being necessary, in fact, at all times to expend money in advance of adequate return. The petitions claim an increase in the statutory percentage allowed under the Finance Act. The interlocutory meeting was held recently before Sir Charles Renshaw, chairman of the board, at which the course of procedure and certain principles were settled. Mr. H. B. Renwick is representing certain London electric supply companies and a large number of provincial undertakings, and Mr. W. F. Fladgate is representing other London undertakings; together practically the whole industry will be represented. The result will be awaited with great interest by the industry, as a matter of important principle is at stake, and one which cannot but affect the financial position of supply undertakings in the future.

The Concordia Electric Wire Co., Ltd.—We learn from the Concordia Electric Wire Co., Ltd., that they have received an anonymous communication with reference to their advertisement in our issue of last week, in which the writer suggests that the "place is being kept warm for Germans after the war." The company stated in their advertisement that the concern was now composed entirely of British shareholders, the enemy shares having been acquired from the Board of Trade. They now ask us to state that, far from their being "kept warm for the Germans," they are preparing for taking their place amongst other British companies to fight the German competition when the war is over. A return is being filed at Somerset House which should convince anyone who cares to make the usual search, that the shareholders are entirely British. "The whole of the present directorate and managing staff are absolutely British born."

A National Gas Council.—A National Gas Council, comprising the governing bodies of all the existing organisations in the gas industry (including the British Commercial Gas Association), has been established to deal, as they arise, with matters of importance and urgency that concern all sections of the industry, and call for united action on its behalf.—*The Times*.

Our Commercial Intelligence.—The *Daily Telegraph* states that Mr. Runciman hopes to be able to make an announcement shortly on the question of the improvement of our existing machinery for the collection of commercial intelligence, and for promoting British trade over-seas.

The Electrification of Wool.—An important discovery has been made by Dr. S. A. Shorter, who is conducting the research into the problem of the electrification of wool and other textile fibres, at Leeds University. It appears that the friction to which the fibres are subjected is not, as was supposed, the only cause of the electrification of wool; electrification is also caused by drying, followed by lowering of the temperature. This entirely new discovery is one of the first results of the research instituted under the auspices of the Textile Institute.

Appointments Vacant.—Engineer (Rs. 800), for the Lahore Electric Supply Co.; three assistant electrical engineers for the Government of India; temporary chief clerk (£140), for the Aberdare U.D.C. electricity and tramway department; tramcar-shed foreman for Rhondda Tramways Co. See our advertisement pages to-day.

Fatalities.—W. H. Connor, a wire-jointer's mate, aged 53, was killed by falling through a trap-door on to a concrete floor 9 ft. below, while engaged on an electrical installation job in King Street, Warrington. Verdict, "Accidental death," with a rider that a fence should be put around the trap-door.

John Hall (15), Parker Street, Brierley Hill, was killed on Monday, last week, at Earl Dudley's Old Level Works, Brierley Hill. The evidence at the inquest showed that the lad was playing with other boys, after supper, when he caught hold of an electric lamp-post, with the result that his clogs became fastened in the wires, one of which he held by his hand. The current was immediately switched off, and the boy released. Artificial respiration was resorted to, but without avail. The voltage was 100 volts A.C., whereas, according to the Home Office Regulations, a voltage of 125 was safe. Verdict, "Accidental death."

Kinema Operators. The increasing tendency to employ youthful persons as operators and men children as assistant operators in London cinematograph theatres has been reported upon by the Finance and Music Halls Committee of the I.C.C. The Committee says:—"In view of the extent to which the safety of the public attending a cinematograph display depends on the skill and presence of mind of the operator, we think that the employment of youthful operators should be prohibited by the terms of the Council's licence, notwithstanding the difficulty now being experienced in obtaining suitable adult employees. The employment of boys and girls over 14 years of age for winding films and for assisting the operator does not involve so much risk, either to the audience or to the individual, provided that the responsible charge operator is always present in the operating enclosure, and that the re-winding room adjoins the operating enclosure; but such persons could not be entrusted with certain of the electrical apparatus (such as motor generators on high-voltage circuits) without risk to themselves and to the installations." The Committee recommends:—"That all licences granted by the Council in future under the Cinematograph Act, 1909, be subject to the conditions as follows:—That the operating enclosure shall be in the charge of a competent operator, who shall be not less than 18 years of age, and shall be present in the enclosure during the whole time that the machine is being operated."

Institution and Lecture Notes.—University College (University of London).—On Friday last Prof. J. A. Fleming commenced a series of lectures on "Long-distance Telephony." After a brief preliminary explanation of the use of the operator j in such expressions as $\cos \theta + j \sin \theta = e^{j\theta}$, he discussed the nature of sound-waves, illustrating the production of a sinusoidal wave-form with the aid of a simple harmonograph. The nature of the vibrations of a telephone diaphragm was next discussed, and it was shown that the natural frequency of its fundamental vibration was in the neighbourhood of 1,000 per second; as the frequency of speech vibrations adopted as a standard in telephony was 800, it was obvious that the frequency of the diaphragm was inconveniently close to that of the vocal standard, as the natural period of the diaphragm affected the wave form. The nature of the waves produced in a telephonic circuit by the human voice was demonstrated by means of oscillograms, which showed that in the case of vowel sounds the vibrations were periodic and continuous, but the consonants produced "explosive" oscillations which were strongly affected by the natural period of the diaphragm. Hence it would be a great advantage if the diaphragm frequency were nearer 5,000 than 800, and in the human ear this condition was fulfilled, the fundamental vibration frequency of the diaphragm of the ear being about 5,000, so that the ear could distinguish very fine differences in sounds.

After explaining the harmonic analysis of complex periodic curves by Fourier's theorem, Prof. Fleming said that Lord Rayleigh and König were of opinion that the ear was more sensitive to the phase differences of the components of a sound-wave than to differences of amplitude; the lecturer, however, believed that the amplitudes of the components were the more important factors. Rayleigh found that an amplitude of vibration in air of $\frac{1}{100,000}$ mm. was just audible, and this was confirmed by Max Wien; the latter also showed that the least audible motion of the diaphragm had an amplitude of 6.3×10^{-10} cm.—far smaller than the wavelength of light (5×10^{-5} cm., green), and comparable with the dimensions of a molecule.

After touching upon the qualities of carbon which made it particularly suitable for the construction of transmitters, Prof. Fleming passed on to explain the effect of the line on the wave-form of a telephonic current, showing that, as the shortest waves travelled fastest and attenuated most quickly, they tended to disappear and leave only a sinusoidal wave. The four primary qualities of the line which were in operation were the inductance, capacity, resistance, and leakage, in addition to which there were four secondary qualities, the vector impedance and admittance, the propagation constant, and the line impedance. The lecturer illustrated the mode of propagation of an electromagnetic wave along a line with diagrams, showing that in the case of a wave reflected at the end of an open line the magnetic force was reversed, whilst when reflection took place at a closed end the electric force was reversed. He then dealt with the mathematical expressions for the voltage and current in a line, which provided the necessary means of calculating precisely what would take place at the receiving end, obtaining the equations—

$$V = V_0 e^{-\alpha x} \cos(\omega t - \beta x) + V_1 e^{-\alpha x} \sin(\omega t - \beta x) \\ V = A e^{-\alpha x} + B e^{+\alpha x}$$

and similar equations for i , in which four equations, he said, the whole theory of telephony was embodied.

Institution of Electrical Engineers. The following arrangements are announced for the London meetings of the Institution:—November 9th, "The eighth Kelvin Lecture, 'Some Aspects of Lord Kelvin's Life and Work,'" by Dr. A. Russell.

November 23rd, "The Parallel Operation of Electric Power Stations," by J. S. Peck.

December 14th, "Colonial Telegraphs and Telephones," by R. W. Wichtman.

January 11th, "Principles Involved in Computing the Depreciation of Plant."

Arrangements for the meetings of February 8th, March 8th, and April 19th will be announced later.

Institution of Automobile Engineers.—At the meeting to be held at the Royal Society of Arts, on Wednesday next, at 8 p.m., a paper by Mr. A. Ludlow Claydon, entitled "Electrical Car Equipment," will be read. The chair will be taken by the President, Mr. L. A.

Lagros. Cards of invitation to the meeting may be obtained on application to the Secretary, Institution of Automobile Engineers, 28, Victoria Street, Westminster, London, S.W.

Institution of Mechanical Engineers.—On October 20th a paper on trials of a Diesel engine, by the late Lieut. F. Trevor Wilkins, was read. The experiments were carried out at the University of Birmingham, and Prof. Burstall's energy diagram was used to enable a heat-balance to be struck. A special form of diaphragm optical indicator, in which the diaphragm was maintained at a constant temperature, was employed. The thermal efficiency obtained by the energy-diagram method ranged from 47.7 per cent. at half load to 42.5 per cent. at full load; the heat lost to the jackets was 24 to 25.3 per cent., and the heat lost to exhaust was 28.3 to 32.2 per cent.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—The Special Finance Committee of Walthamstow U.D.C. has decided in favour of a number of increases of salary and wages, including the following:—Electricity Department: G. J. HOLLAR, £10 per annum; A. E. THOMAS, £15 per annum; T. F. LYNN, £25 per annum; G. W. STRICKINGS, £10 per annum; W. G. GARDNER, £10 per annum. Tramways Department: J. W. BAKER, £7 per annum; G. F. UICOTT, £10 per annum.

The Tadmorden Corporation has granted an advance of £25 in the salary of the electrical engineer, Mr. Joseph Boyce.

The Ilford tramways manager's salary is to be increased from £460 to £480 a year.

Eight candidates were selected from among the 106 applicants for the position of electrical engineer to the Wigan Corporation. The final selection is to be made this week.

The Hammersmith B.C. Electricity Committee recommends that Mr. J. HORSKING be promoted to be engineer-in-charge, in place of Mr. Buchanan, at £175 per annum, rising by two annual increments to £200, plus the bonus; that the salary of Mr. F. G. MURPHY be increased to £175 per annum, rising to £200 by two annual increments; and that Mr. F. L. FITCH be appointed temporary engineer-in-charge at a salary of £3 5s. per week.

General.—Mr. J. H. WHIT, who has been with the Lancashire Dynamo & Motor Co., Ltd., Trafford Park, Manchester, since it started, severed his connection with the company on October 31st, 1916, and on the following day joined the electrical department of Messrs. Vickers, Ltd. His address is now: c/o Messrs. Vickers, Ltd., Electrical Department, Vickers Works, Broadway, Westminster, S.W.

London Gazette Notice.—Territorial Force. Royal Engineers. London Electrical Engineers. Sergeant F. GOBLE to be Second-Lieutenant (on probation). Sergeant R. FRANCES to be Second-Lieutenant (on probation). Acting Lance-Corporal C. S. SILVA to be Second-Lieutenant (on probation).

London Gazette Notice, October 13th, 1916.—Army Ordnance Department. Temporary Inspector of Ordnance Machinery, third class, and Hon. Lieutenant C. F. D. SCGGATE to be Temporary Inspector of Ordnance Machinery, second class, and Hon. Captain while holding a special appointment, dated from May 27th, 1916.

Alderman J. MILES, J.P., Chairman of Bolton Corporation Tramways Committee, has been appointed vice-president of the Municipal Tramways Association.

Mr. E. A. LAMBERT, of Walton-on-Naze, electrical engineer to the Coast Development Corporation, who is a member of the U.D.C., has been gazetted Second-Lieutenant in the Inland Water Transport Section of the Royal Engineers.

Mr. ALFRED HOARE, of Messrs. Hoare & Co., bankers, has been elected on the board of the Notting Hill Electric Lighting Co., in the place of the late Sir Richard B. Martin, Bart.

Mr. M. SHORT, of the Newcastle-on-Tyne Electric Supply Co., Ltd., has been re-elected president of the North-East Coast Association of Chartered Secretaries.

The Council of the Institution of Electrical Engineers have elected Prof. GEORGE CAREY FOSTER, LL.D., D.Sc., F.R.S., past president, to be an Honorary Member of the Institution.

Roll of Honour.—The General Purposes Committee of the I.C.C. reports the names of the undermentioned employees of the Council's tramways department who have lost their lives on war service:—

Private G. H. Barnes, East Surrey Regt. (rotary assistant); Corporal G. Ball, East Surrey Regt. (conductor); Lance-Corporal H. A. Cole, Dorsetshire Regt. (fitter); Private E. J. Davies, Royal Welsh Fusiliers (conductor); Corporal G. Dorman, Hampshire Regiment (conductor); Gunner W. C. Howard, R.F.A. (motorman); Driver M. Humphrey, R.F.A. (conductor); Gunner E. C. Laver, R.F.A. (conductor); Private F. Pearce, Royal Welsh Fusiliers (motorman); Sergeant E. C. Pocock, Worcestershire Regiment (motorman); Rifleman W. C. Walter, Rifle Brigade; Private S. V. Scott, Royal Welsh Regiment (conductor); Sergeant J. E. Simons, East Surrey Regiment (conductor); Corporal C. A. N. Walsby, R.F.A. (rotary assistant).

The Times "Deaths." Column contains the following notice:—"WHITLEY.—On May 31st, of illness contracted abroad, Philip Harold Whitley, Private, E. Surrey, late of the Staff of Electricians, G.P.O."

£1,745, and £10,000 used £25,000 to the renewals and depreciation account. There is a surplus on the year's working of £11,775, and £1,745 brought forward, making £9,226. After paying the preference dividend, transferring to reserve £10,000, and £1,745, and paying a total of 1s. 7d. per share on the ordinary shares, £4,601 is to be carried forward. £6,345 first mortgage debenture stock was bought and cancelled, the average cost to the company being approximately 94½ per cent. The capital expenditure during the year was £110,000, chiefly for the now practically completed Upper Queen Street extension. A poll taken regarding the running of the cars continuously during Sunday evenings showed a large majority in favour thereof, and the service has since been maintained with satisfactory results. The route miles open have increased from 25.42 to 26.59; the passengers carried increased from 41,455,689 to 42,552,551; the average receipts per passenger advanced from 1.55d. to 1.56d.; the average expenditure was .99d., the proportion of expenditure to receipts 64 per cent., and the number of cars 166, for both years.

The annual meeting was held in London on Tuesday.

The revenue for the year ended June, 1916, was £782,218, and the working expenses were £502,295. After providing £2,747 for debenture stock interest and £138,397 for income-tax and excess profits duty, £448,809 remains, plus £85,880 brought forward. £100,000 has been applied towards further reduction of capital expenditure in excess of share capital and debenture stock issued, £100,000 transferred to general reserve fund, £30,000 to the land and buildings depreciation fund, and £100,000 to the provision on account of investment fluctuations. A final dividend of 3s. per share makes a total of 6 per cent. for the year, and a bonus of 2 per cent. (both free of tax) is to be paid, leaving £38,345 to be carried forward. Shareholders are to be asked to vote the directors' remuneration free of income-tax. Annual meeting: November 8th.

For the year ended June, 1916, the profit was £72,498, and after providing for debenture interest, redemption of debentures, and adding the balance brought forward, the net credit balance is £31,404. The reserve fund has been credited with £5,000, a dividend of 3½ per cent. on the ordinary shares is to be paid, and £7,983 is to be carried forward. During the year the tramways carried 22,477,366 passengers, earning £212,792, as against 21,680,070 passengers, earning £206,123, in 1914-15. The traffic receipts again show a small improvement, but this is more than set off by the higher cost of operation. This includes increased labour charges and the allowances granted to employees with the Forces. The London expenses have also grown, owing to the excess profits duty and increased income-tax charges. Mr. J. A. Barkley, the general manager at Cape Town, resigned his post in November last owing to ill-health. Mr. W. F. Long, formerly the municipal electrical engineer at Cape Town, entered upon his duties with the company in February last. Shortly after Mr. Long's appointment, labour trouble broke out, which culminated in April in a most unjustifiable strike on the part of a considerable number of motor-men and conductors. This lasted about four weeks, and during the whole of the time with but few exceptions, the system was kept running full time. Eventually many of the employees who had joined the movement returned to work on the terms laid down by the company, and the strike collapsed. There is every reason to hope that the company's relations with its employees are now established on a satisfactory basis, a result which speaks most highly for the energetic action and tact displayed by Mr. Long and the local directorate in dealing with the situation. Annual meeting: November 15th.

The directors regret delay in the presentation of the accounts for the year 1915 due to war conditions at Nairobi. The table shows the progress of the undertaking:

	1913.	1914.	1915.
Units generated	723,852	1,020,038	1,122,744
Motors connected, B.H.P.	373	422	431
Lights connected (8-c.p.)	15,745	24,808	32,176

An auxiliary steam plant was erected at Nairobi and became available for service in May, 1915, since when a second steam plant has also been installed and is now available. These have been paid for partly by the issue of further shares and partly out of revenue. Owing to the late arrival of the steam plant, delayed by war conditions, causing a temporary shortage of supply during the months of January, February, and March, when there was an unprecedented season of drought, an allowance amounting to £969 was made to consumers. It was necessary to send out the consulting engineer to Nairobi to advise what steps should be taken to meet the difficulties of the situation arising out of the enforced postponement of the Thika River installation on account of the war and its effects. This involved a lengthy stay at Nairobi, and expenses connected with this visit, amounting to £850, appear as an unusual item in the revenue account. Stamp duties on the increased capital of the company amounting to £55 are also mentioned. The net revenue account presents for the first time an item of excess profits duty amounting to £885. As the directors were aware of the unavoidable delay in the dispatch of the yearly accounts from

Nairobi, they (as soon as the approximate results were known to them) declared an interim final dividend making altogether 10 per cent. paid for the year on both preference and ordinary shares, less income-tax.

Mr. CLAUD T. CAVELL (chairman) presided, on October 26th, at the Cannon Street Hotel, E.C., over the annual meeting of this company. He said that the year had been a strenuous one for everyone connected with the management of the company. At the last meeting he indicated, as far as he thought advisable, the nature of the work which they were then employed on and expected to be engaged in during the year, but, as the figures of the balance sheet showed, the work actually undertaken by them had been of greater magnitude than the directors then anticipated. Again he was not permitted to give details, but both the manufacturing department and the contracts department were dealing with a larger turnover than ever before, and it was, in his opinion, greatly to the credit of the staff that this should be the case in view of the extent to which it was depleted by many members having joined His Majesty's Forces. Capital expenditure at the works, including goodwill and patents, had been reduced. To those who knew the works this would appear misleading, in view of the material extensions which were in evidence. The explanation, however, was found lower down in the balance sheet in the item "contracts due for works, stock of materials, &c." It was considered, for the purpose of comparison, better to keep separate as far as possible the expenditure in connection with abnormal works, and this had been done by dealing with them as separate and independent contracts. Of course, they would understand that when they returned to normal times there would of necessity be an adjustment between this item and that of "capital expenditure at works." There was no use attempting to make this adjustment at the present time as, under the Munitions Act, the Government would have a very considerable say as to how it should be carried out. The reduction in "capital expenditure, &c., at works" of over £18,000 represented therefore, roughly speaking, the amount written off this item for normal depreciation. It would be noticed that the auditors in their report stated that "No provision has been made for the shrinkage of assets due to the present exceptional circumstances, but the usual charges for depreciation have been made." This was, of course, correct as far as the balance sheet was concerned, but he would draw their attention to certain words in the profit and loss account, namely, "After setting aside reserve for extra depreciation." Everyone who had any experience of manufacturing knew that depreciation of machinery increased with the time it was at work, but not in direct proportion. The more continuously machinery was operated the less time there was to carry out normal repairs; consequently, the life was shortened out of all proportion to the actual amount of time worked, and the directors considered it necessary to provide amply against this exceptional wear and tear. The profit earned for the year, added to £13,346 brought forward, gave them £79,296 available for appropriation. Out of this sum it was proposed to add £25,000 to the special reserve for contingencies, which would bring the total of this reserve up to £50,000. As he indicated last year would be the case, the work on which they were now engaged was abnormal in great part, and a transition period was bound to come during which all their energies would have to be directed to re-establishing normal conditions. It was a matter of sound policy, therefore, to build up a reserve to help them over this transitional period, and this they were doing by means of the reserve he had just mentioned. With regard to the question of war taxation, it was impossible to say much about this matter at present, except that a sum had been reserved in the accounts which the directors considered sufficient to meet any claims which might be made against them. Advantage was taken during the year of an opportunity to acquire a controlling interest in the shares of Messrs. Willans and Robinson. Many of them knew the large amount of business which they had done together, and the pleasant relationship which had always existed, and while it was not proposed to make any alteration in the present directorate and management of Messrs. Willans & Robinson, it would be realised that there was now no obstacle in the way of cementing that relationship by a closer combination of working interests, leading eventually to material benefits for both. It had been a great satisfaction to them all on the board to see the mobile manner in which the members of the staff threw themselves into the work of reorganisation to meet an entirely new class of manufacture, and with no little success under very adverse circumstances. He attributed the success attained, both at their own works and at the new factory mentioned in the report, to the fact that they were able to provide the nucleus from old employees, and in this connection he wished to include not only the members of the staff, but foremen and workmen alike. In these times, when so much was said about slacking and loss of time, it was pleasant to be able to state that the time lost by the workers at their Preston works from all causes, illness included, over a period of 12 months now under review, was under 1.4 per cent. This included men and women, forge and machine shops. As to the future, he was no more inclined to prophesy than he was two years ago, when they met just after the outbreak of war, but he was prepared to say now that with such a staff as theirs had proved itself to be, given reasonable protection of

a permanent nature against unfair competition from outside the Empire, there was every reason to look to the future with confidence.

Mr. R. H. PRESTWICH seconded the motion.

Mr. LACEY complimented the board and Mr. Walter Rutherford, the managing director, on the improved state of affairs, and said he understood the chairman to refer to the control exercised by German financial houses all over the world when he spoke of unfair competition. He did not think at present that they saw any evidence of this matter being dealt with. There was a lot of talk about banking, but he thought they had better leave their banking system alone, for it was the best in the world. He suggested that it was the industrial trust companies who had done them the harm, and these companies seemed to be controlled by the very people who had tried to break down the British Empire.

Replying to questions, the CHAIRMAN said the organisation of the company had been carried out and approved by the board as proposed by the managing director. A management committee of six was appointed, and each of these six gentlemen presided over a different department, and was responsible to Mr. Rutherford, whilst Mr. Rutherford was responsible to the board.

The report was adopted, and, on the motion of the CHAIRMAN, seconded by Mr. DICKINSON, a hearty vote of thanks was passed to the managing director and staff.

The report for the year 1915, as published in the *Financial Times*, states that the company was organised for the purpose of developing hydro-electric power in Spain, with the intention of serving the very large market for light and power, and also developing the electric railway and tramway system in the city of Barcelona and the surrounding district. For the purpose of constructing and operating the hydro-electric works in Spain a subsidiary company, called the Ebro Irrigation & Power Co., Ltd., was formed, and all the capital stock and bonds of the Ebro Co. are owned by the company. For the purpose of developing the electric railway and tramways a Spanish company, entitled the Ferrocarriles de Cataluña, S.A., was also organised, the entire capital stock of which is owned by the company. Owing to developments unforeseen at the time of the original issue of the 5 per cent. first mortgage bonds of the company, the management came to the conclusion that it was desirable to secure control of the chief electric light and power company in the city of Barcelona, known as the Cia. Barcelonesa de Electricidad, as well as of a number of other small light and power companies in the neighbouring towns. Arrangements which provided for the additional money required were made with a group of French and Belgian bankers, but owing to the outbreak of the European war these arrangements could not be carried out, the result being that the construction work under progress in Spain had to be suspended. At the beginning of 1915 a bondholders' committee was constituted with the object of considering the situation, and the recommendations of the committee for reorganising the finances of the company and completing the hydro-electric works were ratified at a meeting of 5 per cent. 50-year first mortgage bondholders in June last. The amount of the 5 per cent. 50-year first mortgage bonds outstanding on December 31st, 1915, was £7,505,000, and the interest on this and on the various securities to that date to be satisfied in 5 per cent. 10-year notes amounted to \$3,445,663. The Ebro Co., in addition to operating its own hydro-electric business, operates and controls the electric undertakings of the various subsidiary companies which the company controls through share holdings. The surplus earnings from the undertaking as a whole for 1915, after providing for interest on the prior lien "A" bonds, amounted to £250,669, as against a surplus of £266,750, which it was estimated would have been realised if the works had been restarted at the date contemplated. The board consider the enterprises which the company controls in Spain are developing in a sound and satisfactory manner, and if no unforeseen difficulties arise during the present year the result of the year's working should, notwithstanding the delay and adverse conditions referred to above show a very satisfactory increase over the results of the year 1915. The market for power is a remarkable one and indicates an increasing demand, and in order to meet the growth the distribution system has been, and is being, considerably extended and strengthened, and it is contemplated that a large part of the surplus earnings for the next two years will be applied in carrying out this work. The growth of the business will probably necessitate the extension in the near future of the hydro-electric development, and the board have this matter under consideration, so that when the necessity arises the work can be proceeded with without delay. The following summary of the 1914 and 1915 results from the operation of the combined enterprise shows the progress made:—

	1915.	1914.	
	Pesetas.	Pesetas.	Pesetas.
Gross earnings	16,804,223.27	15,466,207.91	+ 1,338,015.36
Operating expenses	7,202,839.94	8,381,734.85	- 1,178,894.91
Net earnings	9,601,383.33	7,084,473.06	+ 2,516,910.27

The results from operation for the first seven months of 1916 show a considerable increase over the above figures, and are as good as was anticipated in making up the financial programme for the year, notwithstanding a general strike in the textile industry during June and July, which adversely affected

the earnings for those months. The whole of the plant, both steam and hydro-electric (with the exception of the turbines at Tremp, which are being reconstructed), is in good working condition.

Drake and Gorham, Ltd.

The directors report that for the year ended June, 1916, after payment of all charges, including bonuses due to staff, allowances to those who have joined the National Forces, and making provision for contingencies, there remains a net profit of £8,527 (as against £3,817 for 1915), plus £1,623 brought forward, making £10,150 (as against £5,748 last year). A dividend of 4 per cent. (as against 2½ per cent.) requires £5,000; there is put to voting down goodwill £3,000 (as against £1,000), and £2,150 is to be carried forward. The net profits, although below the pre-war average, were more than twice those given in the last balance sheet, and there has been a considerable increase in turnover. Contracts in connection with Naval and Military requirements constitute a large portion of the company's operations. A power station of about 4,500 H.P. erected by the company is practically complete, and will shortly be put to work. The wholesale department has further expanded, and shows satisfactory results. The output from the company's works has largely increased, and extensions of this branch are under consideration. The department dealing with electric vehicles propelled by Edison batteries has made good progress. Up to the present 90 men have joined the National Forces, and the difficulty of obtaining necessary labour is increasing. To June 30th £1,733, including directors' fees, had been paid to absentees. Heavy taxation is stated to make it increasingly difficult to finance the extensions which should be made to provide for trade after the war.

Annual meeting: November 9th.

United Electric Tramways Co. of Caracas.

The report for the twelve months ended June 30th states that, after adding the balance forward, the net revenue shows a disposable balance of £14,328, out of which the directors recommend a dividend for the year of 7 per cent., less tax, leaving £2,428 to be carried forward. The profits of the local company were again adversely affected by the war, but during the last months of the year they exhibited a tendency to improve. The internal conditions of Venezuela are satisfactory, and the directors consider that the traffic receipts for the current year are more likely to increase than decrease. The gross receipts amounted to Bs1,426,975, an increase of Bs296 as compared with 1914-15, while the operating expenses were Bs757,806, an increase of Bs24,792, leaving net receipts, at the exchange of 25.25, of £26,501, a decrease of £970. The local company, after providing for the mortgage interest, payable to this company, and setting aside Bs50,000 to reserve and renewal funds, and paying as dividend the whole of the balance of the profits for the year, carry forward the same amount as in the previous twelve months—namely, Bs539,809.—*Financial Times*.

Prospectus.—Fellows Magneto Co., Ltd.—With the permission of the Treasury an issue of 50,000 8 per cent. cumulative preferred shares in this company is being offered for subscription. The company is to take over the business of Fellows & Co., magneto manufacturers and repairers, Horseferry Road, Westminster, and Willesden. The company has Government orders in hand valued at £22,443, and the War Office promises a running order of 400 magnetos per month and spare parts, the value of the order being given at about £84,000 per annum. The company is extending the works and machinery to give a greatly increased output. The capital is £75,000 in 50,000 preferred (8 per cent. carrying also 20 per cent. of the net profits thereafter) and 50,000 ordinary shares of 10s. each.

Companies Struck Off the Register.—The following companies have been struck off the register, and they are dissolved:—

Anglo-German Wireless Syndicate.
 Atkins Filter, Engineering & Water Scaffolding Co.
 Bismarck Lamp Factory, Pittsburgh, Pa.
 Bridlington Electrical Engineering Co.
 Helix Cell & Accumulator Co.
 Improved Railway Signals.
 International Filaments.
 Lighting & Heating Trust.
 New Century Arc Light Co.
 New Ignition Syndicate.
 Paris Accumulator Co.
 Power Transmission Syndicate.
 Smoke Consumption Co., Cooper's Patent.
 United Electric Light & Power Supply Co.
 Warner Engineering Co.

West India & Panama Telegraph Co., Ltd.—A dividend for the half-year ended June 30th of 6d. per share on the ordinary shares (free of tax) is announced.

Russia.—The *Westinghouse Co.* made a profit of 1,041,488 roubles in 1915, and announces a dividend of 12½ per cent., against 8 per cent. for 1914.

The *Moscow Elektropriborakh (Electric Transmission) Co.* made a loss of 71,623 roubles in 1915.

The *Nezhinsk Electric Co., Nezhin*, has been formed; capital 300,000 roubles.

The *General Electric Co.* made a profit of 2,238,370 roubles in 1915, and pays 10 per cent. dividend, as for the preceding year.

The *Russian Electric Co., "Dynamo,"* made a profit of 1,368,316 roubles in 1915, and pays a 7 per cent. dividend, against 4 per cent. for 1914.

The *Electric Light & Equipment Co.* made a profit of £22,288 on sales of £1,000,000 in 1915, and pays a dividend of 7½ per cent., against 10½ per cent. for 1914.

Lisbon Electric Tramways Co., Ltd.—No notice in dividend for the first of the ordinary shares.

West African Telegraph Co., Ltd.—Interim dividend at the rate of 4 per cent. per annum, 4s. per share, free of tax.

Westinghouse Brake Co.—Interim dividend of 5 per cent., 10s. per share, less tax on the ordinary shares.

STOCKS AND SHARES.

TUESDAY EVENING.

THIS week has seen a further diminution in the amount of lighting permitted, and, in the circumstances, it is natural enough to find the market for electricity supply shares leaning to the lower side. The same applies to that for stocks and shares in the gas companies, and if there is anything surprising in the situation at all, it is that the fall should not have been more noticeable. The earlier closing of the shops is another factor which militates against the lighting concerns; and notwithstanding the modification in the hour, from seven o'clock to eight, the restriction is, of course, something of a bear point from the standpoint of the investor in illumination companies.

Markets generally are recovering from the depressing tone set by the news from Roumania last week. Our latest ally seems to be making better progress, and this has set free more money for investment. Next in the financial programme, we shall probably have expectations of a new popular war loan of considerable magnitude, which will furnish the text and the excuse for quietude throughout the Stock Exchange. Business has certainly fallen on restricted lines for the time being, and this notwithstanding the fact that from October to March the Stock Exchange markets ought to be sufficiently active to furnish members of the House with ample employment.

The sentiment in the Home Railway department remains lumpy. The trouble of the matter is that nobody wants to buy Home Railway stocks with the Labour outlook so unsettled and obscure as it is at the present time. Were there any prospect of Labour being satisfied with a definite rate of wages during the war, we might see attention turned to the Home Railway market; but with every settlement liable to be upset within a month or two after its having been fixed, investment money declines to have anything to do with the stocks.

Therefore Metropolitans and Districts are lower, South Westerns have given way, and most of the preferred issues are down. The three Central London assented stocks have all reverted to the same level of 67½. Fresh falls have taken place in the debenture stocks of the District Railway. Underground Electrics maintain their prices well, with the exception of the 6 per cent. income debenture stock, which has fallen two or three points to 102, and the shilling shares, now back to 5s. 6d. The bonds, however, are steady at 89.

Brazil Tractions are amongst the few shares exhibiting strength on the week. Why they should have fallen to 54 was something of a mystery, in the face of the declaration of the usual quarterly dividend of 1 per cent. The recovery to 56 seems to be a natural reaction. Some people point out, however, that for purposes of comparison, the 6 per cent. income debentures of the Underground Electrical Railways are more tempting than Brazil Traction common shares, seeing that the yield on the former is 6½ per cent. free of tax—equivalent to 9 per cent. less tax—while that on Brazil Tractions is 7½ per cent. In the case of the latter, of course, there is the probability that with any substantial recovery in the Brazilian exchange, Tractions might rise 10 points or more, while the Undergrounds remained stationary.

Brazilian investments, by the way, are generally better, in consequence of the semi-official statement to the effect that Brazil will be able to resume cash payments on her funded debts when the funding scheme expires next July—on which point, perhaps, the cautious observer will do well to keep an open mind.

Mexicans again exhibit a yielding tendency. Once more there is little or no definite news from the country, and in its absence nobody wants to buy. The Latin-Canadian group as a whole is steady, and it is of interest to set out a short table showing to-day's prices as compared with those current at the beginning of the month:—

Common Stock.	Price Oct. 31.	Price Oct. 2.
Canadian General Electric	125	125
Cons. Gas & Electric of Baltimore	130	117
Kaministiquia	127½ x d.	128½
Montreal Light, Heat & Power	235 x d.	240
Pennsylvania Water & Power	67	62
Shawinigan Water & Power	139	141½

Most of the business initiated in these shares comes from New York. The rise in Pennsylvanias occurred this week, and is based upon expectations of an increase in the dividend.

The telegraph market is harder, and except for Great Northern, which have been offered down to 38½, a fall of 30s., what movements have occurred are in the upward direction. The Eastern group is steady, with Eastern Extensions ½ better at 131. Indo-Europeans gained 12s. 6d., United River Plate Telephones recovered most of the dividend deducted last week. Marconis have receded to 2½ on the falling away of business, which induced profit-taking and caused the price to slacken. Reuters are good, the present price of 8½ comparing with 7 at the beginning of the week. It is announced that the directors have received a tentative offer for the whole business of the company on terms which would entitle each shareholder to receive a sum of not less than £10 per share in cash. The circular advises proprietors not to part with their shares at the present time. It is interesting to recall that earlier this year the price of Reuters fell to 4 1/16.

Electric Constructions have risen to their par value of £1, and Telegraph Constructions regained half their loss of last week. On the other hand, Babcock & Wilcox are weaker at 24 ex dividend, and British Aluminium ordinary eased off to 27s. 9d. Except for these changes, the manufacturing list is unaltered, but it continues very firm. In the rubber share market, a better tendency is noticeable, due partly to a rise in the price of the raw material to half-a-crown per lb., and partly to the consideration that the excess profits duty may not have so much effect upon dividends as it was at first feared would be the case. The iron and steel group is somewhat heavy, and there is not much doing in the shares of the copper companies.

SHARE LIST OF ELECTRICAL COMPANIES.

		Dividend		Price	Rise or fall	Yield p.c.
		1914.	1915.	Oct. 31, 1916.		
Brompton Ordinary	.. ..	10	10	68	—	27 11 0
Charing Cross Ordinary	.. ..	5	5	35½	—	7 1 4
do. do. do. 4½ Pref.	.. ..	4½	4½	35½	—	8 6 4
Chelsea	.. ..	5	4	3	—	6 18 4
City of London	.. ..	9	8	12½	—	6 12 0
do. do. 6 per cent. Pref.	.. ..	6	6	10½	—	5 17 1
County of London	.. ..	7	7	10½	—	6 10 8
do. do. 6 per cent. Pref.	.. ..	6	6	10½	—	6 18 5
Kensington Ordinary	.. ..	9	7	62	—	6 4 5
London Electric	.. ..	4	4	2½	—	6 10 5
do. do. 6 per cent. Pref.	.. ..	6	6	42½	—	6 11 4
Metropolitan	.. ..	3½	3	12	—	6 0 0
do. do. 4½ per cent. Pref.	.. ..	4½	4½	32	—	7 4 0
St. James' and Pall Mall	.. ..	10	8	—	—	8 8 0
South London	.. ..	5	6	24½	—	4 16 1
South Metropolitan Pref.	.. ..	7	7	16½	—	6 7 9
Westminster Ordinary	.. ..	9	7	67½	—	6 13 0

TELEPHONES AND TELEGRAPHS.

Anglo-Am. Tel. Pref.	.. ..	6	6	98	—	6 2 5
do. do. Def.	.. ..	30/	33/6	24½	—	7 10 3
Chile Telephone	.. ..	8	8	7	—	6 14 5
Cuba Sub. Ord.	.. ..	6	5	12	—	6 8 6
Eastern Extension	.. ..	7	8	12½	—	6 16 6
Eastern Tel. Ord.	.. ..	7	8	14½	—	*6 13 1
Globe Tel. and T. Ord.	.. ..	6	7	12½	—	*6 12 0
do. do. Pref.	.. ..	6	6	10½	—	5 14 3
Great Northern Tel.	.. ..	22	22	84½	—	6 11 0
Indo-European	.. ..	18	13	51½	—	6 7 8
Marconi	.. ..	10	10	22	—	3 9 8
New York Tel. 4½	.. ..	4½	4½	100	—	4 10 0
Oriental Telephone Ord.	.. ..	10	10	28	—	4 6 6
United R. Plate Tel.	.. ..	8	8	62½	—	*6 18 6
West India and Pan.	.. ..	1	—	—	—	—
Western Telegraph	.. ..	7	8	14½	—	*5 10 4

HOME RAILS.

Central London, Ord. Assented	.. ..	4	4	67½	—	6 18 8
Metropolitan	.. ..	12	11	22½	—	4 9 0
do. do. District	.. ..	Nil	Nil	16	—	Nil
Underground Electric Ordinary	.. ..	Nil	Nil	11½	—	Nil
do. do. do. "A"	.. ..	Nil	Nil	5, 6	—	Nil
do. do. do. Income	.. ..	6	6	89	—	*6 14 7

FOREIGN TRAMS, &c.

Adelaide Sup. 6 per cent. Pref.	.. ..	6	6	43½	—	6 1 6
Anglo-Arg. Trams, First Pref.	.. ..	64	64	30	—	8 9 2
do. do. do. 2nd Pref.	.. ..	64	64	22	—	—
do. do. 5 Deb.	.. ..	5	5	6	—	7 2 10
Brazil Tractions	.. ..	4	4	56	+1	7 2 10
Bombay Electric Pref.	.. ..	6	6	104	—	6 17 8
British Columbia Elec. Rly. Pfc.	.. ..	6	6	72	—	6 19 0
do. do. do. Preferred	.. ..	Nil	Nil	55	—	Nil
do. do. do. Deferred	.. ..	Nil	Nil	44	—	Nil
do. do. do. Deb.	.. ..	42	42	66½	—	6 7 10
Mexico Trams 6 per cent. Bonds	.. ..	Nil	Nil	40	—	Nil
do. do. 6 per cent. Bonds	.. ..	Nil	Nil	89½	—	Nil
Mexican Light Common	.. ..	Nil	Nil	17	—	Nil
do. do. Pref.	.. ..	Nil	Nil	80	—	Nil
do. do. 1st Bonds	.. ..	Nil	Nil	40	—	—

MANUFACTURING COMPANIES.

Babcock & Wilcox	.. ..	14	15	34½	—	5 4 4
British Aluminium Ord.	.. ..	5	7	57½	—	6 13 4
British Insulated Ord.	.. ..	15	17½	12½	—	7 0 0
British Westinghouse Pref.	.. ..	7½	7½	24	—	6 0 0
Calenders	.. ..	15	20	14½	—	8 0 0
do. 5 Pref.	.. ..	5	5	6	—	6 17 8
Castner-Kellner	.. ..	30	—	83	—	6 6 8
Edison & Swan, 2½ paid	.. ..	Nil	Nil	10½	—	Nil
do. do. fully paid	.. ..	Nil	Nil	—	—	Nil
do. do. 1 per cent. Deb.	.. ..	5	5	62½	—	8 0 0
Electric Construction	.. ..	6	7½	1	—	7 10 0
Gen. Elec. Pref.	.. ..	6	6	10	—	6 0 0
do. do. Ord.	.. ..	10	10	14½	—	8 18 0
Henley	.. ..	30	26	12½	—	7 13 10
do. 4½ Pref.	.. ..	4½	4½	44	—	5 8 0
India-Rubber	.. ..	10	10	12	—	*3 3 4
Telegraph Con.	.. ..	20	20	28½	—	*6 4 7

* Dividends paid free of income-tax.

THE USE OF IONISED AIR IN AGRICULTURE.*

By INGVAR JORGENSEN.

(Concluded from page 454.)

THE current density in the discharge as obtained with the Lodge-Newman system described in the beginning of this article was found to vary between 10^{-14} and 10^{-11} amperes per sq. cm.

It will be readily understood that the ions moving down towards earth will be influenced by two forces, a vertical force caused by the potential gradient and a horizontal force due to the wind; the consequence is that part of the ions are carried outside the area covered by the wires, and the effect of the discharge is thus not limited to the area under the wires; this dispersion is, of course, very marked in the Lodge-Newman system when the wires are 15 to 16 ft. from the ground.

Details of the distribution of the discharge were given in a paper† by Prof. Priestley and the writer in 1914. As regards the meteorological factors, it can be stated that any meteorological process which will decrease the mobility of the ions, i.e., increase the number of molecules, will decrease the current density of the discharge. Particularly condensation processes have an important effect, as will be seen from fig. 4, which records the potential gradient

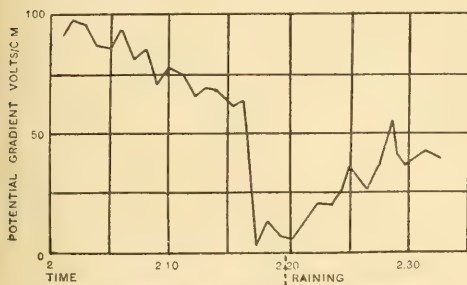


FIG. 4.—SHOWING EFFECT OF RAIN ON DISCHARGE.

during the change from fine weather to rain. It will also be seen that is possible to maintain an appreciable discharge during rain.

The influence of meteorological factors can be summarised then by saying that the current density of the discharge decreases with increasing wind velocity and with decreasing mobility of the ions.

It should also be observed that many atmospheric impurities will move under the influence of the potential gradient under the wires. This, in industrial districts, will lead to the precipitation of many harmful substances on plants. Also radio-active disintegration products possessing a charge will, in many cases, be precipitated, and cause considerable difficulty and error in the measurements.

In regard to the disturbances caused by the abnormal conditions of atmospheric electricity in industrial districts, reference must be made to a paper by Mr. Steuart and the writer.‡

The difficulties met with in attempting to confine the discharge to the area under the wires necessitated the performance of a number of experiments, in which the experimental area was separated from the control by vertical screens of wire netting connected to earth. The smallest

mesh obtainable commercially is, however, $\frac{1}{2}$ in., and even this is rather expensive for large scale experiments.

It is necessary that the screen should extend to a height several feet above the level of the discharge netting.

The amount of ionised air carried outside the experimental area can thus be considerably reduced, but not to zero. Even enclosing the area in a wire cage does not stop the ionised air completely; in one case an experiment was carried out by Miss E. C. Dudgeon with a crop of potatoes growing in such a cage 100 yds. from an electrified area; measurements showed, however, that, with the wind in the proper direction, as many as 10^5 ions per cb. metre were found in the cage (the air under the discharge netting contained about 10^9).

The cage is shown in fig. 5. It must be emphasised that such a cage also alters a good many other conditions, particularly as regards light and humidity.



FIG. 5.—SHOWING CAGE OF WIRE NETTING ($\frac{1}{2}$ -IN. MESH) COVERING AN AREA OF $\frac{1}{16}$ TH OF AN ACRE.

The writer is indebted to Mr. William Low, of Balmakwan, Montrose, for opportunities of taking part in some experiments with a large wire screen insulated from earth. By charging this screen to a suitable potential of the opposite sign to that of the discharge netting, it seems possible to obtain an effective screen.

In the later experiments by Miss Dudgeon, at Lincluden, Dumfries, the distance of the discharge netting from the ground has been considerably reduced. In 1915, the distance was 12 ft.; in 1916, about 7 ft.; and in the



FIG. 6. MEASUREMENT OF POTENTIAL GRADIENT. Flame collector on ebonite rod connected to Exner electrometer.

latter case, the amount of ionised air carried outside the area was very small. At the same time, a stronger discharge is obtained, and the spreading of the discharge diminished.

The writer would like to draw attention to a simple and convenient method for investigating the distribution of the discharge, which will also give comparative measurements of the strength of the discharge. The apparatus is shown in fig. 6, and consists of a flame collector on an ebonite

* The information contained in this article is derived from experiments carried out by the writer in Copenhagen (at the Government Agricultural Experimental Station) and in this country under the Board of Agriculture, in conjunction, first, with Prof. J. H. Priestley (University of Leeds), and, later, with Prof. V. H. Blackman (Imperial College of Science and Technology).

† I. Jorgensen and J. H. Priestley: *Journal of Agricultural Science*, Vol. VI, Part 3.

‡ D. W. Steuart and I. Jorgensen: Notes on the Atmospheric Electrical Potential Gradient in the Industrial Districts Around Leeds. *Proc. Roy. Soc., Edinburgh*, 1914.

and an electrometer (the so-called Exner type).

The electrometer is used in order to obtain the potential of the air at the height of the flame. (It is well known that flames bring about ionisation of the air, and any other substance, e.g., a radioactive substance which will impart conductivity to the air can be used.) The candle is pressed by a spring against the collar of a metal tube, and thus kept continually burning at the same level. This metal tube is surrounded by a glass chimney, and a wire gauze cage affords protection against the wind. The metal frame of the collector assumes the potential of the air just above the flame, and if connected to the electrometer

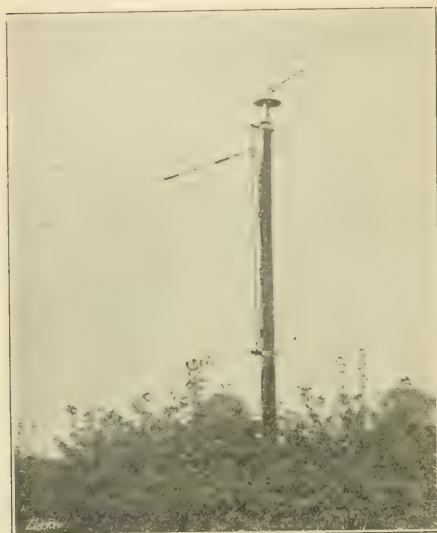


FIG. 7. SHOWING ARRANGEMENT FOR ALTERATION OF THE HEIGHT OF THE DISCHARGE NETWORK ON THE LEFT.

A reel can slide up and down the iron rod attached to the pole.

this potential can be determined. The deflection of the electrometer leaves is a measure of the potential, to which the electrometer is charged, but the rate at which the leaves are deflected can be used as a measure of current (this is a method much employed in radioactivity measurements).

If a current of i amperes charges the electrometer of capacity c in t seconds to v volts, then the current may be determined from the equation—

$$i = (c/9 \times 10^{11}) \cdot v/t.$$

In practice it was generally arranged that the leaves deflected until they touched the sides of the earth-connected electrometer cage. They would then lose their charge, and return to the zero position. The number of times the electrometer thus discharged per minute would thus give a rough measure of the strength of the discharge. This method has been used by Miss Dudgeon with much success in her experiments.

In the foregoing I have indicated some of the technical problems involved in the method, but the practical engineer will, no doubt, ask whether the results obtained are of sufficient economic importance to justify the expenditure of money on technical research? and what, at present, is the balance between the cost of electrical energy supplied and the increase in crop production?

The first question is extremely difficult to answer. Agriculture is an old industry, but its methods have not changed a great deal through the ages. Indeed, things have altered probably less in agriculture than, for instance, in the building and shipwright's trades, in which the per-

manence through the ages of the fundamental principles has been emphasised by Kipling.

Thus up to the present day the efforts of agriculture have been limited to attempts to control the factors which operate through the soil. But it must not be forgotten that plant growth is dependent both on material and on the radiant energy of the sun, and a large part of the material is obtained from the air (carbon dioxide).† No attempt has been made to increase either the gaseous compound nor the radiant energy, although there can be no doubt that in many cases a lack of carbon dioxide or of radiant energy limits the growth of crops. The methods dealt with in the present article form an attempt to supply energy artificially, thus constituting a new departure which deserves attention, and so the possibilities and limitations of the method should be fully investigated.

Certainly results obtained so far seem to indicate great possibilities; but they must be accepted with a certain amount of reserve, remembering that technique in agricultural experiments is far from perfect.

For accounts of earlier work, the reader is referred to Lemström's book, where many cases of remarkable results are recorded. It may also be interesting to quote some of the figures given by Sir Oliver Lodge in the paper already referred to. Experiments with wheat were carried out at Mr. Bomford's farm at Bevington, which showed in 1906 increases of 39 per cent. and 29 per cent.; in 1907, an increase of 29 per cent.; in 1908, 24.3 per cent.; in 1909, 23 per cent.; in 1910, 22 per cent.; in 1911 (drought), 0 per cent.; and in 1912, an increase of 20 per cent.

It is mainly due to the energy and enterprise of Miss E. C. Dudgeon, of Lincluden House, Dumfries, that the experiments are being continued in this country, and it has become possible to start a scientific investigation of the problem with the support of the Board of Agriculture.‡ The writer records with pleasure his indebtedness to Miss Dudgeon for her collaboration in pioneer work in this subject.

In the crop experiments with oats, carried out by Miss Dudgeon in 1915, the following increases were obtained || :—

Grain	...	...	30 per cent.
Straw	...	...	58 per cent.

Still better results were obtained in 1916.

It will, of course, be understandable that if such results are obtainable under all circumstances, particularly if the present high prices of cereals in this country should continue, it would pay to employ the method on a very large scale. The actual current used at present is small; thus in Miss Dudgeon's experiments this year 3 amperes at 50 volts were used in about 800 hours. If this current had been available from a power station the actual expense would have been negligible, compared with the increased value of the crop.

However, the area employed by Miss Dudgeon in the Lincluden experiments was only about one acre. The power consumed in the primary of the induction coil (about 150 watts) was badly utilised, as only 10–20 watts were discharged from the overhead network.

Thus we are again reminded of the fact that the network is a very essential part of the installation (as important as the antenna in a wireless station). Upon the construction of the network depends the efficiency of the installation. It will be seen that with the same energy used in the primary of the induction coil, a much larger area could be provided with ionised air. The writer has not had an

* R. Kipling: "Rewards and Fairies." London, 1910, page 55.

For instance, Pharaoh the Great, addressing the bricklayer engaged on building flats near the Marble Arch, says:—

"Your glazing is new and your plumbing's strange,
But otherwise I perceive no change.
And in less than a month if you do as I bid,
I'd learn you to build me a Pyramid."

† For a general account of this subject, see the articles by I. Jørgensen and W. Stiles on Carbon Assimilation in the "New Phytologist," 1915-16.

‡ This is at present being carried out at the Imperial College of Science and Technology under the general direction of Prof. V. H. Blackman.

|| For details see *Journal of the Board of Agriculture*, October, 1916.

opportunity of taking measurements in an installation where the network covered more than 12,000 sq. metres; but in all cases the discharge has been proportional to the area covered by the network, the current used in the primary of the induction coil being approximately constant. Presumably this was not appreciated by Dr. Breslauer (the German agent of the Agricultural Electric Discharge Co.*), who measured the current passing into a network covering 30,000 sq. metres and one covering 60,000 sq. metres. In the first case, a current of 0.38 milliampere was obtained (at 60,000 volts), and in the second case, 0.51 milliampere. It is difficult to see why he should assume that the difference between these two measurements (0.13 milliampere) should be the true value of the discharge current in the network covering the area of 30,000 sq. metres.

A disadvantage of the Lodge-Newman system is that the Lodge valve will not stand a strong current; for the same reason it has not found very extensive application in X-ray work.

It might, perhaps, interest readers of this journal to have an estimate of the cost of an installation similar to the Lodge-Newman; the figures are, of course, only approximate, and are not those of the Agricultural Electric Discharge Co.:—One induction coil, £30 to £40; one mercury break, £10; and five Lodge valves, £10.

The cost of the wires in the network is quite negligible; special high-tension insulators are not required unless the discharge is wanted during rain and in damp air; it is sufficient to use ebonite rods between the netting and the pole.

Thus neither the installation nor the cost of operation should prevent its application on a large scale, if future experiments confirm the experiences gained so far, and it will be seen that in this case an entirely new field is opened for electrical engineering.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Western Local Section.

ON Monday, last week, Prof. D. ROBERTSON, as chairman, delivered his inaugural address, of which the following is an abstract:—

A century ago the inventive genius, of itself, had a fairly free scope, but in the industrial world of the present day it must be coupled with a much higher degree of scientific knowledge and technical training, and have behind it much greater material resources than formerly, if it is to make its influence felt. In the early days of industry the problems to be solved were mainly mechanical, speeds were low, the choice of materials was comparatively small, and the duties put upon them were moderate, while prices were high enough to permit the use of sufficient material to give a good big factor of safety. Only the simplest calculations had to be made, and little scientific knowledge was necessary beyond that acquired in the daily routine of the shops. Consequently, many important advances were made by men having but the slightest theoretical knowledge.

Nowadays, competition required the utmost to be got out of each ounce of material; higher speeds may cause extra material to be a source of weakness rather than of strength, and introduce phenomena whose control requires the keenest tools that theory can supply. The advent of electrical transmission has brought into being an entirely new branch of engineering, ever extending its bounds, involving enormously more theoretical knowledge than the older branches, and requiring, in addition, a clearer insight into abstract things. On all hands, calculations must be more exact, and side issues of little importance in the old days have now to be closely taken into account.

We have every reason to be proud of the advances made, and being made, by our own countrymen in the domain of science, but at the same time I do not think we put into this work a sufficient number of men of the right sort, the right training, and the right temperament. Further, I do not believe we shall ever get them until we offer them prospects comparable with those open to the other learned professions. It is not sufficient to depend alone on the favoured few whose circumstances enable them to pursue their own ideas without having to worry about the cost or about their bread and butter. To keep up the prosperity of our country we

must put the best brains from all classes to those tasks which are most likely to increase the common good.

Although legislation can help but little in raising science to its rightful status, still it can do something. It might, for instance, encourage the study of science in our public schools by insisting on a certain minimum of scientific knowledge in future generations of public officials. Another thing which the Government could do is to make the value and number of the scholarships open to the science boy somewhere about level with those given for classical studies.

By thus making the way to a large number of the lucrative positions lie through a study of science, we should very quickly find every school running a real scientific side, and our universities would then be able to pass away from the condition of having to make their scientific alumni pass their first year in learning elementary work which they ought to have had at school.

But we must mainly look to our own men of eminence to bring about a better state of things by continually keeping the needs of science before the proper influential quarters. The war has focused attention on scientific work with an entirely new force. Never again must public opinion be allowed to forget how much is owed to the often-time obscure worker in the research laboratory. In particular, our leading men must see that their magnificent rally to the assistance of a Government, whose "neglect of science" has been their perpetual lament, shall not be misconstrued by the politician and official, and confirm their notion that scientific men are merely theorists whose ideas can usually be neglected, and who are too aetherial to require any encouragement or any visible means of support, but whose assistance can always be obtained, on those rare occasions when it is useful, without any reward and, indeed, almost without the trouble of having to ask for it. In short, our best men must make the Government appreciate the value of their services, and the only way to do that is to see that they are paid for.

The true research worker must possess an infinite patience, a fertile imagination, a wide knowledge of the laws of nature, and an unbounded faith in the possibility of accomplishing the task on which he is engaged. He must refuse to be diverted from his goal by any reputed impossibility, and, if necessary, he must be prepared to overthrow accepted ideas when they stand in his way. The advances of the genius are made by accomplishing the impossibilities of his fellows. In 1900, Bremer improved the arc light by doing exactly what everyone would have said was the wrong thing; before Marconi's experiments, in 1901, it was perfectly easy to demonstrate that trans-Atlantic radio-telegraphy must for ever be impossible; in 1910 Coolidge succeeded in drawing tungsten into the finest wires that were ever made, in spite of the knowledge among the experts that this metal was far too brittle to be even formed into a rod; in 1913 Langmuir produced the gas-filled lamp, when we all knew perfectly well that the best possible vacuum was absolutely necessary for an efficient lamp.

And so it will always be. He is not worthy of the name of pioneer who regards even the laws of gravitation, and of the conservation of energy, mass and momentum as dogmas which may not be attacked and overthrown when they block his way.

Research is best dealt with in bulk, so that workers in different fields may come into daily intimate contact. A man with a new idea will develop it more rapidly and carry it further if he discusses it over a pipe with a fellow spirit, even though the latter can do no more than listen to the exposition. If the subject borders on his own in any way, the cross-fertilisation of the sciences produced by such a discussion may lead to enormous results. But the research worker must also come into close touch with the industrial side of his own subject. The man in the factory meets many problems for whose solution he possesses neither the time nor the knowledge. The scientific man, however willing and competent he may be, would never meet these problems by himself. Keep these two men apart and the problem remains for ever unsolved, but bring their experiences together and progress is sure to follow.

For the success of this co-operation, mutual respect and confidence are required between the manufacturing and scientific sides of industry. This co-operation has been greatly developed with marvellous results in several directions in America, where its realisation has been facilitated by the aggregation of capital into huge trusts. To some extent the difficulty can be overcome by insisting that the research workers should periodically spend some time in the factory.

Each industry has its own problems which are more or less recognised by those engaged in it. I wish to direct your attention to one rather big problem of the utmost importance for the future welfare of our own country. I refer to our supply of energy. Past ages have placed vast stores to our credit in the great coal bank, but as we are drawing our cheques upon it with ever-increasing prodigality, and nothing is now being paid into it, sooner or later we shall find our cheques returned marked "no funds." It will not likely occur in our time, but, historically speaking, the exhaustion of our coal supplies is not remote. It seems fairly certain to come within three centuries, and may even occur within one. If our country is not to decline into a very inferior position by that time, we must, in the interval, either discover new sources upon which we can draw, or else we must contrive to live within our income.

* M. Breslauer: "Zeitschrift für Elektrochemie," 1910, p. 357.

Our annual consumption of coal is about 240 million tons per annum. Since the energy of one ton of coal is almost exactly 1 kw.-year, we are drawing on our energy capital at the rate of about 240 million kw.

We have, of course, other sources of energy of which we are aware, and possibly many others still unknown. The energy of disintegration of the atoms is enormous; when this is brought under our control we shall have an ample supply for a few ages more, and may even be able to ward off the approach of the next ice age, which is due in some thousands of years.

Another large store of energy, mainly derived from the kinetic energy of rotation of the earth, is made available to us through the tides. To raise the level of one square mile of sea by one foot involves the expenditure of about 340 kw.-hours. Under ideal conditions of admitting all the water at high tide, and releasing it again at low tide, this amount of energy would be available each half-tide of, say, 6½ hours. The tidal power is thus equivalent to about 55 kw. per square mile per (foot rise)². Ideal conditions could not be realised, and there would be losses in the turbines, and so we probably err on the high side if we take 10 kw. per square mile per (foot rise)² as the maximum we might expect to be able to utilise. This would give 10,000 kw. per square mile with a double tidal amplitude of 31.5 ft., and 500 kw. for one of 7 ft.

The Bristol Channel is by far the most favourable place in this country for the large scale utilisation of the tides, and I think the Firth of Clyde stands next because of the large area which could be enclosed within a comparatively short dam. We shall not be far out if we take the 10,000 kw. per square mile as applicable to the first, and the 500 kw. to the second of these areas.

A dam across the Bristol Channel from Breen Down to Lavernock Point, taking the Flat Holm on the way, would be under eight miles long. It would enclose well over 100 square miles of water, and would give, say, a million kw. One built across below Ilfracombe would be nearly 30 miles long, would enclose quite 10 times as much, and might be expected to give us about 10 million kw.

The only possible place for a dam across the Firth of Clyde is the shallow bar somewhere about the Girvan-Kintyre line. It would be in somewhat deeper water than the Bristol Channel ones, would be just over 30 miles long, and would enclose much about the same area as the lower Channel one. But, owing to the much smaller tides, it would probably give us no more than half a million kw.

We have other estuaries which could all be made to contribute their quota, but when all are harnessed I think we shall still be very far short of the equivalent of our present consumption of coal. The tides will never do more than replace a quite small part of our coal consumption.

The intensity of the sun's radiation as it falls on the earth's atmosphere is somewhere about five million kw. per square mile of normal surface, which would mean about three million kw. per square mile of land at our latitudes at the equinox noon. Averaging it out throughout the 24 hours and throughout the year we may call it one million kw. per square mile here. Over one-half of this is absorbed by the atmosphere, but what is left is ample for our needs, and we must find a method of turning it to our own ends before our coal supply is exhausted.

For the economical utilisation of the sun's energy on a large scale it will be necessary to keep the size of the powerhouse within reasonable dimensions, and to provide for keeping it running throughout the whole 24 hours. The direct application of the rays for driving a heat engine, which has actually been done at Meadi, in Egypt, would thus scarcely meet our needs, even if our climate were suitable, which it is not.

Storage of the energy in some intermediate form is thus necessary to enable us to concentrate it and to level up the discrepancies between the curves of supply and demand. Nature provides us with such storage in several forms. First we have gravitational energy in the shape of water raised from the oceans up into the clouds, and this has the especial merit that it makes some use of the areas covered by water. But the smallness of our island makes our share of this bountiful supply somewhat meagre. Other countries are more favoured in this respect than ours, and every development of the electrical transmission and utilisation of power increases the advantages which their industries consequently possess over ours.

The winds give another means of temporarily storing the energy received from the sun, partly in the kinetic form and partly in the compression of the air. Here, again, difficulties arise from the uncertainties of the winds, and from the enormous size which a large-power windmill would have. Still, research must not dismiss anything as impossible. The rapid advances in the size of steam and water turbines and of electric generators should teach us not to dismiss wind-power as utterly hopeless.

The last form of storage which I shall consider is chemical energy, to which class, indeed, our coal itself belongs. The only way in which the solar energy is taken up chemically in nature, so far as I am aware, is through the agency of plant life. Failing other means, we must grow our fuel. I therefore offer to our agriculturists the problem of producing a plant having a high calorific value, which shall utilise as high a proportion as possible of the energy falling on the areas devoted to its cultivation, and which shall be suitable

for use as fuel, either directly or by distilling alcohol or other spirit from it.

At the same time I ask our electrochemists to find a method of taking up that energy electrically from the plant, or its products, without first converting it into heat, so as to avoid the large thermo-dynamic losses inherent in the heat engine.

Or, better still, I ask our chemists to devise some reaction which will occur with the absorption of energy under the action of sunlight, and which can be reversed, under control, with the return of that energy in the electrical form. In short, give us a storage battery which is charged by submitting the active materials to sunlight, and which is discharged in the ordinary way.

As a last resource, in case these should fail, let our ultra-physicists combine with the biologists and produce between them a sufficient number of Maxwell's sorting demons to emancipate us from the second law of thermodynamics.

DIESEL ENGINE USERS' ASSOCIATION.

THE first of the autumn meetings of the Diesel Engine Users' Association was held on October 20th. After the election as members of the association of several engineers having the control of Diesel engine plant, certain resolutions were passed providing for alterations and additions to the rules. From the end of the current year an entrance fee of one guinea is to be charged to all new members elected.

To meet the demand which has arisen in many quarters for copies of the reports of proceedings and of the general information and data circulated by the Association, provision has been made for a class of "subscribers." Such "subscribers," who must be duly accepted by the committee, would consist of individuals or firms who are not qualified for full membership, and who would be entitled to receive the particulars circulated on payment of a sum of one guinea per annum. They would not be entitled to attend the meetings of the Association (except by special invitation of the committee), neither would they have any voice in the control of the Association. "Subscribers" may at any time send communications to the honorary secretary, and, in the opinion of the committee they are of sufficient general interest, such communications may be read and discussed at a meeting of the Association.

Air Compressor Explosions and Troubles.—The committee presented a report on the subject of explosions in air compressors and on the various troubles experienced with air compressors, having special reference to the accident which occurred at the generating station of the Smithfield Markets Electric Supply Co., Ltd., in February last. After discussion on certain points this report was adopted by the Association, and it is in due course to be printed and circulated among the members.

Tar Oils as Fuel for Diesel Engines.—MR. NAPIER PRENTICE gave further information in connection with the application which had been made by the Suffolk Electricity Supply Co., Ltd., for the avoidance or suspension for the duration of the war of the Konrad Aust patent in connection with the use of tar oils as fuel in Diesel engines. He considered that on national grounds such action should have been urged or supported by a Government department. Since the application had been made, however, his experience in the use of tar oils in Diesel engines without the fitting of any pilot ignition apparatus had been so satisfactory that he did not think it would be advisable that his company should incur any costs in connection with the adoption of the method of working covered by the patent. He was now effecting a saving of about 50 per cent. in fuel costs by the partial use of tar oil.

MR. GEOFFREY PORTER (president) gave particulars concerning a pilot ignition apparatus which had been fitted to a Diesel engine at Worthing. The saving in fuel costs obtained by using tar oil in this manner with about 10 per cent. of crude oil for the ignition charge amounted, up to date, to about 47 per cent. The only trouble experienced had been in connection with the formation of a deposit which choked the pulverisers. No trouble had been experienced with the exhaust valves or with the needle valves. He also stated that he had tried on another engine a mixture of three parts of tar oil to one of crude oil. The engine had knocked rather heavily, but at three-quarters of full load, and with fairly continuous running, no further troubles had been experienced. He, however, did not favour the use of mixtures of tar oil and crude oil. There was some risk of misfiring, and there was a difficulty in securing complete mixture of the two classes of fuel oil.

MR. W. A. TURNELL stated that he had worked a Diesel engine on tar oil with a slight alteration to the flame-plates, and he had obtained a saving of about 50 per cent. in fuel costs. He had not noticed any corrosive effect by the tar oil on the copper pipes or brass fittings.

Further information on the subject of actual experience in the use of tar oils was given by Messrs. F. W. STRICKLAND, J. BROADBENT, and W. FENNEL.

MR. NAPIER PRENTICE strongly urged that on national grounds, as well as in their own interests, Diesel engine users should continue to endeavour to make use of home products of fuel oil to the greatest possible extent in preference to fuel oil imported from abroad.

TRADE STATISTICS OF THE STRAITS SETTLEMENTS.

The following statements, showing the imports (not for transshipment) of electrical and other materials into the various Straits Settlement ports in 1915, is taken from the recently-issued official trade statistics. In compiling these statistics the first port of shipment is generally accepted as denoting the country of production. The values for 1914 are added for purposes of comparison, with notes of any increases or decreases.

IMPORTS INTO SINGAPORE.

	1914. Dollars.	1915. Dollars.	Inc. or dec. Dollars.
<i>Telegraph and telephone materials.—</i>			
From United Kingdom ...	145,000	389,000	+ 244,000
„ Belgium ...	3,000	—	3,000
„ Germany ...	1,000	—	1,000
„ Other countries ...	10,000	16,000*	+ 6,000
Total ...	159,000	405,000	+ 246,000

* Australia \$2,000.

<i>Tramway and railway materials.—</i>			
From Belgium ...	65,000	—	65,000
„ Germany ...	6,000	—	6,000
„ United Kingdom ...	200,000	77,000	123,000
„ Other countries ...	6,000	178,000*	+ 172,000
Total ...	277,000	255,000	- 22,000

* United States \$165,000.

<i>Electrical machinery.—</i>			
From United Kingdom ...	209,000	219,000	+ 10,000
„ Germany ...	17,000	2,000	- 15,000
„ Italy ...	6,000	5,000	- 1,000
„ Sweden ...	3,000	—	3,000
„ Belgium ...	1,000	—	1,000
„ United States ...	8,000	13,000	+ 5,000
„ Japan ...	2,000	8,000	+ 6,000
„ Other countries ...	17,000	40,000*	+ 23,000
Total ...	263,000	287,000	+ 24,000

* Netherlands \$17,000.

<i>Engines, boilers, and parts.—</i>			
From United Kingdom ...	325,000	266,000	- 59,000
„ Germany ...	3,000	—	3,000
„ United States ...	—	8,000	+ 8,000
„ Other countries ...	14,000	27,000*	+ 13,000
Total ...	342,000	301,000	- 41,000

* Denmark \$5,000.

<i>Machinery, other (except sewing machines).—</i>			
From United Kingdom ...	671,000	502,000	- 169,000
„ Australia ...	4,000	36,000	+ 32,000
„ Belgium ...	15,000	—	15,000
„ Germany ...	33,000	—	33,000
„ Holland ...	2,000	—	2,000
„ United States ...	60,000	65,000	+ 5,000
„ Other countries ...	125,000*	116,000	- 9,000
Total ...	910,000	719,000	- 191,000

* Selangor \$55,000.

<i>Lamps and lampware.—</i>			
From Belgium ...	8,000	—	8,000
„ Austria ...	6,000	—	6,000
„ Germany ...	125,000	17,000	- 108,000
„ United Kingdom ...	76,000	45,000	- 31,000
„ United States ...	9,000	6,000	- 3,000
„ Japan ...	4,000	15,000	+ 11,000
„ Other countries ...	15,000	33,000*	+ 18,000
Total ...	243,000	116,000	- 127,000

* Holland \$18,000.

IMPORTS INTO PENANG.

<i>Electrical machinery.—</i>			
From United Kingdom ...	128,000	44,000	- 84,000
„ Germany ...	20,000	—	20,000
„ Denmark ...	5,000	2,000	- 3,000
„ Other countries ...	20,000*	6,000	- 14,000
Total ...	173,000	52,000	- 121,000

* Holland \$7,000, and United States \$9,000.

<i>Machinery, other (except sewing machines).—</i>			
From United Kingdom ...	183,000	88,000	- 95,000
„ Belgium ...	3,000	—	3,000
„ Germany ...	10,000	—	10,000
„ United States ...	16,000	18,000	+ 2,000
„ Other countries ...	18,000	8,000	- 10,000
Total ...	230,000	114,000	- 116,000

	1914. Dollars.	1915. Dollars.	Inc. or dec. Dollars.
<i>Engines, boilers, and parts.—</i>			
From United Kingdom ...	328,000	163,000	- 165,000
„ Australia ...	60,000	33,000	- 27,000
„ Germany ...	5,000	—	5,000
„ Belgium ...	2,000	—	2,000
„ United States ...	16,000	—	16,000
„ Netherlands ...	39,000	5,000	- 34,000
„ Other countries ...	8,000	4,000	- 4,000
Total ...	458,000	205,000	- 253,000

<i>Lamps and lampware.—</i>			
From Belgium ...	2,000	—	2,000
„ Germany ...	27,000	2,000	- 25,000
„ United Kingdom ...	36,000	28,000	- 8,000
„ Other countries ...	6,000	11,000*	+ 5,000
Total ...	71,000	41,000	- 30,000

* Japan \$5,000.

<i>Telegraph and telephone materials.—</i>			
From United Kingdom ...	1,000	—	1,000

<i>Tramway and railway materials.—</i>			
From United Kingdom ...	13,000	2,000	- 11,000
„ Belgium ...	8,000	—	8,000
„ Holland ...	—	1,000	+ 1,000
Total ...	21,000	3,000	- 18,000

IMPORTS INTO MALACCA.

<i>Telegraph and telephone materials.—</i>			
From United Kingdom ...	12,000	2,000	- 10,000
<i>Engines, boilers, and parts.—</i>			
From United Kingdom ...	—	5,000	+ 5,000
<i>Electrical machinery.—</i>			
From United Kingdom ...	—	1,000	+ 1,000
<i>Machinery, other (except sewing machines).—</i>			
From United Kingdom ...	37,000	18,000	- 19,000
„ Other countries ...	10,000	11,000*	+ 1,000
Total ...	47,000	29,000	- 18,000

* Federated Malay States \$10,000.

<i>Tramway and railway materials.—</i>			
From United Kingdom ...	3,000	—	3,000

N.B.—Dollar = 2s. 4d.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

BRITISH DOMINIONS AND POSSESSIONS.—A Supplement (Part I) to the *Board of Trade Journal* of October 12th contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported to various destinations from British India, Canada, New Zealand, South Africa, Newfoundland, Egypt, Malta, Cyprus, Mauritius, and Ceylon. A further Supplement (Part II), issued on October 26th, contains similar lists for the Straits Settlements, Hong-Kong, Nigeria, Gold Coast, Jamaica, Barbados, Trinidad and Tobago, and British Guiana. The information given in these two Supplements supersedes that given in the Supplement published on July 13th last. Copies of the Supplements may be obtained, price 3d. each (post free 3½d.), from Messrs. Wyman & Sons, Fetter Lane, E.C.

UNION OF SOUTH AFRICA.—Instructions have recently been issued by the Union Customs Authorities in regard to the invoices of goods for importation into the Union, and the necessity of clearly distinguishing thereon the home consumption prices from the export prices of the goods.

Under Section 7 of Act 26 of 1914, the value of goods subject to *ad valorem* duty in the Union shall be taken to be the "true current value" for home consumption in the open market of similar goods in the principal markets of the country from which, and at the time at which, the goods were imported, including carriage to the port of shipment and the cost of packing and packages, but not including agent's commission when such commission does not exceed 5 per cent.; provided that in no case shall the value for purposes of duty, as above defined, be less than the cost of the goods to the importer at the port of shipment.

The Commissioner of Customs has pointed out that a fruitful source of trouble in connection with the invoices is the practice of many suppliers invoicing goods at c.i.f. or f.o.b. prices, and making a declaration that these prices are the home consumption prices, and then adding a further statement at the foot of the invoice that these prices include certain charges as detailed, for packing, railage, freight, &c. Such a declaration is obviously wrong.

In order to conform to the requirements of the Customs

Admission. I.P.M. 1000. (For the South Africa sub-
ject.) The following is a summary of the results of the
statement that the subjoined statement of values and costs
is accurately given in conformity with the requirements of
the Union Customs Tariff:—

Three tariff values	£
Actual trade despatch	£
Net value	£
Insurance	£
Railage	£
Shipping charges	£
Total	£

As a result of the above, the tariff is reduced to 100 per cent.
South Africa (i.e., actual f.o.b. cost).

BASUTOLAND, BECHUANALAND PROTECTORATE, AND SWAZILAND.—Proclamations dated August 14th provide for the introduction of amendments in the import duties in force similar to those recently made to the Union Customs Tariff by Act No. 37 of 1916—see the REVIEW of September 15th—and have the effect of bringing the Tariffs of these countries into line with the Union Tariff.

SWEDEN.—Since October 1st the exportation of copper ore and nickel ore has been prohibited by the Swedish authorities.

FRENCH COLONIES.—The provision of the Decree of February 24th last, in virtue of which tungsten ore was allowed to be exported from French Colonies and Protectorates (other than Tunis and Morocco), without special authorisation, when consigned to the United Kingdom, the British Dominions, &c., has now been abrogated by a Decree of the Minister for the Colonies.

TUNIS.—By a Decree dated September 8th the importation of various articles of foreign origin, or coming from foreign countries, is prohibited. The list of goods is the same as that prohibited to be imported into France and Algeria by the Decrees of May 11th and July 18th. (The full list was printed in the *Board of Trade Journal* of July 27th and September 14th). The prohibition is, however, not to apply to goods which are proved to have been dispatched to Tunis, or declared for warehousing in that country, prior to the date of publication of the Decree (September 16th). Relaxations of the prohibition may, as an exceptional measure, be authorised under conditions to be fixed by the Tunisian Director-General of Finance. Applications for import licences must be addressed by Tunisian importers to the local authorities.

CHILE.—A translation of the New Customs Tariff Law, to which reference was made in the REVIEW of August 18th, has recently been issued as a Parliamentary Return (Cd. 8,364), copies of which may be purchased (price 1s. ex postage) from the usual sale agents for Government publications. In addition to the translation of the new Law, a translation is included of a series of general rules respecting the application of the Tariff.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 14,658. "Electric cables and electric transmission systems." F. B. WHITAKER, October 16th.
- 14,660. "Sparkling plugs." M. FAVERO & H. J. BLANCH, October 16th.
- 14,661. "Sparkling plugs." A. E. FOWNS, FOWNS & SONS, C. W. TONKS, F. FOWNS, G. A. TONKS, October 16th.
- 14,666. "Telephones." S. SIMPSON, October 16th.
- 14,670. "Electrical communicating apparatus, telegraph system." A. M. BROTH, October 16th.
- 14,690. "Electrostatic apparatus." R. J. I. MEULEN & THE UNIVERSAL ONYX CO., October 16th.
- 14,691. "Electric signalling." S. Z. DE FREKANT, October 16th.
- 14,703. "Combined electric lampholder and movable-jointed bracket." H. C. GABRIEL, October 16th.
- 14,707. "Therapeutic electrical chair." W. BULLOCK, October 17th.
- 14,721. "Improving voltage regulations in alternating-current sub-stations, feeders, rotary converters, &c." A. M. TAYLOR, October 17th.
- 14,739. "Variable magnetic-opposed reaction-coil electric circuit." I. E. ASKE, October 17th.
- 14,745. "Magnetic circuit." A. D. CLARKE & E. G. F. BROWN, October 17th.
- 14,767. "Vacuum-type inverted converters." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO., October 17th. U.S.A., November 20th, 1915.
- 14,768. "Separators for electric batteries." O. OLDHAM, October 17th.
- 14,784. "Bayonet cap switch lampholder for electric lamps." P. J. MORRIS, October 18th.
- 14,797. "Spark plugs." H. W. F. IFFLAND, October 18th.
- 14,812. "Electrodes for secondary batteries." E. H. NAYLOR & S. F. TYLER, October 18th.
- 14,819. "Miners', &c., electric battery lamps." F. J. TURQUAND, October 18th.
- 14,825. "Voltage or intensity regulators." A. J. JULLIN, October 18th.
- 14,827. "Switches for electric circuits." S. W. BENDMIRE & T. C. W. FULLINGER, October 18th.

- 14,842. "Electric circuit breaker." J. H. COLLIE, October 19th.
- 14,843. "Electricity multiple cable-dividing boxes or apparatus." R. W. BROWN, October 19th.
- 14,886. "Dynamo-electric machines." A. H. MIDGLEY & C. A. VANDERVELL, October 19th.
- 14,927. "Electrical cut-outs and distributing boards." R. W. BILL, October 19th.
- 14,930. "Controlling electric arcs." D. F. COMSTOCK, October 20th. (U.S.A., October 20th, 1915.)
- 14,946. "Magnets for magneto-electric machines." G. F. COOKE, October 20th.
- 14,949. "Transmitting apparatus for electric signalling." S. OULIANINE, October 20th.
- 14,957. "Electric relays." S. OULIANINE, October 20th.
- 14,960. "Automatically-controlled relay commutators." S. OULIANINE, October 20th.
- 14,975. "Conductive hearths for electric furnaces." H. EICHELBERG & H. A. GRAVES, October 17th.
- 14,983. "Electrical signalling systems." A. W. SHARMAN, October 21st.
- 15,007. "Electric motor controllers, &c." J. ANDERSON & G. ELLISON, October 21st.
- 15,008. "Apparatus for regulating voltage of dynamos." A. J. JULLIN, October 21st. (France, June 9th, 1914.)
- 15,009. "Apparatus for regulating voltage of dynamos." A. J. JULLIN, October 21st. (France, June 16th, 1914.)
- 15,010. "Apparatus for regulating voltage of dynamos." A. J. JULLIN, October 21st. (France, July 28th, 1914.)

PUBLISHED SPECIFICATIONS.

1915.

- 13,568. MEANS FOR MINIMISING SPARKING AT BREAK OF A CIRCUIT CONTAINING INDUCTIVE LOAD. C. H. W. WILSON, September 24th.
- 13,806. ELECTRIC BELLS AND THE LIKE. R. E. H. LOVELEE, C. E. Ford and Edison & Swan United Electric Light Co., September 28th.
- 13,904. HIGH-FREQUENCY DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.), September 30th.
- 13,912. ELECTRO-MAGNETIC POWER TRANSMISSION APPARATUS. A. H. Neuland, September 30th.
- 14,047. SAFETY ATTACHMENT FOR SYNCHRONISERS. P. E. Means, October 4th.
- 14,160. DYNAMO-ELECTRIC MACHINES. A. H. Neuland, October 6th.
- 14,216. DYNAMO-ELECTRIC MACHINES OF THE COMMUTATOR TYPE. M. Walker, October 7th.
- 14,292. PORTABLE TELEPHONE AND TELEGRAPH INSTRUMENTS. International Electric Co., Ltd., and R. G. le Noir, October 7th.
- 14,233. TELEPHONES. International Electric Co., Ltd., and R. G. le Noir, October 7th.
- 14,530. ALTERNATING-CURRENT ELECTRIC MOTORS. J. G. Shaw, C. R. Shaw and H. G. Sharp, October 16th.
- 15,143. PRESSURE DIE FOR INSULATOR PRESSING MOULDS. P. Simonsen, October 26th. (November 17th, 1914.)
- 16,721. VEHICLES. British Thomson-Houston Co. (General Electric Co., U.S.A.), November 26th.
- 17,533. ELECTRICAL INDICATING DEVICES TO BE USED ON TAXI-CABS AND THE LIKE. H. Richardson & H. E. Gill, December 15th. (Cognate application, 6,065/15.)
- 17,833. SYSTEMS OF ELECTRIC WELDING. D. H. Wilson, J. M. Andersen and K. L. Curtis, December 31st. (December 31st, 1914, U.S.A.)

1916.

The numbers in brackets are those under which the specifications will be printed and bridged, and all subsequent proceedings will be taken.

894. CURRENT LIMITERS OR ELECTRIC INTERRUPTERS. K. Petersen, January 30th, 1915. [100,048.]
- 4,113. ELECTRIC FLASH-LAMP ATTACHMENTS. T. Y. Urwin & British Ever-Ready Co., March 24th. [101,585.]
- 5,240. SPARKING PLUGS. A. E. Lamkin, April 10th. [101,592.]
- 5,673. RAILWAY SIGNALING APPARATUS. J. P. O'Donnell, April 18th, 1916. [101,593.]
- 6,735. ELECTROLYTIC CELLS. C. Churchill & Co. and E. Geeraerd, May 11th, 1916. [101,598.]
- 7,347. MEANS FOR EARTHING ELECTRIC CONDUCTOR CONDUITS. G. Rushton and L. R. Lacy, May 23rd, 1916. [101,604.]
- 8,521. FITTINGS FOR PREVENTING THEFT OF ELECTRIC INCANDESCENT LAMPS. J. Harrington, June 16th. [101,607.]
- 9,577. RAILWAY SIGNALING APPARATUS. J. P. O'Donnell & H. S. Knox, June 17th, 1916. (Addition to 8,328/15.) [101,608.]
- 6,698. METHOD AND APPARATUS FOR VARYING THE PRESSURE IN ELECTRO-MAGNETICALLY-OPERATED CARBON PRESSURE REGULATORS. Akt. Ges. Brown, Boveri & Cie, June 25th, 1915. [100,788.]
- 9,745. ELECTRIC COUPLINGS. Allmänna Svenska Elektriska Aktiebolaget, July 21st, 1915. [100,948.]
- 10,554. ELECTRIC CABLE JOINT BOXES. C. Vernier, [101,614.]
- 11,678. MEANS FOR TELEPHONE COMMUNICATION TO AND FROM MOVING RAILWAY TRAINS AND THE LIKE. V. G. Werner & K. H. Warfvinge, August 27th, 1915. [101,343.]

British Trade with Canada.—The Ottawa correspondent of the *Morning Post* states that Mr. O'Hara, Deputy Minister of Commerce for the Dominion, giving evidence at the sitting of the Royal Commission, said that the sale of British-made goods was not pushed with sufficient vigour in Canada, whereas American exporters advertised widely, besides having the advantage of reports as to trade openings for American goods all over the Dominion. He suggested that the British Trade Commission service should be extended throughout Canada, representatives being appointed in all the large centres. Further, he recommended that the sister Dominions should also send trade agents to Canada.

THE
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ELECTRICAL REVIEW.

LINKING-UP AND WAYLEAVES.

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FROM time to time we have drawn attention to the great importance of the wayleave problem to the development of electricity supply in this country—a problem which, at all times thorny and difficult, has lately become of the greatest urgency in view of the national movement towards the linking-up of isolated electricity supply undertakings. It is one of the undesirable results of our highly complex civilisation that the rights of ownership of land in this old country, which formerly were properly regarded as held in trust for the community to which they really belong, in course of time have become entirely vested in the individual, who can dispose of them as he thinks fit; and unfortunately, only too often he is inclined to fix an outrageously exorbitant price upon the very moderate concession of the right to carry electric cables across his property, through the air or in the subsoil, although the loss of user or the inconvenience to which he is subjected by their presence is infinitesimal. And this is true, whether the owner be a private person, a public company, or even—save the mark!—a local authority. Moreover, the victims of this grasping policy are not only “limited companies,” which are so commonly regarded as fair game for plunder, but include also individuals and public bodies. The extortion thus attempted is usually a manifestation of greed combined with utter indifference to the public welfare. One can understand the position of an owner who, for æsthetic reasons, flatly forbids the suspension of wires over a picturesque tract of country which he claims as his property; but the attitude of the ordinary extortioner is merely contemptible, and frequently involves the unfortunate supply undertaking in heavy and unjustifiable expense to circumvent the obstacle.

From these conditions there appears to be but one avenue of escape—the power of Parliament, as the representative of the State, in which all ownership is ultimately vested, to override the eccentricities of the private owner, either by granting compulsory wayleaves or by compelling the owner to submit to arbitration and to accept a fair return for the small concession involved. Only by a quick and easy procedure at small cost can the due development of electricity supply in sparsely populated districts, and the linking-up of neighbouring supply systems, be brought about, and now is the time for the electrical industry to bestir itself with this end in view. The opportunity is particularly favourable in view of the declared intention of the Board of Trade to back up the supply undertakers in the direction of co-operation, the general weakening of individual rights and privileges under war conditions, and the national demand for economy and industrial reform. In view of the great importance of the subject we commend to the notice of our readers the article on “Wayleaves” printed elsewhere in this issue, the writer of which is not only “an interested onlooker,” but is also intimately acquainted with the situation and its needs. As he points out, “it is essential to the electricity supply authorities that simplicity of procedure, combined with speed and a definite time-limit, should be secured.” Our contributor outlines a course of procedure calculated to attain these ends, and the time is ripe for action on the part of the Institution, which has already recommended the formation of a Government tribunal to control the supply of elec-

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tricity, to which the necessary powers might be given. This would be preferable to placing the matter in the hands of the Board of Trade, which is already overburdened with powers and duties of the most diverse and, possibly, incongruous descriptions. Surely it is high time that the various branches of Government departments which at present deal with electrical matters were brought together as a single organisation under one head; the distribution of Messrs. Trotter, Ram, Nelson, and other officials amongst the different departments is adverse to the attainment of the highest efficiency, and though these gentlemen, thanks to their personal qualities, have hitherto succeeded in co-operating harmoniously and effectively, we cannot doubt that their more intimate association would tend to the welfare of the electrical industries.

DUBLIN'S ELECTRICITY SUPPLY.

THE fact that all was not well with the electricity supply undertaking of the City of Dublin was not unknown to anyone acquainted with the history of its constitution, equipment, and administration; our own columns have borne testimony to the troubles with which it has been beset, when from time to time the curtain has been partially raised and a glimpse of the inner working of the department has been obtained. But who, outside the staff itself, could have surmised that its affairs were in so unhappy a condition as it revealed by the remarkable report of Mr. P. W. d'Alton, of which we give the gist elsewhere in this issue?

That serious defects in the administration of the undertaking were suspected or known to exist was clearly shown by the action of the City Council, in appointing a Special Committee in April, 1915, to inquire into the conduct of its affairs; and the Committee was fortunate in its choice of an expert to carry out the exhaustive inquiries that were necessary, and to advise it as to the best course to pursue in order to remedy such diseases as he might diagnose. Few men in this country can have had a more varied or comprehensive experience in the erection and management of steam and electrical plant than Mr. P. W. d'Alton, who, moreover, possesses the quality, invaluable in dealing with Irishmen, of being of that nationality himself and able to understand the temperamental peculiarities of his fellow-countrymen. His verdict may be accepted without hesitation.

The report possesses two distinct aspects, largely independent of one another: it deals on the one hand with the actions of the City Council and its committees, and on the other with the work of the technical staff. That the former were influenced only to a moderate extent by the advice of the staff, and were sometimes decided upon in direct opposition to the views of the engineers, is shown by the report, and is also known from the history of the undertaking. We may especially draw attention to the following incidents: the determination of the Council to adopt the Pigeon-House Fort site for the power station in 1899, in spite of advice to the contrary and of its obvious disadvantages, together with the refusal of the Council to rectify its error in 1911, when an admirable opportunity offered to build a new station in a more favourable position; and the persistent placing of the contract for coal in the hands of one firm, at a price which, Mr. d'Alton says, is very high. It is difficult to conceive of circumstances which could justify such actions, but it is only too easy to imagine cogent reasons for them.

As for the technical staff of the department, which appears to be somewhat over-manned—for which the Council and not the engineers are responsible—it is difficult to account for its methods of operation,

except on the basis that economy was a secondary consideration. Apparently the regular practice has been to run the most extravagant plant in the station as much as possible, and to use the modern economical boilers and turbines only on the peaks! How anyone can hope to justify so extraordinary a system of procedure we cannot imagine. No better method could be devised if the object were to consume as much coal as possible.

It will be observed that Mr. d'Alton adversely criticises the system of dual control which obtains at Dublin; in this we cordially agree with him. We have repeatedly urged in these columns that if the best results are to be obtained from a commercial enterprise such as public electricity supply, it is essential, first, to select an able man as engineer and manager, and secondly, to give him a free hand, with full authority over his subordinates. We believe we are correct in saying that Mr. Mark Ruddle, the city electrical engineer, has never been given a free hand; his recommendations have been deliberately ignored by the Council, and he has not even been permitted to select his own staff, still less to dismiss those whom he found unsatisfactory. A committee should never attempt to run a department; its function is to see that the department is properly conducted by the manager whom it appoints for the purpose, and it should never on any consideration act behind his back or undermine his authority. In this instance we believe the Electricity Supply Committee is not to blame so much as the Council, which has repeatedly flouted the Committee's advice when the latter supported the engineer. In passing, we may point out that though Mr. Ruddle has for many years carried out all new construction, thus saving the cost of a consulting engineer's advice, he has never been awarded a farthing by way of remuneration for his special services.

Since writing the foregoing comments, we are glad to see that the Committee, by a majority of eight to one, has recommended the Council to invite Mr. d'Alton to take entire charge of the undertaking for a period of three years—the only course that offers a reasonable prospect of restoring prosperity to the undertaking. Of course there is another side to the question—will so busy a man as Mr. d'Alton, with his manifold professional engagements, including important functions in the service of the State, find it compatible with his own interests and those of his other clients to devote the whole of his time and energy to the service of Dublin City? It seems, to say the least, unlikely; but possibly some middle course may be found, which will enable him to supervise the reorganisation of the undertaking and to place it on a new basis without serious interference with his activities in other directions. Another question that arises is whether he, or any other eminent engineer, would care to take the risks involved in the attempt to pull the undertaking out of the difficulties in which it is entangled, at a time when the local and national circumstances are so unfavourable to a successful result. However, that is a matter for Mr. d'Alton to decide, and we hope that he will find it possible to come to the rescue of this ill-starred undertaking.

To eliminate German ownership from businesses in England during the war is of the utmost importance, but in the interests of British trade after the war it is

most essential that such ownership should be transferred to British concerns which are not only entirely above any suspicion of having enemy connections, but are best fitted by experience and in other ways to derive the fullest possible industrial advantage from whatever they take over. We feel, therefore, that the British electrical industry should find occa-

sion for self-congratulation in the announcement which is reprinted in our "War Items" to-day concerning the taking over of the British staff, stock, trading connections and records, also the "goodwill" of the A.E.G. Electric Co., Ltd., from the Controller appointed by the Board of Trade, by Messrs. Dick, Kerr & Co., Ltd. The activities of this particular A.E.G. branch were very extensive in the carrying out of what is best understood as industrial installation work, such as colliery, shipbuilding, and works equipments, a department of the industry in which it was possible for Continental manufactures to be introduced without receiving the same publicity as municipal contracts involved.

Messrs. Dick, Kerr & Co. have had a wide experience of work of this kind, and are pre-eminently suited to complete the contracts which were in the hands of the A.E.G. interests. The British staff of the latter will no doubt gladly welcome the change-over to purely-British employment, and, if we mistake not, their past experience and the business records of one kind and another that pass over with the "goodwill" will be of considerable value in the new owners' future trading and contracting operations. No questions relating to patents arise in connection with the transaction, as this particular A.E.G. concern was purely a contracting company. It is a moot point what is the value of the goodwill of a German company ordered to be wound up under the Trading with the Enemy Amendment Act. Such value varies according to the character of a business, and the mind of its valuer, in normal times; the profits, past and reasonably prospective, are really the only true criterion. That being so, what are the prospective profits of any A.E.G. company in the British Empire? If sentiment be a controlling factor, profits and goodwill will be very negligible quantities for some time. But the matter of winding up companies under the Trading with the Enemy Acts seems to be a very complex one, and if it be correct that winding up in such cases does not necessarily mean liquidation, then the Acts hardly seem to carry the matter as far as national sentiment desires. Nothing would please the enemy better than to feel that in spite of all our attempts to extirpate his influence from our industries, the way was, for want of firmness on our part, left open for an early resumption of his activities. The action of Messrs. Dick, Kerr and Co. in making this purchase is an indication that some of our firms recognise that the present situation demands appropriate individual initiative from within in organising the industry, and that too much dependence must not be placed on measures which the Government may introduce.

N.E.C.A. Activities. * ORGANISATION is not generally considered to be a predominant characteristic of the British race.

Rather have we allowed the Prussians to claim unchallenged the palm for that accomplishment. This being so, it was with pleased surprise that one read in Mr. Gribble's articles describing his experiences in Ruhleben Camp of the amazement of the Germans at the genius for organisation which the interned prisoners had shown. From a state of chaos, they so quickly organised themselves into a self-contained, self-governed community that the Germans were forced to express their astonishment and admiration, and to remark that, under similar conditions, they themselves would have been as helpless as babies.

The explanation of this seeming paradox would appear to be that, owing to a long period of military dominance, the Germans are now very amenable to discipline, or *compulsory co-operation*, whilst the British, with their love of freedom from restraint, resent any form of interference with their liberty of action, but will *voluntarily co-operate* for

common objects when the necessity or advantages of such co-operation are appreciated. It is largely because of this difference in national characteristics, and on account of the necessity of a prolonged period of education before the benefits of co-operating for the attainment of improved conditions are appreciated, that associations of contractors, manufacturers, &c., take so long in this country to become firmly established, and to attract sufficient members to justify an association in claiming for itself that it is representative of any particular section of industry.

The National Electrical Contractors' Association for example, has now been in existence for over 15 years, yet it could not be claimed either from the point of view of numbers or the amount of capital represented, that it is anything like representative of the whole electrical contracting industry of this country. There is still a very great amount of missionary work to be done before the great majority of electrical contractors become educated up to the idea that unity is strength, and that results may be achieved by co-operative effort which are impossible to the individual.

Among the objects of industrial associations are the raising of the status of their members, the improvement of the standard of work, the elimination of questionable practices, the obtaining of better prices, and so on. By far the most attractive of the objects are those which aim at improved financial conditions, and success in this direction generally outweighs, in the opinion of the majority, all other advantages. Thus we gather from a recent issue of *The Electrical Contractor* that the value of the E.C.A. cable rebate is appreciated far more highly than "the other less tangible, but (in the Editor's opinion) far more valuable assets derived from membership."

It was possibly with this knowledge, and with the object of enlarging its powers in the direction of developing the financial side of the Association, that it has now blossomed out into the N.E.C.T.A. Ltd. The formation of the limited company was necessary in order to put into force the *Guaranteed Work* scheme of the Association, as, according to its Charter of Incorporation, the Association was prohibited from doing any act which would give to its own members advantages not possessed by contractors outside its membership.

By the *Guarantee of Work* scheme customers will be indemnified against faulty or defective installations, and the Association will have power to compel members to "make good," should an installation be proved to be defective. The scheme is not exactly an insurance scheme, as no premium is payable; it is in effect, an agreement between the Association and the individual members that work proved to be defective shall be put right by the original contractor free of expense to the customer or, failing compliance, at the expense of the Association.

Now that the limited company has been formed, no doubt many other directions will open for its activities, such as the negotiation of trading treaties with other associations, by which members only will benefit; trading arrangements with supply authorities; the handling in bulk of employers' liability and other insurance matters; collective buying and distribution of goods; the organisation of exhibitions and co-operative showrooms, and so on.

We should like to see among the leading items in its programme the formulation of a definite and satisfactory form of apprenticeship, coupled with a final test examination, which shall confer as definite a status on electrical wiremen as is now possessed by the "registered plumber." Now that the Association is in touch with the City and Guilds of London Institute this is a matter which should not be difficult to bring to a satisfactory issue. We shall follow with increasing interest the development of the Association's useful work.

THE SUCCESSFUL MANAGER.

(COMMUNICATED.)

It is the American advertiser who has started appealing to the desire possessed by multitudes of rising to the top of the tree. The advertisement generally runs down the idea of working at a bench or behind a counter, and represents the man who goes in for the course of training advocated as sitting at a desk on which stands a portable telephone, laying down the law to some servile looking workman. We have heard a lot lately about "the will to power," and the Germans have shown us plenty of illustrations of that determination to be efficient which merits success.

A love of work and a determined character will fit a man to be made a foreman.

To these add a good education and technical ability, and one is fitted to be in charge of a department.

To the above add commercial ability and as many of the qualities enumerated below as possible, and any position is attainable.

The following catalogue of talents, natural and acquired, is chosen as suitable for a man occupying a very responsible position, and in charge of large number of men.

A superior quality of character and intellect are necessary. This will give a natural leadership over the average man. A sense of superiority will give a manager confidence. He will feel his dignity, and be proud of his position, and there is no harm if he is slightly puffed up with a sense of his own importance, provided he does not carry it too far, and suffer from swelled head. This would make him ridiculous, and no one in authority can afford to have those under him sniggering at him behind his back. His character and abilities must be such as to command their respect.

To be too intellectual is not desirable. Such a man is apt to look too far ahead for the best method, quite forgetting that it is the common-sense, practical method, adopted quickly, that is wanted. A very intellectual man is apt to become a recluse, a student of books rather than of human nature, and while such tastes may benefit a professional man, what we are considering is the best type of man to manage other men. It is better for a manager to leave the study of technical details to an assistant, whose duty must be to keep him informed of new improvements, and where to get the best information quickly. A strong will is absolutely necessary, and also the ability to put up a good fight if required. A peace-at-any-price man will always be imposed on. A reputation for being able to hit hard, and keep it up, will prevent other firms or employes from interfering in a manager's projects without good cause. A continual fighting attitude is, of course, bad. It will repel any thought of offering help from other managers, and drive away good assistants. The employé must feel that the manager's interests and his own are similar, if not identical, to ensure satisfactory and harmonious working. Firmness without despotism and the insistence of orders being carried out is what is wanted. The willingness to accept responsibility must go with a strong will. Unless he has this pluck a manager will be afraid to take any risks for fear of a venture turning out badly. Big successes are mostly obtained through taking risks. There is the strong temptation to throw the blame on a subordinate for an unsuccessful venture. To blame when the failure is due to the subordinate disobeying orders or showing lack of skill is just, but if this is not the case it is bad policy. If done repeatedly the best of the assistants will either leave to obtain fairer treatment or refuse to take an interest in their work.

A magnetic personality is a gift which is invaluable in dealing with directors, committees, or employes. If one is deficient in this respect a persuasive eloquence must be attained to take its place. The art of speaking well and in such a manner as to convince your hearer that your desires or plans of action are the correct thing and what should be carried out, is worth a good deal in business. The person may realise afterwards that you are wrong, but meanwhile he has agreed to what you want.

A mean, petty spirit is to be avoided. The minute

attention to details will probably result in the firm saving pence and losing pounds. It is right and proper that the rank and file should exercise economy in the use of material, but the seeing that they do so should be left to an assistant, and only occasionally receive the attention of the manager. The fidgeting over trifles irritates the staff and prevents the manager attending to the big things in business life. He should not suffer from a chronic bad temper, or be perpetually on the go. The former will breed indifference amongst the employes, whilst the latter gives him no time for the quiet planning which is necessary. Both are signs of nervous tension which should be improved either by a holiday or by a changed method of living. A manager must have a "thick skin." A sensitive man who is hurt by pin-pricks is no good for a high position. The higher the position the more one is subject to attacks, and to be badly affected by them impairs one's efficiency.

A good memory is a valuable asset, and anyone may make considerable improvements with or without the use of any special system. Thought control is a great help to efficiency. It gives one the power to exclude all other matters except the one requiring immediate attention, and when away from business to forget all about it, thus giving the mind a necessary rest.

Nothing absolutely ideal is to be expected in this world, and no man possesses all the qualities that have been enumerated. This, however, does not prevent any manager, or would-be manager, from glancing through the list, noticing something that he is well aware that he is rather lacking in, and determining to acquire, as far as possible, this aid to efficiency.

A LARGE D.C. STATION.

THE generating station at the Detroit Works of the Ford Motor Co. is said to be the largest purely direct-current station in the world, having a maximum rating of 65,000 kW. at 250 volts, and embodies many novel features in design. When complete, it will contain 14 reciprocating engines of 6,000 H.P. and one of 4,000 H.P., driven by gas and steam, and one 1,500-H.P. steam engine. These engines are coupled to Crocker-Wheeler generators of 4,000, 2,500, and 1,000 kW. respectively, running in parallel on a two-wire system at 250 volts, 80 R.P.M. Turbines were not used on account of the inadequate water supply; and the cost of the extra apparatus required for A.C. transmission was considered to balance the cost of the additional copper for the D.C. system. The installation was recently described by the electrical engineer to the company, Mr. Fred Allison, in a paper read before the American Institution of Electrical Engineers, and abstracted in the *Electrical World*, from which we take the following particulars:—

The operation of the composite gas-steam sets raises some novel points. In the interest of economy, it is desirable that the proportion of the load on the steam side be held to a minimum, consistent with proper governing in response to load variations, as the thermal efficiency of the gas side is greater than that of the steam side. Since it is almost impossible to make gas of a constant quality, the performance of the gas side of a given engine will vary somewhat according to the quality of the gas, the conditions of the igniters, &c. Therefore, if this side of the engine shows unfavourable symptoms, the load of that unit is automatically taken over by the steam side. In operating such large units, it is of great importance that the watch engineer shall have full control of the load on his engine. It will be seen, therefore, that the division of the load between units operating in parallel must within certain limits be handled between the engines and the switchboard, so that the control of the load is handled at the engine. Safety considerations as to the governing make it desirable that the sudden loss of the working load consequent upon the opening of the circuit-breaker shall instantly stop the production of power on the gas side. This end is attained by interrupting the ignition circuit coincidentally with the opening of the circuit-breaker by means of a switch provided for that purpose, and functioning with the circuit-breaker. Another device controlled by this switch is the gas-throttle control magnet, the de-energisation of which results in shutting off the gas supply.

The generators are of the commutating-pole type, with compound-wound magnets; the armatures of the 4,000-kw. machines are 15½ ft. in diameter and carry 1½ tons of copper windings each, while the commutator is 9½ ft. in diameter and contains over two tons of copper.

The brush bus-rings, with the interpoles and field windings, add another 1½ tons of copper, making in all over 5 tons to each machine. The armature shaft is 34 in. in diameter, and the journals are 60 and 60 in. long.

The gas engines are of the two-cylinder 4-cycle type, with cylinders 42 in. in diameter and a stroke of 72 in. The piston rods are chrome-vanadium-steel forgings 13 in. in diameter and 16½ ft. long. One gas engine weighs 250 tons, and has an output of

3,300 H.P. at full load: it is believed that this is the highest output per ton achieved up to the present. Water cooling is applied to the cylinders, housings, piston rods, valve boxes, and main bearings, and the water, leaving the engine at about 175° F., is used for boiler feed and for the hot water supply to the factory. The exhaust gases have a temperature of 1,100° F., and pass through a superheater situated in the steam line between the high and low-pressure steam cylinders. Afterwards the exhaust gases pass round the steam cylinder jacket, and finally through an economiser before discharge to the stack.

Ignition is provided by a double set of plugs to each cylinder, of the make and break type. The ignition leads pass through a switch, which is automatically operated when the equaliser switch

is closed, is normally open, and the upper, or "high-speed" contact, normally closed. The circuit-breaker, the closing of which this apparatus controls, has three separate poles, closed in predetermined sequence. The equaliser pole is closed first, and with it auxiliary contacts which control the field and armature circuits of the gyrostat motor. Before it is called upon to function, the motor has time to assume the speed of rotation corresponding with the voltage impressed upon the armature. When the motor armature is energised in the direction corresponding to generator voltage predominating over bus voltage, the governors, which are under the control of calibrated springs, will assume positions corresponding with the particular speed of rotation, the action of the governors being independent up to a certain speed, beyond which, as the result of links connecting them with a slight lost motion, they act as a unit. It has already been stated that the rotation of the governors only occurs when the direction of voltage difference is favourable to paralleling; when the magnitude of this voltage is such as to give the governor shaft a certain speed of rotation, then the low-speed contact is closed. The minimum voltage difference necessary to accomplish this is, in the case of the particular apparatus in question, 2 per cent. of the normal bus voltage. Should the voltage difference, however, amount to 2½ per cent. or more, the upper, or high-speed contact, is opened.

The switchboard is 424 ft. in length, and consists of 222 marble panels, each equipped with circuit-breaker, ammeter and 1,000-ampere double-pole double-throw knife switch, except a number of panels set apart for special purposes. The switchboard cost about £80,000, or £200 per foot run. There are 30 copper conductors from each machine, each consisting of a bar 6 in. × ½ in.; these are led to the circuit-breaker panels through a special runway, where they are secure against interference. Special precautions are taken to support these conductors firmly and to guard against buckling due to a short-circuit. All the copper is run at a working density of 750 amperes per sq. in. About 165

tons of copper was required for the whole installation.

The Ford factory has a covered floor space of 4½ acres, housing 8,000 power-driven machines. There are 178 feeders, distributing current by cables of 1 sq. in. section. Provision is made on a rack over the top of the machine shops for 90 pairs of 1-in. cable, of which 50 pairs have been installed. An elaborate signalling system has been provided, including a 200-pair telephone switchboard, connected with every distributing centre throughout the works, and with various points in the generating station. A signal board is in-talled consisting of four panels, each carrying 300 signal

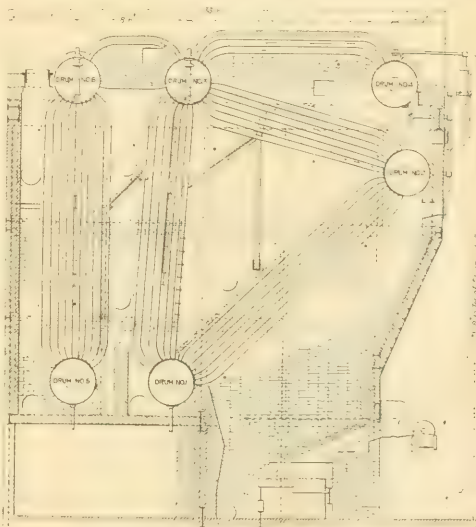
is closed, and, as indicated above, provision is made to open the ignition circuit if the main circuit-breakers open, thus cutting off the power on the gas side, while the governor takes care of the steam side. The make and break is effected by electromagnetic devices, to which the current is distributed in proper sequence by a simple commutating device, the mechanism being so timed that when the brush leaves a segment the corresponding igniter is at its maximum opening. Excellent results are obtained by this method of ignition.

The steam engines are of double-expansion Corliss-valve design, with cylinders in tandem on the piston rod. The diameter of the high-pressure cylinder is 36 in., and that of the low is 68 in. The stroke is 72 in. Steam at 700° F. enters the high-pressure cylinder at 180 lb. per sq. in.

The condensing water is cooled with sprays over cooling ponds.

Coal bunkers, stokers, and boilers are located on the third floor: the boilers are rated at 4,000 H.P. each, and are to be 14 in number, consuming 2,000 tons of coal per day of 24 hours, and evaporating 22,000 tons of water. The second floor is occupied by the main steam piping, the vacuum ash-hardening mechanism, oil filters handling 3,000 gallons per hour, and the exhaust gas economisers.

The I.T.E. circuit-breakers are triple-pole and double-throw, controlling the positive, negative, and equaliser leads, and providing connection with either of two sets of bus-bars. They are equipped for remote control, but can be closed by hand; overload time-limit and reverse-current devices are provided. The poles of the circuit-breakers are closed in the order equaliser, positive, and negative, interlocking gear being employed to ensure this sequence. I.T.E. motor-operated field rheostat mechanisms are installed, enabling the voltage of all the generators to be regulated from a central control board. In view of the importance of putting generators in parallel with others already on load without disturbing the regulation, where the generators are so large, this operation is effected with the aid of I.T.E. "gyrostatic voltage balance detectors," which control the circuits of the motors closing the negative poles of the incoming generators. The detector consists primarily of a pair of switches in series with each other, and connected in circuit with the motor: the movable members of these switches are controlled by gyrostatic governors mounted upon a vertical shaft rotated by a motor immediately below it. Whilst in use the field winding of this motor is connected across the mains of the 250-volt control circuit, while its armature is at the same time subjected to the potential difference which exists between the associated generator and the bus-bars. The direction of rotation of this armature depends, therefore, upon whether bus or generator voltage predominates, and its speed in either direction depends upon the voltage difference. By means of a specially designed clutch placed between the motor and the governor shaft, the motion of the former is transmitted to the latter only when the direction of rotation is that caused by a predominance of generator voltage over bus voltage. When rotating in the opposite direction the motor runs free. Close to each voltage balance detector is an automatic cut-out, which interrupts the motor armature circuit should the voltage difference attain such a magnitude as to produce a dangerously high speed of rotation. The lower right hand, or "low-



SECTION OF BADENHAUSEN 4,000-H.P. BOILER.

lamps, a green lamp showing on the board when a feeder circuit is in operation, and a red light when it is not.

The prime movers were designed and constructed under the direction of the Ford Motor Co.

No information is given regarding the gas supply, but further particulars of the boiler plant are given in an article by Mr. J. P. Badenhause in *Power*.

The author states that the problem was to obtain the highest possible output from a given volume of boiler-room space. The

existing boiler room was designed with 14 bays each containing two boilers of 40 H.P. representing at 50 per cent over normal load) one H.P. per 35.44 cu. ft. of volume; the large boilers now being installed are expected to give 4,000 H.P. per bay, or 1 H.P. per 106 cu. ft., representing a saving in cost of buildings of £140,000, in addition to the saving in space occupied. A reduction in coal consumption of 14 per cent, equivalent to £40,000 per annum, is also anticipated. [The American "boiler horse-power" represents an evaporation of 34.5 lb. of water per hour from and at 212° F.]

The design of these boilers, the largest ever installed in the United States, was a difficult problem, involving many studies and sketches by the author.

The type considered throughout was the Badenhausen water-tube boiler, with various modifications; the design finally adopted is illustrated on p. 509. The objects aimed at were as follows:—(1) Minimum floor space. The boiler has a width of 24 ft. and a depth of 16 ft. at the floor level. (2) Maximum heating surface in available space. The boiler has 25,000 sq. ft. of heating surface. (3) Large furnace volume. (4) No soot locks. (5) Continuous unrestricted circulation. (6) Accessibility in the sense of permitting ingress into the setting, so that every tube and every baffle can be touched, cleaned and replaced by human hands. (7) Good support and suspension. (8) Dry superheated steam at any rating.

The design consists essentially of the boiler proper with an additional feed-water preheating section. Owing to the fact that the heat is absorbed more rapidly the greater the difference in temperature, it is sound engineering to preheat the feed water at one stage and bring this feed water into another boiler stage where it is evaporated. The third and final stage is to superheat the steam.

Referring to the figure, the water enters drum No. 6, flows downwardly in the rear bank and enters the forward bank of tubes connecting drums Nos. 5 and 6. The gases flowing from the preceding heating surface touch one half of the tube bank and then the other; and as there is a difference of temperature in each half of the tube bank, there is also a positive circulation owing to such difference. This gravity circulation in the preheating section is an excellent feature.

After the water is heated, it passes through the horizontal tubes from drum No. 6 to drum No. 3, then drops down through the vertical tubes at the left of the bank into drum No. 1, entering from here into the general circulation. From drum No. 3 the steam flows through the tubes at the top of the setting into drum No. 4. All the moisture is thus eliminated, and the steam is slightly superheated. From drum No. 4 the steam goes into a Superno superheater, in which it is expected that a superheat of from 250° to 350° will be obtained.

The stoker is of an extra-heavy Taylor design, the grate surface approximating 21 ft. wide × 11 ft. deep.

Since the first four units were installed, orders have been received for three more boilers, all of which will be built in the plant of the Badenhausen Co.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

The "Kantark" Patent Ironclad Fuseboard.

THE MIDLAND ELECTRIC MANUFACTURING CO., LTD., of Stafford Works, Barford Street, Birmingham, have introduced a new type of distributing board under the above title, for which many advantages are claimed. As shown in fig. 3, it consists of a cast-iron box in which the bus-bars are fixed behind a protecting

and a detachable fuse-carrier which carries the fuse wire and blade contacts. The shield is hollowed out to form the outer wall of the arc chamber, and scalloped at the sides to form ventilating slots leading from the arcing chamber (shown in section in fig. 5). The contacts in the base are covered with detachable protective shields, so that the live parts cannot be touched even when the fuse bridges are removed; the contacts themselves are solid brass blocks, provided with double set screws which clamp the circuit wires and ensure a low-resistance contact. The blade contacts are double and of ample section, and the fuse wire is fixed under a single washer and nut at each end. The arcing chamber is lined with absorbent material, and the fuse may blow repeatedly without damage. A special feature is the small number of connections between the supply cables and the circuit, the fuse being attached directly to the bar, as shown in fig. 6, which also illustrates the main cable lug, which is reversible to allow the cable to enter from the top or the bottom of the board. The outer case can be made watertight with a gasket, and the door can be fitted with a glass panel if required. Teak cases are also made, but only in one size, whereas the iron cases are made double and triple pole for 2 to 10 ways, and 10 to 50 amperes, at 600 volts. Simplicity and cheapness are included amongst the merits claimed for this device.

B.T.H. Instrument Transformers.

In a recent list (No. 4,591) issued by the BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, full particulars are given of their instrument transformers for circuits up to 12,000 volts.

The range of current transformers includes air, porcelain, compound, and oil-insulated types in eight different forms for varying

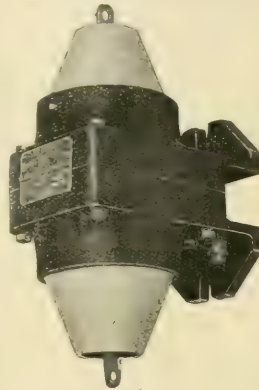


FIG. 1.—B.T.H. CURRENT TRANSFORMER.



FIG. 2.—B.T.H. POTENTIAL TRANSFORMER.

currents and pressures. All transformers of the same ratio and form are interchangeable, and transformers of the same form but of different ratios may be interchanged if the instrument is re-scaled; the secondary windings being uniform throughout.

We illustrate in fig. 1 a type C, form B, compound-insulated current transformer, suitable for primary currents up to 300 amperes, where the voltage between phases and earth does not exceed 4,000. The core and windings are assembled in a cast-iron



FIG. 3.—KANTARK IRONCLAD FUSEBOARD.

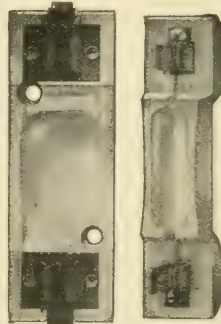


FIG. 4.—"KANTARK" FUSE UNIT, OPEN.



FIG. 5.—SECTION OF ARCING CHAMBER.

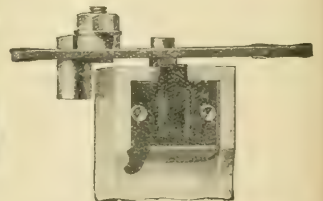


FIG. 6.—BUS-BAR CONNECTIONS.

shield, and the individual fuse elements are secured directly to the bars at one end, the body of each element being supported on teak bridge battens, which allow plenty of under-space for the main and branch cables. Each element (fig. 4) consists of a porcelain base carrying the fixed contacts, and provided with an arcing chamber,

case, which terminates in porcelain cones, through which the primary terminals project. The secondary leads are brought through bushed holes to special terminals.

Fig. 2 is a type VS, form AA, single-phase, oil-insulated, potential transformer, one of the series of such transformers

supplied by the company. Air-insulated transformers are supplied for pressures up to 6,600 volts, in sheet-metal casings, and oil-insulated transformers for pressures of 5,500 volts and upwards. These are in cast-iron cases with the core and windings suspended in oil. The terminals are mounted on porcelain insulators fixed to the cover. The transformers are listed complete with cartridge fuses; but for 5,500 volts and above, clips are provided to allow the substitution of expulsion-type fuses. Transformers without fuses can be supplied if required.

A Sparkless Signalling System.

Messrs. JOHN DAVIS & SON (DERBY), LTD., of All Saints Works, Derby, have brought out a system of signalling for use in mines, in which, it is claimed, the sparking danger is entirely overcome. The bell is of the makers' patent "solenoid" type, with no contact breaker, the gong being struck by an iron plunger which is actuated by a solenoid through which an intermittent D.C. or an alternating current is passed. Means are provided for adjusting the position of the gong with regard to the striker, enabling the bell to operate with a battery current or with D.C. or A.C. supply at any reasonable voltage or frequency. Obviously there can be no question of sparking at the bell. When direct current is used to actuate the bell an interrupter is provided, in the shape of a relay in a water and flame-proof cast-iron case, the lid of which fits on wide machined faces. The relay is fitted with special devices to damp the sparks at the contacts, and has a special winding to reduce sparking on the line, so that reliance is not placed on the flame-proof case for safety. The line circuit and relay can be worked off a 4-volt supply, so that dangerous sparking is practically impossible.

Main Regulators.

Main regulators manufactured by the GENERAL ELECTRIC CO., LTD., of London, which we have previously described, have been hand-operated, but the present example, forming part of an important contract for a large municipality, is driven by a small "Witton" electric motor; this is mounted on the top of the regulator, and is controlled from the main switchboard by means of a pair of small push switches, forming one unit, and so arranged that they cannot be left in the "on" position. There is one switch for each direction of operation and an interlock prevents both switches

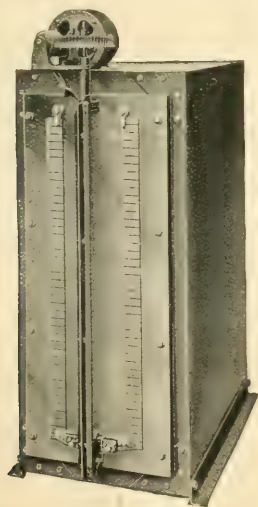


FIG. 7. ELECTRICALLY-OPERATED "WITTON" MAIN REGULATOR

being operated at the same time. To preclude damage to the motor when the main regulator control has come to the end of its travel, either at the top or the bottom, a resistance is inserted in series with the motor, and, in addition, a flexible coupling is provided between the motor and the worm driving the gear wheel. This construction avoids limit switches and is very simple and effective. The regulator itself is of the Witton rectangular pattern with grid resistance, one of a wide range of types which are manufactured by the G.E.C.

Excess Profits Duty.—As stated in our last issue, the Board of Referees have now given their decision in the appeal of the Melbourne Electric Supply Co. Ltd., and the Electric Supply Co. of Victoria, Ltd., under Sec. 42 of the Finance (No. 2) Act, 1915, and have increased the statutory percentage from 6 per cent. to 7½ per cent. The Crown were represented by Mr. Ernest Clarke and Mr. W. C. Stamp; Mr. W. Allen, instructed by Mr. Sydney Morse, appearing for the appellants. Evidence in support of the appeals was given by Mr. R. Percy Sellon (managing director of the Melbourne Co.), Mr. G. Saies (secretary of the Victoria Co.) and Mr. Arthur D. Bird, of Messrs. Humphreys-Davies & Co.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear in the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

"Summation Watt" Capacity of Field Rheostats and the Like.

My attention has been drawn to the reference in Dr. C. C. Garrard's book, "Electrical Switch and Controlling Gear," re the "Summation Watt" formula advocated by me in the ELECTRICAL REVIEW, page 257, February 13th, 1914, as compared with his formula.

Dr. Garrard's formula "square the mean of the maximum and minimum field amperes multiplied by the resistance of rheostat," is only true if the curve plotted between amperes and rheostat ohms is a straight line. Only for extremely short ranges is this true, and the greater the range between maximum and minimum amperes, the greater the inaccuracy of his formula.

Referring to my letter in your issue of February 26th, 1914, I showed that with a rheostat resistance of 3½ times that of the field his formula gave a rheostat size 67 per cent. greater than that actually required.

He points out that my formula, viz., $\frac{I_{max} \times I_{min}}{I_{max} + I_{min}} \times R$, becomes approximately equal to $I_{max} \times V = \text{constant}$, which he states is absurd. Now, the greatest possible current range is obtained in a potentiometer rheostat where I_{min} is zero. In an article dated March 26th, 1915, in the ELECTRICAL REVIEW, I gave the correct formula for such a potentiometer rheostat as $I_{max} \times V$, plus the constant watt loss due to resistance being across excitation circuit. However, in an ordinary rheostat the constant watt loss does not exist, therefore the original formula holds good.

In practice a designer may be limited to a relatively small number of resistance units. This is particularly the case if open wire spirals are used. Then to obtain a very large "R" compared with field ohms, a much larger rheostat would be required than one wherein the unit range was not so limited; this, however, is not the fault of the formula but of the facilities at the disposal of the designer, and is no reason for advocating an incorrect formula.

Stretford, November 2nd, 1916.

L. Boothman.

P.S.—I have sent a copy of above to Dr. C. C. Garrard.

With reference to Mr. Boothman's letter of November 2nd, I would point out that the various formulae discussed are all empirical; none of them are strictly correct. When I first saw Mr. Boothman's formula I was impressed by it and endeavoured to use it; I, however, came up against the difficulties I have mentioned in my book, and therefore reverted to the formula I had previously used. Mr. Boothman has, with considerable ingenuity, worked out different formulae giving the summation-watt capacities for the various types of rheostats. I venture to think, however, that the simple formula that I have recommended, which can be applied to any form of rheostat, is the best for all-round practical purposes. It must be borne in mind that the I_{max} and the I_{min} in the formula are the maximum and minimum currents flowing in the rheostat itself.

I am not sure that I follow the argument that Mr. Boothman gives in his letter. Taking, however, his result as given for a potentiometer regulator, he gives—

$$\text{Summation-watt capacity} = I_{max} \times V + V^2/R$$

Now, I_{max} is constant independently of the rheostat; V is also constant. Mr. Boothman's formula therefore says that the higher the resistance of a potentiometer regulator, the smaller is the summation-watt capacity. Now, as I use the term summation-watt capacity, I mean a figure of comparison of the size and the cost of the regulator. In this sense I do not think the result, deduced above from Mr. Boothman's formula, is correct. There can be no doubt that there is a certain value of rheostat ohms which gives the most economical form of potentiometer regulator, less and higher ohmic values being both worse; but Mr. Boothman's formula says that the higher the rheostat ohms, the less the summation-watt capacity.

I also do not think Mr. Boothman has answered my argument as regards his formula for ordinary shunt regulators. He re-states my argument in his letter, but I cannot see that he answers it.

I do not wish to deny the utility of Mr. Boothman's formulae, and have no doubt that when used properly they give very useful results. I have merely wished to point out that they are not universal, and, in my opinion, must be used with caution.

To sum the matter up, the figure for the summation-watt capacity should only be used for comparing one rheostat with another; the figure has no very precise physical meaning. In my experience, the formula I have recommended gives perfectly satisfactory results, and, by reason of its simplicity and adaptability to any kind of rheostat, is to be preferred to more complicated ones.

Charles C. Garrard.

Birmingham, November 6th, 1916.

The Prevention of Bribery.

With reference to your leading article on this subject, I wish to say that the League has always attached more importance to propaganda than to prosecutions, and it has been very active during the last ten years in its efforts to create and maintain a healthy public opinion. In one direction which you mention something has undoubtedly been accomplished—in a conference with head-

others. The fact is that so many in responsible positions, and among whom are the young people, to say nothing of the representatives of all denominations, pass by on the other side of the street which the League could do more, but not without the effort which I should very much like to see come from the electrical branch of the engineering industries to the same extent as from other branches.

We must not be flattered that this is undoubtedly a hindrance to the enforcement of the Prevention of Corruption Act. There is no question of blackmail in this connection than in regard to any other crime. Without the fiat the public is amply protected, for it is not generally known that a summons could in any case be granted by a magistrate except on a sworn information (though the Attorney General, who can stop prosecutions, is not, judging by his speech in Parliament, aware of the fact); next, if the magistrate commits, before a grand jury and a petty jury, then an appeal may lie to the Court of Common Appeal; and lastly, proceedings may be instituted for malicious prosecution under the Vexatious Indictments Act.

The Secretary of the Bribery and Secret Commissions Prevention League, Incorporated.

London, E.C., November 6th, 1916.

Between Two Stools.

Having been the victim of circumstances arising out of my acceptance of a post within the Greater London area, I feel it to be my duty to warn those of your readers who, if tempted to transfer their services from one certified establishment to another, may find themselves similarly involved.

I was privately offered a more remunerative and equally important position (my previous one being a badged occupation in a certified establishment which I had held for a number of years) which I accepted, subject to being able to obtain a leaving certificate.

This, due to the magnanimity of my chief, I obtained, but within a short time of taking over my new duties, I received a curt notification from my future chief, that owing to possible complications in which he might be involved as a result of the transfer, the engagement must be considered off.

Let it be clearly understood that no fresh facts had been disclosed or altered circumstances arisen between the date of my acceptance of this post and the receipt of the aforesaid curt cancellation.

I leave it to the imagination of your readers to supply the details to complete the picture, and offer them my advice: Don't be tempted by private offers unless completely assured that you are dealing with persons alive to the responsibilities vested in the higher commands, and not with those unscrupulous enough to sacrifice the career of a subordinate on the altar of their own irresponsibility.

Victimus.

LEGAL.

HIGH-SPEED TELEGRAPH PATENT EXTENDED.

IN the Chancery Division, on Wednesday, November 1st, Mr. Justice Sargant heard a petition for the prolongation of a patent granted to Fredk. George Creed and Wm. Arthur Coulson for improvements in high-speed automatic telegraphy, with the object of reproducing telegraphic messages in printed characters.

MR. CREED gave evidence that since 1896 he had devoted himself to the problem of making high-speed telegraphy automatic, with the object of dispensing with the skilled telegraphist. About 1906, the late Lord Kelvin became interested in his keyboard perforator, and used his influence with Lord Stanley, the then Postmaster-General. Witness gave a demonstration at the Post Office, with the result that they gave him an order for ten printers and six receivers. The witness described the different steps which led to the introduction of the latest machines.

The SOLICITOR-GENERAL (Sir George Cave, K.C., M.P.) said he was not there to oppose the petition, but merely to assist the Court. In these cases it was of the greatest importance that petitions should not be extended beyond the statutory period. He thought that this was a very special case. The petitioner must show that his invention was a meritorious one, and that he had not been sufficiently remunerated owing to no fault of his own. But he recognised the merit of this invention.

His LORDSHIP said that, owing to circumstances over which he had no control, the patentee had not been able to push the invention in the way he might have done. He proposed to grant an extension of seven years, not to exceed five years after the termination of the war. As the patent had expired on October 17th, he granted a new one for the period mentioned.

RAILWAY AND COMPRESSED AIR. THE ARBITRATOR'S AWARD.

MR. ALEXANDER ROSS, President of the Institution of Civil Engineers, as arbitrator, has issued his award touching a difference between the Postmaster-General and the Great Eastern Railway Co. The matter was reported in our issue of October 20th.

The Arbitrator, in his award, states that "having heard counsel and witnesses for both parties, and having examined that

part of Liverpool Street Station under which the intended works will be executed, and also the works on each side now being executed by the Postmaster-General, he affirms and awards that it is not necessary to use compressed air in carrying out the works."

BRITISH POWER, TRACTION AND LIGHTING CO., LTD., v. HODGSON.

ON Monday last, Mr. Justice Peterson, in the Chancery Division, concluded the hearing of a summons in this action, by which the plaintiff company asked that the defendant, A. E. Hodgson, might be ordered to pay into Court the sum of £7,563, in accordance with the certificate of the Master dated July 20th, 1906.

The case, as stated by Mr. HUGHES, K.C., for the plaintiffs, was that the defendant was a promoter of the company, chairman of directors, and a managing director, and without the knowledge of his co-directors or other members of the company entered into contracts which amounted to fraud or fraudulent breach of trust. The action was started in 1903, alleging, amongst other things, that at defendant's suggestion the company paid commissions to a syndicate, whereas the defendant himself was the syndicate and benefited by the commissions so paid, and that he negotiated a contract in France for the company while he had himself a contract on more favourable terms. Judgment was given for the plaintiffs in the action by consent on May 2nd, 1905, Mr. Hodgson having become a bankrupt during the course of the proceedings. He had now obtained his discharge, and the present summons was issued, alleging that as the finding of the Master was based on a judgment in an action for fraud or fraudulent breach of trust, he was not protected by his bankruptcy in respect of the amount found due by the Master's certificate.

MR. TOMLIN, K.C., for the defendant, argued that he only consented to judgment on the understanding that all charges of fraud were withdrawn, and that the plaintiffs' rights should be to prove in his bankruptcy for any sum that might be found due under the order. If the judgment was one based on fraud, he said the defendant would take steps to have it set aside, on the ground of mistake on the part of his legal advisers, as he had all through refused to settle the case unless all charges of fraud were withdrawn.

In reply to the contention, Mr. HUGHES pointed out that the receiver in bankruptcy had taken no steps before the Master, but the proceedings had been attended by the defendant personally.

His LORDSHIP held that the judgment in the action was based on fraud, and nothing else; and that, therefore, the defendant was not protected by his bankruptcy. He accordingly ordered him to pay the amount found due into Court, and the costs of the action. The order would, however, be stayed pending an appeal and a summons the defendant might issue for further time, in view of his taking proceedings to set aside the order of May, 1905.

DUBLIN ELECTRICITY SUPPLY.

IN a report of the Special Committee appointed by the Dublin Corporation to inquire into the administration of the Electricity Committee and matters relating thereto, it is stated that, having considered the report of Mr. Patrick W. d'Alton, M.Inst.C.E., the expert consulting and inspecting engineer appointed to examine and report upon the questions involved, it has been resolved, by eight votes to one, to recommend that the Town Clerk write to Mr. d'Alton asking him upon what terms and conditions he would undertake the entire management of the undertaking during a period of three years.

The Special Committee was appointed as far back as April, 1915, and on August 7th requested Mr. d'Alton to make a thorough investigation of the Dublin electricity undertaking from its inception to the present time, and to report on ways and means of rendering it more profitable to the city. In December last, after making an exhaustive study of the history and constitution of the undertaking, Mr. d'Alton submitted his views to the Council in a very full report, parts of which were published in the local Press in February, without the authority of the Corporation.

Mr. d'Alton's report, and replies thereto by Mr. Ruddle, city electrical engineer; Mr. Kettle, deputy engineer; Mr. F. Allan, secretary of the Electricity Committee; and Mr. Mangin, city accountant, are now officially published. In a supplementary report, Mr. d'Alton states that he has now an opportunity of bringing his original report "into truer perspective than that into which it appears to have drifted as a result of premature and incomplete publication," and of the premature and incomplete publication of other reports written with, he doubts not, perfectly sincere motives to discount his conclusions.

The questions to be reported upon were, besides administration, the prices charged for light and power; the number of engineers and workmen employed and paid out of revenue; the salaries and wages paid out of revenue; the procedure adopted with regard to purchasing coal; charges for interest and repayment of moneys borrowed; and the question of additional borrowing. The following is an abstract of the report:—

Referring to the difficulties with which all electrical undertakings had to contend in the early days of electricity supply, Mr. d'Alton remarks that no useful purpose would be served

be dealing with the troubles experienced at Dublin prior to the erection of the generating station at Pigeon House Fort and the adoption of a three-phase system of distribution to sub-stations at 5,000 volts, under the advice of the late Mr. Robert Hammond.

The Pigeon House Fort site was adopted, "possibly for political reasons," against the advice of the city electrical engineer, Mr. Mark Ruddle, and of Sir Alexander Kennedy, and its selection, says Mr. d'Alton, cannot be justified; it was a mistake of great magnitude, for which the economy of the undertaking must suffer throughout its existence. It has involved much additional capital expenditure, increasing the cost per unit, and has caused losses in transmission, in time spent by the staff in travelling to and from so inaccessible a place, and in money spent in transport of material, besides duplicating centres of control and necessitating an increased staff of workmen. The mistake might have been retrieved when the installation of modern generating plant was being considered, but the opportunity was not taken, and Mr. d'Alton does not regard the question of changing the position of the power house as falling within the scope of his inquiry.

Reviewing the conduct of the undertaking, the author highly commends the enterprise, ability, and loyalty of the successive Electric Lighting Committees which have so well served the undertaking; under their guidance the output has increased from 3,000,000 units sold in 1906 to more than 9,000,000 in 1914-15. But the distribution of the sales over the day has not been equally satisfactory, and unless the motive power and long-hour lighting connections are developed, the load-factor cannot be so improved as to enable the engineering staff to generate electricity at a reasonable cost.

Large numbers of gas engines are used in the city which should be replaced by electric power; the curve of power output itself indicates by its steepness that there is plenty of scope for development of the motor load, provided that expert engineers are employed as canvassers. At present the undertaking is controlled by a chief engineer who is not a manager, and a manager who is not an engineer; Mr. d'Alton holds that the engineer of such a system should be manager as well, and as such should be held responsible for the successful conduct of the business from start to finish.

The average price charged for electricity in Dublin (2.66d. per unit) is easily the highest of the 14 undertakings which have an output for private supply and public lighting only (no traction), exceeding 6,000,000 units a year (1.76d. per unit). Mr. d'Alton points out that the rates for private supply in Dublin are unduly high, and that a reduction would increase the demand, improve the load factor, and benefit the service with profit to the city; "it is generally the case that the revenue from new consumers under a reduced rate counterbalances any loss by such reduction to old consumers in any given year."

Turning to the power station, Mr. d'Alton says it is difficult to understand how, even 15 years ago, so large a scheme should have been provided with a power house incapable of adequate extension and equipped with so little generating plant; the result has been heavy expenditure on alterations and reconstruction. The Stewart engines originally installed were probably of a type as good as any then available, but were a constant source of trouble, and were not taken over for several years after their installation. No steam consumption figures were asked for or taken, but the engines were condemned on defects of construction, and were partly reconstructed by the Oerlikon Co. A Belliss-G.E.C. set of 1,500 r.w. capacity was added in 1906, but does not seem to have turned out to be an economical steam unit. With the original generating sets were installed four Babcock and six Lancashire boilers; Mr. d'Alton cannot understand why the latter were included, and says they must have cost the ratepayers a large sum of money for repairs, maintenance, stand-by losses, and steam for forced draught. The city electrical engineer was in no way responsible for the situation or equipment of the power house, which apparently, when he took charge of it at the end of Mr. Hammond's connection with the job, he considered to be little better than a scrap heap.

In 1907 a Richardsons-Westgarth-G.E.C. turbo-alternator of 1,500 kw. was installed, which until 1911 was by far the most economical unit in the station. This set was ordered by the Corporation in defiance of the recommendations of the Lighting Committee and the advice of the engineer, neither of the makers having previously built machines of that type and size.

The set, however, though economical, was used only to carry the peak loads until 1912, when the new portion of the power house was placed in commission. Two Oerlikon sets of 3,000-kw. capacity were installed, one at the end of 1911, and the other last year. Mr. d'Alton states that the low-pressure guide disks of the first of these turbines are in very rough condition, and the metal may later on have to be changed to prevent loss of efficiency.

Indicator diagrams from the reciprocating engines show that the high steam consumption is due not to wear of parts, but to imperfections of design, and to the extremely low vacua obtainable from the defective condensers. The latter "are wrong, all wrong, and have been so ever since 1906."

The tubes have been subject to a curious corrosive action, which has resulted in leakage so serious that the condensate cannot be used for feed water, thus adding to the coal consumption, already excessive on account of the low vacuum. Mr. d'Alton has had tubes examined and the water analysed

by experts, and believes he is on the point of success in discovering the cause of the trouble, to which he ascribes great importance. He regards the Oerlikon sets as generally excellent. The switchgear consists of Ferranti cellular gear, which has done, and still does, good service, and modern cubicle switchgear of satisfactory design, but, unfortunately, the latter has had to be fixed at odd angles and levels owing to the design of the building. The control gear in the new station is well schemed on modern lines.

The boiler houses "contain a miscellaneous collection of steam makers, planted apparently without any regard to considerations of keeping steam ranges within rational limitations, of economy in the disposition of feed pipes, of coal-carrying apparatus, or of the evacuation of ashes." The plant comprises four B. & W. boilers of 10,000 lb. rating, six Lancashires of 3,500 lb. capacity, one B. & W. of 20,000 lb. capacity, and a Yarrow boiler, of which little use has been made, and which appears to partake of "the qualities and reputation of the white elephant." There are also four new B. & W. boilers of efficient and up-to-date design. Why the Lancashires were installed in a station designed for a peaky lighting load, Mr. d'Alton is at a loss to understand; their use has led to serious loss due to the quantity of coal wasted.

In 1905-6 the consumption of coal was 7.98 lb. per unit generated, suggesting an over-all consumption of "no less than 40 lb. of steam per kw.-hour, a wretched result." The loss due to the bad vacuum (less than 20 in.) implies an increased steam consumption of at least 20 per cent. The Belliss 1,500-kw. engine is much more economical than either of the 1,000-kw. Stewart sets, and ought to be worked always in preference to the latter, but has not been used nearly so much as it should. Similarly the Richardsons-Westgarth-G.E.C. set, which is far more economical than the Stewart sets, was used only for 40 to 50 hours weekly during the first two years.

Mr. d'Alton is "at a loss to understand why the staff continues to show preference for the old Stewart sets," which have been used consistently, winter and summer, for many years, with grave prejudice to the coal bill and the running cost. He points out that the modern efficient plant, in both boiler and engine rooms, ought to be employed on the daily load and the old machinery only, if at all on the peak or in emergency. The practice that has been followed of using extravagant plant most of the time, and saving the efficient plant for emergencies, is one of the primary reasons for the high cost of production. For the year ending March 31st, 1913, the following ratio resulted:—

Units, old plant to new	...	...	...	2.46 : 1
Coal used, old plant to new	...	...	...	3.47 : 1

The total steam consumption of the Oerlikon sets is very much less, even at one-third load, than that of the best of the older sets at its maximum rated output, and, had they been fully utilised, the saving in coal would have amounted to nearly £3,000 in the year above mentioned. A consideration of the results obtainable by using the most efficient of the boilers and generators leads Mr. d'Alton to the conclusion that an annual saving of no less than 7,974 tons of coal, costing at present prices £9,000, could be effected.

"The operation of the boiler house is characterised by the same curious policy as that which has been evident in the engine room, viz., the constant use of extravagant plant while efficient and economical boilers are held in reserve for peak and emergency loads." The 24,000-lb. Babcock boiler, which is equal in output to three or four Lancashires, is apparently used only for about one day per week on the average. The steam used for forced draught alone for the Lancashire boilers is said to have cost some £500 a year.

No fault is found with the constitution of the running staff in point of numbers, though Mr. d'Alton noticed evidence of slackness on the part of the shift engineers, particularly in the boiler house, and the wages paid, except in the case of the deputy works superintendent, are adequate. Mr. d'Alton considers, however, that the pay allotted to the engineer in charge of generation and the deputy works superintendent is insufficient to attract such a class of engineer as is required for the satisfactory operation of so large a system. "The old plant requires a larger staff than will be necessary when the turbines are being fully utilised, and it should not be worked merely to give employment to men who would otherwise be unnecessary. In other respects economies in labour are foreshadowed."

The total wages at the power house (excluding the engineer in charge) amount to more than £10,000 a year, an outlay which Mr. d'Alton considers exceedingly heavy for such a station. The generating engineer is handicapped by the want of adequate power and authority over the employees, and is unable to clear out hangers-on.

As regards the distribution system, Mr. d'Alton regards the plant as satisfactory in all respects, except that about twice as many sub-stations have been established as would appear necessary. Unfortunately, the mains are not utilised as fully as they should be. The occurrence of serious discrepancies between the official returns for units generated, units sold, &c., and the actual figures recorded at the power house induced Mr. d'Alton to have the watt-hour meters at the station tested at Trinity College, and led to the discovery that some of them were in such bad condition that their indications were unreliable, the errors amounting in some cases to as much as 30 per cent. low, so that the actual output could

only be guessed at. Making approximate corrections, it appears that the units are counted for amount to more than three millions, or about 25 per cent of the units delivered to the factories. The loss would have been less but for the excessive multiplication of distributing points. The staff engaged upon construction and installation work appears, to Mr. d'Alton, to be unduly large compared with the duties discharged. The system suffers severely from the lack of a highly qualified sales engineer. The permanent employees numbered 36 persons, with a total pay roll of £5,800 per annum, and 107 temporary employees at £2,875 per annum, making a total of £8,675 a year, including the staff and clerical workers, the total is nearly £12,000 a year. Of this amount £1,200 is charged to revenue, and about £7,740 to capital account. The wages of the secretarial section amount to about £3,300 per annum.

The coal supply seems to have become a monopoly, as for many years it has been in the hands of one firm of contractors. The price, says Mr. d'Alton, is very high, and he comments on the surprising fact that, in spite of widespread advertisements in the Press for tenders for a possible 52,000 tons for 1914-15, only one firm submitted an offer. Efforts should have been made to ensure competition in a matter of such vital importance. Moreover, the specification did not adequately define the class and quality of coal to be supplied, and the fuel has shown wide variations in calorific value.

The undertaking has been burdened with heavy charges for interest and repayment of loans upon an exceptionally large capital outlay per kilowatt. Whereas the average capital charges in the cases of the 14 undertakings previously mentioned are 0.8d. per unit, in Dublin they amount to 1.3d.

In order to prevent a deficit on the working of the system in the current year (1916), Mr. d'Alton says that strenuous efforts will be necessary to reduce the costs of production. All the generating sets should be put in perfect order before the autumn, and an additional turbo-alternator should be put on order if it were possible. Extension plant will be necessary for the winter of 1917, costing probably £50,000, and the next generating set should be of greater output than any as yet installed.

Mr. d'Alton concludes his report with a summary of the conclusions at which he has arrived on the basis of the investigations which he has made.

Asked to comment on Mr. d'Alton's report, Mr. MARK RUDDELL, City Electrical Engineer, says that none but those responsible for the conduct of the undertaking can realise the difficulties which have had to be surmounted in the daily working of the plant. He refers to Mr. Kettle the parts of the report dealing with the working of the generating plant, but claims that the Lancashire boilers are as economical as the water-tube types, and states that as the Yarrow boiler was specially installed as a stand-by in case of emergency, it would have been absurd to use it in the regular working of the station. The comparison between Dublin and other places is, in his opinion, fallacious owing to the differing local conditions; moreover, the units sold for power have in six years increased four and a half times, but the load factor has only increased from 13.4 to 14.5 per cent., and while the power output is 47 per cent. of the total, it produces only 22 per cent. of the total income, whereas the lighting load, 5 per cent. of the total, produces 78 per cent. of the income. He disagrees with Mr. d'Alton's suggestion that the units used on the works should be deducted from the total units generated before estimating the percentage of units lost in transmission, but endorses his statement that the city electrical engineer should have full responsibility for the selection and control of the staff. He holds that the rates of charge for private supply are not excessive, citing a report by Mr. Pearce in 1911 in support, and disputes the figures given in the report as expended in wages for distribution. Objecting to a more rigid specification for coal as likely to inflate prices and limit competition, Mr. Ruddle urges the necessity of procuring an underfeed stoker already asked for, and approves of the immediate provision of an additional generating set. Finally, he does not agree with the sweeping condemnation of the Stewart engines, or the recommendation to use the large water-tube boilers for the daily load and to hold the remainder in reserve.

Mr. H. MANGAN, City Accountant, says he fears that the conditions of supply in Dublin must be inherently unfavourable to any remarkable development in the load factor, which has remained persistently low for many years, but concurs with Mr. d'Alton's suggestion that potential consumers should be canvassed by competent technical assistants. Regarding the prices charged, he demurs to their reduction below cost in the hope of developing a better class of supply, and points to the effects of high prices of coal, &c., upon the costs of production; if the savings indicated by Mr. d'Alton materialise, a reduction in price should not anticipate, but follow them. He criticises the comparison drawn between Dublin and other cities as worthless and misleading in the absence of details as to the relative proportions of the power and lighting supplies, but refers to the reluctance of the Electricity Department to allow a fair price to the Main Drainage Department, whereas a much cheaper rate has recently been allowed to a Government Department for a much smaller supply. He had already (in 1909) drawn attention to the high cost of coal per unit, and supports Mr. d'Alton's criticism of this item. The Board of Trade form provides no space for "losses in transmission," but these can be shown in

future. He deprecates the practice of paying the salaries of permanent officials engaged on extension works out of loans instead of out of revenue, and again recommends that loans for meters should be short-term loans in view of the short lives of the apparatus.

Mr. F. J. ALLAN, Secretary to the Electricity Supply Committee, complains that Mr. d'Alton did not visit his department before preparing his report, and claims that there has been no lack of effort on the part of the sales office to spread the use of electricity, pointing out that Mr. d'Alton fully acknowledges the rapid development of the load, which dated from the inauguration of the Commercial Sales Department in 1907. He gives figures illustrating the steady improvement in the output for lighting and power respectively, and states that the former unbusinesslike methods of dealing with the public have been completely removed. The "bitter prejudice which existed for years against the Dublin Corporation electricity undertaking" has at last been brought down to comparatively narrow limits. Complaints are best dealt with by an official in constant touch with the Committee. There is no dual control, and the departments co-operate in a whole-hearted manner; the account clerks and meter readers must work together, and with the canvassers. No alterations in prices have been made without careful consultation with the Committee and Mr. Ruddle, and the rates are not excessive for Dublin. The number of power users near the lines of mains still unconnected is very small. The number of meter readers cannot be reduced, and it is difficult to see where a saving in the cost of the secretarial department can be effected.

Mr. L. J. KETTLE, Deputy City Electrical Engineer, in a lengthy report on the points concerning the generating works, draws attention to the improvement in coal consumption in 1906-7, for which he claims the credit as the result of long hours of work; he was engaged to effect certain economies, and considers that he more than made good his guarantee. The 3,000-kw. set could not have been run in 1912-13, as suggested, owing to the lack of a steam-pipe connecting the old and new stations, there being a coal store between the two; there was only one feeder between the new plant and the city supply, and the new switchgear had not been installed, while the two new Babcock boilers could not be run continuously owing to a mistake in design. Even if the plant could have been run, the economy suggested by Mr. d'Alton would not have been realised, as the set could not have been kept fully loaded, and the old plant could not have been completely shut down. At a load of 500 or 1,000 kw. the old engines are more economical than the 3,000-kw. turbine. Mr. d'Alton's figures for steam consumption, he says, are wrong, and the low load factor is the main cause of the high generation costs. Even if up-to-date plant were installed, the costs could not be reduced "in a dramatic and sweeping manner" if the external conditions were not radically improved. If an additional 5,000-kw. set and new boilers are installed and the 3,000-kw. sets overhauled, they can shut down the old plant and show a considerable reduction in the costs. Continuity of supply is more important than a small economy with risk of interruption. He was hampered in laying out the plant by the limited ideas of the authorities. He defends the method of running the boiler plant, and points out that Lancashire boilers are unsuitable for getting up steam in emergency, whereas the Yarrow boiler can be put in service in one hour. Corliss engines compare very favourably with turbines in point of economy and reliability; those they installed were not the best of their kind, but were good value for the money, and had saved the situation more than once. The Belliss & Morcom engine needs overhauling, and the grease extractor should be removed; the Richardson Westgarth turbine may be reconstructed when more plant is available. No great loss has been incurred through the faulty condensers, and the figures Mr. d'Alton gives for increase of consumption of steam per inch of vacuum lost relate to turbines, not to reciprocating engines. The meters are not inaccurate, and should have been tested *in situ*. With regard to the coal supply, he is anxious to increase the competition, and to install a furnace which will enable a wider range of coal to be employed, but he disagrees with Mr. d'Alton as to the quality of the coal supplied, and as to the adoption of a more rigid specification.

In the supplementary report submitted by Mr. d'ALTON at the request of the Committee, he states that he has no intention of defending in any way the views which he put forward in the original report, and sees no reason to depart from the conclusions then attained. He is satisfied that the administration is capable of improvement, and that economy is practicable without prejudice to the efficiency of the service. He stands by his comparison between Dublin and other places, and is convinced that only the lighting most important to the consumers has yet been connected, while the lighting most important to the undertaking (that of the long-hour consumer) has not been encouraged as it should have been. He did not make the statement that the wages spent on distribution amounted to £12,000 per annum; with the exception of what was paid for public lighting, the charges under the head of distribution were not unduly high, but there is no sufficient justification for the large proportion charged to capital. He fails to see how a more rigid coal specification could produce a more limited competition than at present, when the number of competitors for the Dublin contract amounts to one. The reduction in coal consumption

in 1906 and 1907 did Mr. Kettle credit, but emphasised the bad engineering of the station as he found it. Mr. d'Alton insists that the turbines are greatly superior in economy to the old engines, and maintains that "the sacrifice of efficiency on the altar of superprecaution is not the highest practice of a responsible engineer"; in many municipal stations engineers have overdone security and sacrificed economy. The merits of the turbine cannot be questioned; Corliss engines are never installed nowadays, and those in the power-house gave endless trouble. The condenser trouble at the Pigeon House, if not absolutely novel, is not a common one; Mr. Kettle's views on condensers will not find many supporters, and Mr. d'Alton states that he was not thinking of turbine practice when discussing the vacuum on the Corliss engines. The Oerlikon turbine was run for 2,500 hours, showing that the absence of a steam-pipe and the availability of only one feeder were not insuperable obstacles to its employment; he is satisfied that the turbine could have been run on a load of 1,000 h.p. for a much longer period than Mr. Kettle states, and that the question of load factor has no bearing on the case. If the Yarrow boiler is used only for peak loads and emergencies it may have a long life, but not a useful one. He did not advocate the employment of the Lancashire boilers for emergency work, and cannot accept the view that this type can compete in efficiency with the water-tube type. Mr. Kettle's comments on the difficulties put in his way in the attempt to improve the boiler-house plant confirm Mr. d'Alton's views, and demonstrate the bad conditions under which the plant is operated. The size of coal should be specified, and the coal delivered should be tested; various sizes of coal from the same seam will not yield the same B.T.H.U., and 10,500 B.T.H.U. is too low for "washed single nuts"; the slack should give that value, and a pure washed "single" will give 1,000 B.T.H.U. more than the slack from its own seam. Moreover, the specification does not name any colliery or district, and both the heat value and the price vary considerably with the district of origin.

Mr. d'Alton describes Mr. Mangan's report as courteous, interesting, and helpful, though he cannot agree with all that he says. He is informed on good authority that an active forward policy would double the present output in a short time, and the gas company has, in fact, adopted such a policy with success. He is well aware of the amount of work done by Mr. Allan and his "live" department, but is none the less convinced that such an undertaking must be administered by an engineer. By way of comparison, Mr. d'Alton cites the case of Poplar, where the output for 1914-15 was about 30 per cent. greater than that of Dublin, but the expenditure on salaries and commissions, under the management of an engineer, was £4,159, whilst that of Dublin was £7,862. He cannot understand Mr. Allan's reference to the "bitter prejudice" existing against the Dublin electricity undertaking.

The various reports and the Special Committee's recommendations with regard to the offer to Mr. d'Alton were expected to come before the Municipal Council at its meeting on Monday last, but were not mentioned, and it is now supposed that they will be dealt with at a special meeting.

WAR ITEMS.

Exports to China.—The "London Gazette" for November 7th contains further names of persons and bodies to whom exports to China and Siam may be consigned.

Enemy Businesses in India.—The "Board of Trade Journal" for November 2nd contains a list of businesses being carried on in India by hostile firms which the Governor-General in Council has ordered to be wound up.

Belgian Power Plant Sent Into Germany.—"Les Nouvelles," the Belgian paper published in Holland, reports that the Germans continue to take possession of factories on the Meuse. All the machines belonging to one power company have been sent to Germany.—*Times*.

German Trade Unions.—Since the beginning of the war the German trade unions have lost 60 per cent. of their members. In June, 1914, the membership of the unions amounted to 2,482,046, but by the end of 1915 this number had dropped to 982,843.—*Times*.

To be Wound Up.—The following further companies have been ordered to be wound up under the Trading with the Enemy Amendment Act:—

Bosch Magneto Co., Ltd., 204, Tottenham Court Road, W., manufacturers of magnetos. Controller: A. E. Woodington, 5, Philpot Lane, London, E.C.

British Incandescent Mantle Works, Ltd., Ravensbury Road, Earlfield, manufacturers of incandescent gas mantles. Controller: T. Wise, Bassishaw House, Basinghall Street, E.C.

Enemy-owned Electrical Shares.—In the House of Commons last week, Mr. George Terrell asked whether the enemy-owned shares in the Enfield Electrical Cable Manufacturing Co., Ltd., had yet been sold by the Public Trustee, and, if so, to whom and for what price. Mr. Pretyman replied that the Public Trustee informed him that he was carrying on

negotiations for the sale of the enemy-owned shares in this company, but he had not yet effected a sale.

Government Order Regarding Motor Construction Work.

—The Minister of Munitions announces that as from November 15th, he prohibits until further notice any person, firm, or company engaged in the manufacture or repair of any vehicle designed for mechanical transport or traction, or any part of such vehicle, from carrying out in any factory, workshop or other premises, without a permit issued under the authority of the Admiralty, the Army Council, or the Minister of Munitions, any work consisting in the manufacture, assembling, or erection of any new or unused motor internal-combustion engine, designed or adapted for mechanical traction, or of any new or unused motor cycle, motor chassis, motor wagon, or of any tractor or other motor vehicles of any kind propelled by mechanical means, subject, however, to the exception of work required to complete contracts placed by the Admiralty, the War Office, the Minister of Munitions, or an Allied Government, on or before the date of this order.

The Manufacture of Copper Wire and Cables.—The Minister of Munitions announces that, in exercise of the powers conferred upon him by the Defence of the Realm (Consolidation) Act, 1914, the Defence of the Realm (Amendment) No. 2 Act, 1915, the Defence of the Realm (Consolidation) Regulations, 1914, and all other powers thereunto, enabling him, he hereby prohibits as from the date of this Order, the manufacture of any copper wire or any cable containing copper, except for the purposes of any of the following contracts or orders for the time being in existence, namely:—

1. A contract or order to which there shall have been allocated by the Priority Branch of the Ministry of Munitions a reference number and priority classification within Classes "A" or "B" of circular L. 33 as to control of output issued by the Minister of Munitions on March 31st, 1916, or:

2. A contract or order with and bearing the reference number and identification letters of any of the following departments, namely: The Admiralty, the War Office, the Ministry of Munitions, and the Post Office.

Messrs. Dick, Kerr Purchase A.E.G. British Interests.—We reproduce the following from the *Times*. We comment upon the matter in our leaderette pages:—

"We learn that the business of the A.E.G. Electric Co., one of the three subsidiaries in this country of the Allgemaine Elektricitäts Gesellschaft, of Berlin, has just been sold by the controller appointed by the Board of Trade to Dick, Kerr and Co., Ltd., whose electrical works are at Preston.

"The A.E.G. Electric Co. was the most important of the three subsidiaries, and had offices and depots in London, Newcastle, Cardiff, and Birmingham. It had undertaken large contracts for leading colliery and shipbuilding companies, and one of the reasons advanced for the continuance of its operations after the outbreak of war is understood to have been the importance of the work it had undertaken for firms engaged on British Government contracts. The contracts varied in value from £1,000 to about £40,000, and the liquid assets held in this country amounted to well over £100,000. It is understood that as these assets are now transferred to the Public Trustee, practically all that was saleable, apart from stock, was the goodwill, and that as the company's profits have naturally fallen off during the war, the price paid was not large. Before the war the company employed an army of German mechanics, and the whole of the capital was held by the parent company in Berlin. During the war the German staff is stated to have been replaced by a British staff, and the latter is now taken over by Dick, Kerr & Co., together with a number of uncompleted contracts. The Controller, Mr. Maurice Jenks, of 6, Old Jewry, E.C., was appointed by the Board of Trade on July 7th last, and now, having effected the transfer of the German business in its entirety to a British firm, he ceases his connection with the company, except, it is understood, for the collection of certain debts.

"The controller for the Electrical Co., Ltd., one of the two other subsidiaries in this country of the German concern, was appointed by the Board of Trade on March 9th; an order was issued at the end of July for sales to cease; and on October 17th the residue of the stock was disposed of by Messrs. Wheatley, Kirk, Price & Co. Its head office was in the Charing Cross Road.

"The third subsidiary is the A.E.G. Electric Co. of South Africa. Its business here is stated to have been confined to arranging contracts for electrical apparatus with the South African mines. The controller was appointed on July 7th, and the intention is to close down the business in this country very shortly. The stock in South Africa is being dealt with by the Union Government under recent legislation."

The Electrical Co., Ltd., the A.E.G. Electrical Co. of South Africa, and the A.E.G. Electric Co., Ltd.—Notices appear in the *London Gazette* for November 7th to the effect that these businesses having now been sold and disposed of, or the companies having ceased to carry on business in the United Kingdom, creditors who have not yet sent particulars of their claims, &c., to the controller, Mr. Maurice Jenks, 6, Old Jewry, London, E.C., must do so by November 30th. In each case a paragraph is added to the notice intimating that all persons having in their possession any property or effects belonging to the companies must deliver same to the controller forthwith, and all debts due must also be paid to him.

Tramway Service or the Factory?—Is fore the Huddersfield Municipal Council last week, Henry Oldham, a local firm's manager, asked that the Corporation were unreasonable in refusing to let him have certificates. He had taken on the conducting work temporarily, having been a finisher's assistant at a local factory, which he had had to leave owing to illness in the week last November. He had since been twice sent back to the firm to go back, and about a month ago he gave the Corporation a fortnight's notice and went back to the factory. He had only been there a short time when, owing to correspondence between the factory-owners and the tramway's manager, he could not be kept by the firm. He held that he would be doing work of greater national value by going back to his old job, as conductor's work could be done by women. Mr. Proctor (Deputy Town Clerk) said the man could not be spared. The department had 82 male and 64 female conductors, but 18 of the men were to be taken into the Army in a few days, and the male conductors also formed the reserve from which to draw drivers. Mr. Wilkinson (tramways manager) said he had had only one application from a woman as conductor within the past month, and it was now impossible to get women. When the 18 male conductors went to the Army the tramway service would have to be reduced. Mr. Proctor said a decision by the Tribunal was important, as several other men similarly placed desired to leave the tramways department. The Chairman said the question was whether it would be in the national interest that the man should work in the factory or remain in the public service. The Tribunal must refuse the application.

Exemption Applications.—At Woking Tribunal, the Woking Electric Supply Co. asked for leave to appeal for J. S. Fowler (23), single, an electric wireman. The Clerk said the application was out of date, and the Tribunal refused to hear the application. Mr. E. G. Nicholson, the secretary of the company, gave notice of appeal.

At the Yarmouth Tribunal, an ironmonger and electrician appealed for his only electrician (36), without whom, he said, he could not carry on his business. He was the only man of military age in his employ in this department, five having gone. Conditional exemption was continued.

At Dover, on November 1st, the Town Council applied for the retention of the driver of an electric scavenging vehicle (32). A month only was granted.

Eleven motormen and one inspector were appealed for at Brighton by the Corporation. Mr. Marsh, in reply to a question, said that women could be employed as drivers on the Lewis Road route, but not on the hilly route. Now only 63 men were employed, and if 12 went it would be a serious matter. Sir John Blaker, the Military Representative, said it was a bad example to see such a large number of eligible men employed on a Corporation undertaking. All the men appealed for were under 33, and two of them were unmarried. It might mean a less frequent tram service, but this the inhabitants would be quite willing to put up with. Twenty years ago they did without trams, and now, in this crisis, he thought that all the men should go. Mr. Marsh replied that 214 men had enlisted from the depot, a percentage of 72 of the whole staff, and no tramway service in the country had a better record; Torquay coming second. Two single motormen and the inspector, also single, were each given a final two months, and the others three months each.

An electrician at Lindfield was appealed for by the Crawley Electric Light Co. at a sitting of the East Sussex Tribunal, exemption having been refused locally. The man, it was stated, was responsible for overhead cables, and was necessary for the public safety. Although deaf, and having a corned chest, he was passed for general service. Exemption was not allowed.

Before the Surrey Appeal Court, on October 28th, the Military Representative appealed against exemption given to Mr. Morgan, of the Reigate municipal electric light staff, who had been given until January 1st by the Reigate Tribunal. The Court made the exemption allowed final.

At Worthing, an electrical engineer, who was for a time a voluntary munition worker, appealed, and stated that he was released from the work because he was liable for military service. His appeal for exemption was rejected.

A Hove electrical engineer, left with only one man, and who said that the business could not continue if he had to serve, has been given two months' exemption.

At Aylesbury, a firm of electrical engineers, with premises at Kingsbury, applied for the retention of their electrician and confidential clerk. The former, passed in Class C1, was given six months, and the latter, fit for general service, was directed to be called up on December 1st.

At Kidderminster, the Tramway Co. appealed for two motormen and a car-shed foreman, and five months were allowed to each.

Warwickshire Appeal Court has given exemption until a substitute is found by the military to Mr. A. L. Smith (27), electrician, appealed for by the Stratford-on-Avon Electricity Co., Ltd.

At East Ham, the Broadway Cinema Co., Ltd., appealed for their electrical engineer, S. C. Potter (26), who works the generating plant, but the appeal was dismissed, and a month's delay granted.

At Pontefract, Mr. J. L. Brown (25), appealed as the only qualified electrician left in the town, and he was exempted until January 1st.

Chelmsbury Mortuary Tribunal has refused exemption to A. F. Lightfoot, electrician at Highley Picture Theatre, and notice of appeal was given on the ground that appellant is unfit for foreign service.

At Chester-le-Street, on October 30th, the County of Durham Electric Power Distribution Co. appealed for a meter fitter and tester and account collector (37). He was put back until called up, with the right of appealing again.

Before the Holland (Lincs.) Appeal Court, on October 27th, Mr. R. W. Sanders, of Boston, appealed for the retention of C. E. Clanc (300), electrical case maker, but the appeal was rejected.

Castleford Tribunal has refused exemption to F. P. Smith (18), electrician to the Victoria Picture Co., the only man left to attend to the electrical apparatus at three picture halls.

The East Kent Appeal Court, on October 30th, granted six months' exemption to Mr. Colin Campbell (40), managing director and secretary of the Whitstable Electric Light Co. Mr. Campbell had previously been given until January 15th, and against this the Military Representative unsuccessfully appealed. It was stated that Mr. Campbell had been trying to get capital for debentures to prevent the winding up of the company, and that in ten months he had been successful in raising and getting promises for about £4,500 for this purpose.

At Folkestone, on October 21st, Mr. A. R. P. Thorn (23), electrician, was granted one month's exemption.

At Bexhill-on-Sea, Messrs. Bruce & Co., electrical engineers, appealed for W. R. Chapman (29), but the Military opposed, on the ground that a discharged man from the Royal Engineers should be employed. Mr. Bruce stated that he had tried without success to replace Chapman, who had been with them for 15 years. He added that he could do with six electricians. Three months were allowed.

Battle Rural Tribunal have granted conditional exemption to Mr. C. D. Geer (31), electrical engineer.

Shoreham (Sussex) Tribunal, on Monday, granted two months' exemption to an electrical engineer, aged 40, passed in Class B1, and who has four brothers serving.

A Brighton firm of electricians appealed, on Monday, for an electrician (26) and a wireman (33), and stated that they had lost 63 men. The electrician was allowed a final 14 days, and the wireman two months.

At Douglas (Isle of Man), on October 31st, Mr. Edmondson, of the Manx Electric Railway Co., appealed for B. A. Robinson (18) and W. A. Cowan (18), electrical engineering pupils, both of whom are in the third year of their training. Each was exempted until they attain the age of 19.

At Douglas (Isle of Man), on October 31st, Mr. W. J. Fargher appealed for the retention of W. S. White (35), electrician, the only man left to do the electrical repairs, and who was essential to the business. Conditional exemption was granted.

BUSINESS NOTES.

Catalogues and Lists.—STONEBRIDGE ELECTRICAL CO., LTD., Windmill Road, Hampton Hill, Middlesex.—16-page price list of drawn-wire metal filament lamps.

—SPRAY ENGINEERING CO., Boston, U.S.A.—Bulletin describing their "Spray" paint gun.

The Foreign Trade Representative.—In the articles which we have published from time to time by expert observers in different markets abroad regarding the spirit and measures that will be most likely to operate in favour of British trade, the writers have attached great importance to the social standing, habits and presence of the representatives who are sent out by our manufacturers. Our contributors in Egypt, India and China in particular have laid emphasis upon the matter. An American Consul has just put such points very plainly before U.S. traders in connection with efforts in the West Indies. He says that it will depend largely upon the representatives they send to win this market how far American firms are successful there. In the past poor impressions sometimes made by salesmen have been unsatisfactory and anything but factors in the promotion of trade. In more than one case prejudice has remained for a long time, and it has been hard work to remove it and restore confidence. "The day of the noisy, self-advertising commercial traveller has long gone by, at least in these countries, and the cultured, courteous representative is the type wanted. The merchants of these Colonies are men who have built up their firms through years of thrift and close attention to business, and who hold the respect of the communities in which they live. As in most tropical countries, their people have a leisurely way of doing business. They like to 'take it easy,' to talk things over. Often the ability to add social courtesy to business efficiency is the surest method of getting business, and the commercial traveller who may be introduced to their social clubs or to their homes is not unusually the man who will book the most orders. A representative of one large American house closed in a half hour, 'over the teacups,' a contract on which he had been working unsuccessfully for days at the business office. Many an order obtained on the cool veranda of a tropical clubhouse after lunch would not have been given elsewhere."

Private Arrangement.—THE TYLER APPARATUS CO., LTD., Bannister Road, Kilburn Lane, N.W., electrical engineers. A conference of creditors was held last Friday, at the Institute of Chartered Accountants, Moorgate Street, E.C., for the purpose of considering a proposal by the company for the ultimate payment in full of the unsecured creditors. The chair was occupied by Mr. P. Houstoun, of Messrs. Corfield and Cripwell, accountants and auditors, who said that the conference was the outcome of negotiations which had taken place. The company was formed in 1912, with a nominal capital of £10,000, and received £3,500 for shares, which were subscribed for in cash. Shares of the face value of £5,000 had been allotted to the vendors. An approximate balance sheet had been prepared as at October 13th last, the date when a receiver was appointed. That showed that the total liabilities of the company were £22,814, made up as follows:—

Issued capital, £8,505; debentures, £2,950; cash and trade creditors and bills payable, £9,488; and further cash claims, £1,871. On the other side of the balance sheet it appeared that up to January 1st of the present year there was a loss on the trading of £5,865, while since that date there had been a loss of £386. The assets were as follows:—Cash, £34; furniture, £200; premises account, £100; constructional works, £169; pattern account, £122; tool account, £532; plant and machinery, £2,656; goodwill, £5,000; stock, £1,553; and sundry debtors and bills receivable, £5,571. Some time ago, a creditor in the North of England levied execution, and in order to protect the assets, a receiver was appointed. The execution creditor had since filed a petition for the compulsory winding-up of the company. In September, 1913, a debenture for £6,000 was issued to the parent company to secure a cash advance. There were five other affiliated companies who had money advanced to them by the parent company. At the same time, the parent company issued a debenture for £25,000 to the bank, and all the subsidiary companies executed a declaration and admission of trust in favour of the bank. They also gave an undertaking to the effect that they would not, without the permission of the bank, pay off any of the debentures which had been issued in favour of the parent company. The manager of the present company knew nothing about that declaration, and it appeared that over £4,000 of the original debenture had been paid to the parent company. A receiver had been appointed in connection with the parent company, and that gentleman had a claim against the present company, not for the balance of the debenture of £1,400, but for the original amount of £6,000. Of course, the present company had a claim against the parent company for the £4,000 odd which had been paid off the debenture, but that might be a bad debt. Second debentures in the company were held by a Mr. Powell, who only advanced his money during the present year. The manager of the company (Mr. Pearson) had also advanced considerable sums, and guaranteed the accounts of some of the creditors. When the bank advanced money to the parent company, the amount was guaranteed. The guarantors proposed to settle with the bank, and to transfer the balance of the first debenture of £1,400 to the second debenture-holder. The latter would then advance the company a further sum of £1,000 to provide it with the necessary working capital. The amount which the company had repaid off the debentures would be wiped out. Certain of the book debts were charged, but the debenture-holder was agreeable to the remaining book debts being released and collected for the benefit of the unsecured creditors. From the book debts it should be possible to collect sufficient to pay the creditors at least 2s. or 3s. in the £ on the amount of their claims. After the book debts had been collected, the company would pay over £50 weekly for the liquidation of the creditors' claims. The smaller creditors would be paid in full within a reasonable time. It had to be remembered that unless some scheme was adopted, the unsecured creditors would get nothing. Under the present scheme the creditors would certainly receive 2s. or 3s. in the £, and they stood a sporting chance of receiving a good deal more.

In answer to questions, Mr. Houstoun stated that the company had always been hampered for want of capital. In 12 months a considerable sum was paid for accommodation. If the company was wound up, the creditors would not get anything. There was a considerable number of suing creditors.

Several creditors expressed the opinion that there was a good future before the company, and that every effort should be made to continue it. The matter was discussed at some length, and eventually resolutions were passed in favour of the acceptance of the scheme, and it was decided that the petition for the winding-up of the company should be opposed. Mr. G. E. Corfield was appointed to act as trustee for the creditors in the matter, and it was stated that the Court would be asked to approve of the scheme, and a further meeting of the creditors would then be called.

Car-lighting Devices in Australia.—Although several tenders were sent in in response to the Melbourne Tramways Board's invitation for devices for car illumination, none proved entirely satisfactory, the fault in most cases being the expense of working, but in some the delay entailed in procuring the plant. Fresh tenders are, therefore, being invited, and it is stipulated that tenderers who cannot supply plant must state the cost of the plant that will be required. The Board now has 1,014 cars, but the plant must be capable of meeting the requirements of 1,250 cars with lights of approximately 100 C.P. to each car. Tenderers must also state the cost of maintenance, and whether they are prepared to install the plant and give a fortnight's trial of their system on one of the cars. The Board offers in various ways to assist tenderers in the experimental stage of their work, and will also give a premium of £100 for the most suitable design, with specifications, whether it is adopted or not.—*Australian Mining Standard.*

Book Notices.—Walford's Tea, Coffee and Rubber Guide. London: Martin Walford & Co. 1s. 6d. net. This pamphlet gives a list of about 300 dividend-paying rubber shares and their yields.

"Journal of the Röntgen Society." No. 49, Vol. XII. October, 1916. London: Percy Lund, Humphries & Co. Price 4s. net.

"Science Abstracts." A and B, Vol. XIX, Part 10. October 25th, 1916. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"Elenco dei Fabbricanti in Italia di Materiale e Macchinario Elettrico." Milano: Stabilimento Grafico Stucchi, Ceretti & C.

"Scientific Papers of the Bureau of Standards." No. 289. "The Damping of Waves and Other Disturbances in Mercury." No. 291.

"A System of Control for an Electric Testing Laboratory." Washington: Department of Commerce.

"Proceedings of the American Institute of Electrical Engineers." Vol. XXXV, No. 10. October, 1916. New York: The Institute.

"Engineering Industry in War and Peace." The B.E.A.M.A. has published a pamphlet containing verbatim reports of the speeches delivered at the Mansion House meeting in September, together with photographs of the speakers.

"Business—and Bribery after the War." By R. M. Leonard. Twelve-page pamphlet issued by the Bribery and Secret Communications Prevention League Inc., 9, Queen Street Place, E.C.

British Travelling Exhibitions.—Replying to a Parliamentary question, the other day, Mr. Runciman said that he was considering the possibility of arranging for an exhibition of British manufactures which would visit the principal commercial centres in the Dominions. He was in communication with the Secretary for the Colonies on the subject. Extensive preparations would have to be made should an exhibition of the kind prove practicable. He did not contemplate attempting to include in the present scheme exhibitions in neutral countries.

Liquidation.—GENERAL ACCESSORIES CO., LTD.—A meeting of creditors is called for November 7th, at 120, Blackfriars Road, S.E.

Bankruptcy Proceedings.—R. E. CONNOLD, electrician, Canterbury.—November 17th is the last day for the receipt of proofs for dividend. Mr. G. E. Corfield, trustee, Balfour House, E.C.

LIGHTING AND POWER NOTES.

Aberdeen.—The Electricity Committee is supporting the recommendation of the electrical engineer that tenders be obtained for the erection of a sub-station at the east end of York Place, at a cost of £2,800; the continued additions of load in this area, together with a recent application of a further 700 H.P. for a shipbuilding yard, make it imperative to proceed with the work at once.

Accrington.—LINKING-UP.—At a recent T.C. meeting, Alderman Higham favoured the proposed interconnection of the Lancashire electricity supply systems. The interlinking of Accrington with Rawtenstall, and probably Blackburn, would be beneficial, especially during temporary breakdowns.

Aldershot.—PRICE REVISION.—The D.C. has decided to increase the charges for electricity as follows:—A flat rate of 6d. per unit, in lieu of 4½d. per unit, plus 10 per cent.; power and heating, 3d. to 2½d., instead of 2d. to 1½d. plus 20 per cent.; Messrs. Gale and Polden to be charged for power consumption 1½d. per unit, in lieu of 1d. per unit, plus 20 per cent.; and a rental to be made for consumers' meters of 1s. 6d. to 2s. 6d. per quarter, according to size.

Ardley.—SEWAGE WORKS SUPPLY.—The Electrical Distribution of Yorkshire, Ltd., has been asked to guarantee a supply of electrical energy at Brodley Sewage Works for a period of five years, with the option of a further five years' extension.

Australia.—The Huntley Shire Council (Victoria) has been requested by the ratepayers to consider the erection of a municipal plant to supply Elmore with electric light and power, or alternately, that the Council should forego its right in favour of a company. A report on the project has been prepared and forwarded to the Council for its information.

The Renmark (South Australia) electric lighting plant has been taken over by the Council. The consulting engineer, Mr. F. Coote, has recommended an increase in the power plant by 100 H.P.

In connection with the Inkerman (Queensland) irrigation scheme, Messrs. J. Hargreaves (hydraulic engineer) and H. Eklund (assistant engineer), Queensland water supply department, have recently returned from a visit to the Lower Burdekin district. The scheme embraces an area of 25,000 acres. It is estimated that 6,000 acres would be ready for planting cane when the scheme is available to supply water, and with the system of rotation 2,000 acres will be dealt with at a time. Distribution will be controlled by electricity. Though pumping is the most important feature, it is expected that before long the pumping demand will be secondary to that for general use. A steam generating set is proposed for the work, with a distribution at 6,600 volts to the pumps.—*Tenders.*

Bacup.—**BULK SUPPLY.**—The T.C. has intimated to the Electricity Company its inability to agree to terms for supply, and has asked for the terms granted by Rawtenstall in the case of the Haslingburn supply.

Baldon.—**E.L. PROPOSAL.**—With regard to the question of bulk supply the Council has informed the Shipley D.C. that it has not at present favour the suggestion of granting powers to distribute electricity in the Baldon area, and that the matter may be considered in abeyance until the conclusion of the war.

Barnsley.—**YEAR'S WORKING.**—There was a deficit of £363 on the working of the Corporation electricity undertaking during the past year.

Belfast.—A deputation representing the electrical trades of the city recently waited on the City Council to urge the necessity of proceeding with the erection of the new electricity station at the Musgrave Channel, and installing the first set of not less than 5,000 kW. as quickly as possible. It was urged that the present station had now reached its maximum output, and that the members of the electrical trades felt that their business was likely to suffer unless suitable provision for electric supply was made. The Lord Mayor assured the deputation that the subject would be taken up afresh and discussed seriously, but he could not promise anything more than that.

At a recent meeting of the Council, Mr. Caughey pointed out that the city electrical engineer reported that he estimated the demands upon the station would leave a margin of about 11 per cent. on the plant, based upon the assumption that the whole of the plant was simultaneously available at its full normal rating.

Birmingham.—Several times during the last week the Corporation tramway service was suspended owing to shortage in power supply. The Electricity Committee, at a meeting on Friday last, specially considered the matter; the question was whether it was wise to notify the public that between certain hours the cars would be definitely stopped, pending the repair and extension of the plant at the Nechells power station, or whether it would be better and more advantageous that efforts should be made to run the cars as often as possible. Mr. Chattock, the chief electrical engineer, and Mr. Baker, the tramways manager, had discussed the matter, and the conclusion arrived at was that it would be better not to issue any definite notice as suggested.

Another matter which occupied the attention of the Committee was the general question of the supply of current throughout the city. The output of the department has increased from 80 million units to 150 millions during the last two years, and efforts have been made to increase the engine power in a corresponding degree. Deliveries of plant, however, have been frequently delayed, and this, with a depleted staff, is largely the cause of the inability of the department to cope with the demands made upon it. Steps are being taken to secure the installation of plant, which should have been in working order by the end of September, before the middle of December, and when that has been accomplished it is hoped the output will be materially increased and that the difficulties of the Committee will come to an end.

Canadian Water Power.—The High Commissioner for Canada has received the following information by cable from the Hon. W. J. Roche, M.P., Minister of the Interior at Ottawa:—A part altogether from the Northern Territories, practically all the Yukon Territory and the northern and eastern portions of Quebec, where the resources are not yet exploited, some 17,746,193 H.P. are available in water powers in the Dominion of Canada. Developed water powers aggregate 1,712,193 H.P., of which Nova Scotia has 21,412 H.P.; New Brunswick, 13,390 H.P.; Prince Edward Island, 500 H.P.; Quebec, 520,000 H.P.; Ontario, 789,466 H.P.; Manitoba, 56,730 H.P.; Saskatchewan, 45 H.P.; Alberta, 33,305 H.P.; British Columbia, 265,345 H.P.; and the Yukon Territory, 12,000 H.P. Eight million H.P. are available within range of the present markets, and within 15 years will be in use.

Clyde Valley.—**NEW POWER STATION.**—On November 1st the new Cambuslang power station of the Clyde Valley Electrical Power Co. was formally opened. The plant is situated at Clyde Mill, the river water being available for condensing purposes. The first generating set installed is a Westinghouse 5,000-kw., 25-cycle, three-phase turbo-alternator, supplied with steam from Babcock & Wilcox boilers, each evaporating 34,000 lb. of water per hour at 200 lb. per sq. in. For coal supply the wagons are tipped hydraulically into a hopper, which supplies the conveyors passing over the bunkers; the ash and soot are removed by a suction plant. The buildings are steel framed with brick filling, and a portion of the old mill dam has been rebuilt in concrete. It is interesting to note that woman labour has been employed with success on the works.

Continental.—**GERMANY.**—According to the "Muenchner Neueste Nachrichten," the electricity supply works on the Isar have been enlarged in order to supply the new Krupp works with electric light and power. In consequence of the impossibility of providing the required hydraulic machinery, recourse has been had to steam power, and a steam turbine of between 5,000 and 6,000 H.P. has been installed.

NORWAY.—The Hitterdal Divisional Council has decided to acquire the Omres waterfall in Saudal, with a view to the erection of a hydro-electric station at a cost of either 455,000 kroner or 2,800 H.P., according as it is decided to develop 1,100 H.P. or 2,800 H.P.

The Stadsraad on October 14th approved of a resolution of the authorities of Rygge to raise a loan of 100,000 kroner for extensions of the Communal electric station.

With a view to power production, the Trondhjem Municipality has decided to build a dam across an inlet of the sea opposite Nendal, enclosing an area of 20 kilometres, and creating a 15-ft. fall.

Darlington.—The report of the electricity department shows an increase of 22 per cent. in the number of units generated for lighting and power purposes since April last. The accounts to the end of March last showed a net profit of £2,918, and the Committee recommends that this be placed to the reserve account.

Folkestone.—**PRICE INCREASE.**—The Electricity Supply Co., Ltd., has notified the T.C. that from the meter readings at the beginning of the December quarter, the charge for current will be increased by a further 5 per cent., in addition to the 10 per cent. already enforced.

Harrogate.—**YEAR'S WORKING.** The annual accounts for 1915-16 show a total revenue of £20,202; working expenditure amounted to £9,137, and the gross profit to £10,765. From the latter, after meeting interest and sinking fund charges, £1,784 was placed to reserve and £1,000 to relief of rates; the balance, together with £289 from reserve, making £819, was expended on works of a capital nature. The reserve balance amounts to £4,029. During the year 1,474,234 units were sold, the maximum load amounting to 800 kW.

London.—**HACKNEY.**—The Electricity Committee recommends the extension of the distributing main in High Street, Kingsland, in order to supply electricity to a factory, the firm guaranteeing a minimum of £100 per annum for five years. The Committee also recommends that application be made to join the I.M.E.A.

WOOLWICH.—At the meeting of the B.C. the Electricity Committee reported having completed negotiations for supply with one large company. Negotiations are proceeding with an important authority whose representatives had applied for terms for a stand-by supply. The terms accepted in the one case, and the terms offered in the other, are such as will safeguard the Council against any large capital expenditure or loss on revenue account. The Works Committee reported having entered into an arrangement in regard to the lighting of certain roads.

ISLINGTON.—**EXTRA WAGES.**—The B.C. has granted an addition of 1d. an hour to the wages of the employees of the electricity department.

Lowestoft.—Last week Mr. R. C. Maxwell, inspector of the L.G.B., held an inquiry into the application of the T.C. for sanction to various overdrafts, including £4,000 on the tramways account and £6,000 on the electric lighting account.

Newport (Mon.).—The Electricity Committee has considered the memorandum circulated by the Joint Committee in connection with National Electricity Supply, and has passed a resolution authorising the borough electrical engineer, Mr. A. Nichols Moore, to take part in the proposed Committee for that area of supply, and to report as to progress made with the scheme, without, however, pledging the Committee to any course of action until it has had full opportunity of considering it.

New Zealand.—According to the *New Zealand Gazette*, as a result of a poll of the ratepayers of the Borough of Stratford (North Island), it has been decided to borrow the sum of £16,000 for street lighting, electric power supply, &c., purposes.

Oulton Broad.—**STREET LIGHTING.**—The local electric lighting company has informed the U.D.C. that it does not see its way to make any further reduction in the contract prices for street lighting. The matter has been referred to the General Purposes Committee.

Reigate.—At the meeting of the T.C. it was stated that, for the half-year ending September 30th, which included the five months covered by the Daylight Saving Act, the undertaking had lost in revenue from lighting £594. The reduced demand had enabled the staff, for the first time in the history of the undertaking, to shut down the whole of their steam plant, and run entirely on oil, thus saving 93 tons of coal. If they could continue to run through the winter without the aid of steam, as there was reason to hope they might, the loss of revenue would, in a measure, be compensated for by the saving in consumption of coal.

Ripon.—**E.L. SCHEME.**—The T.C. has decided to apply for a provisional order for electric supply; the approximate cost of the scheme is £20,000. The site selected by a Committee for the generating station did not meet with the approval of the Council, and in order to give the Committee the opportunity to select another site the matter was adjourned.

Rotherham.—Plans have been passed for the Rotherham Forge and Rolling Mills Co., Ltd., for an electrical sub-station; the Corporation electricity department is to carry an overhead electric cable across the River Don to these works. New electrical air compressors are to be put in at the sewerage works, and towards the cost the Electric Light Committee will contribute £500.

Sheffield.—PROPOSED NEW POWER STATION.—The Electricity Committee reports that the generating station at Neepsend is unequal to supplying all the power required by consumers, and recommends that a new generating station be provided. The Committee recommends that Sir Alex. Kennedy be asked to advise on the matter, and that steps be taken for obtaining the necessary powers, either by the promotion of a Bill in Parliament or otherwise, to carry out any scheme that may be decided on.

The Finance Committee approves of the recommendation of the Electricity Committee to acquire land and erect a sub-station at a cost of £8,000 exclusive of the cost of the land, subject to Government approval.

Swinton (Yorkshire).—STREET LIGHTING.—A question has arisen between the Swinton U.D.C. and the Mexborough and Swinton Tramway Co. in regard to the matter of payment by the Council to the company for current for public lighting, which, under the restrictions of the present time, has been discontinued. The company has insisted upon full payment of the rate per lamp which it is entitled to under its Act, and has held up the payment of rent to the Council as security for settlement of the lighting account.

Wolverhampton.—PRICE INCREASE.—The charges for electricity are to be increased temporarily by 10 per cent., in order to put the electrical undertaking on a sound financial basis.

The Electricity Committee, in its annual report, states that, notwithstanding the increased prices of material and labour, the costs of production per unit sold show a decrease, compared with the year previously, under every heading excepting that of coal. During the year it was found necessary to make preparations for additions to the generating plant, and the L.G.B. sanctioned loans amounting to £51,416 for this purpose. These extensions cover the addition of two boilers with all auxiliaries, one 5,000-kw. turbo-alternator set with the necessary switchgear, &c., alterations to the buildings of the boiler and engine houses, new converter plant, and sub-stations in the town, together with E.H.T. mains. The steady increase of output from the works has been maintained, as will be seen from the fact that for the year under review the increase in units sold was 2,154,426. Negotiations have taken place with several important outside industrial undertakings who have under consideration the question of building new works, with a view to their taking electricity supply in Wolverhampton, and it is hoped good results will follow.

TRAMWAY and RAILWAY NOTES.

Bacup.—ARBITRATION.—Mr. McElroy has appointed November 20th for the arbitration between the Bacup and Rawten-stall Councils on the question of alteration of the tramway fares between the two towns, if necessary; the arbitration will be continued on November 22nd.

Blackpool.—YEAR'S WORKING.—In his annual report, Mr. Chas. Furness states that the total income of the Corporation tramways was £80,066 and the working expenses were £45,030. The gross profit of £35,025 was divided as follows:—Interest and sinking fund charges, £18,760; reserve fund, £3,275; permanent way renewal fund, £8,000; and contributed to rates, £5,000. The net profit constituted the third best in the history of the department. The year's receipts were £3,961 more than in the previous year, though up to the end of September the increase only stood at £849. The winter months showed an approximate increase of £2,600. The number of passengers showed an increase on the year of 967,337, and the mileage a decrease of 16,132. The passengers carried numbered 14,585,851.

Seventy employes are on war service, three have fallen in action, whilst a number of others have sustained injuries. Referring to the employment of female conductors, Mr. Furness says they have, on the whole, acquitted themselves creditably.

Blackpool.—LYTHAM.—STORM DAMAGE.—Owing to a sudden gale on the Fylde Coast, on October 30th, the tramway service on the Blackpool, St. Annes and Lytham route was impeded, owing to the wires being blown down. The cars were held up for some time during the evening; those on the Promenade route found it impossible to run to time.

Bradford.—Our correspondent writes that the queue system has been in operation for a long time on certain of the tramway routes, but in Forster Square, the centre of a wide distribution of services, there has been difficulty in establishing a satisfactory queue method, owing to the fact that the Heaton, Frizinghall, Baildon Bridge, Saltaire, Bingley and Cross Flatts cars run over the same route for considerable distances out of the city. Their starting point, too, is at a most congested corner. Recently an attempt was made to establish some sort of order in the unruly mob which has been in the habit of rushing the cars, by posting notices threatening penalties if a queue were not formed, but these had little or no effect, and last week three separate queues, with barriers, were fixed. The result is not altogether a success, because inspectors and policemen have still to keep order, and the congestion at the two corners now in use is probably worse than ever.

Continental.—SPAIN.—The *Gaceta de Madrid* publishes a notice authorising the Compania Nacional de Tranvias de Barcelona to undertake the extension of the electric tramway to Saus.—*Board of Trade Journal*.

Darlington.—TRAFFIC RESULTS.—The tramway earnings for the past six months shows an increase of £432. The Committee recommends that the salary of the traffic superintendent be raised to £170 per annum, but a request by male employes for an increased war bonus has been referred to the General Purposes Committee.

Halifax.—The Corporation has applied to the B. of T. for a further Order under the provisions of the Special Acts (Extension of Time) Act, 1915, to extend until August 18th, 1918, the period for the completion of the following tramways authorised by the Halifax Corporation Act, 1911, viz.:—Nos. 1, 2, 4, 7, 14, 15, 16, 17, 18, 21, 22, 34, 36, 37, 38 and 39, wholly situate in the borough; Nos. 19 and 20, wholly situate in the urban district of Queensbury; Nos. 23 and 24, wholly situate in the urban district of Shelf; and Nos. 25, 26 and 27, wholly situate in the borough of Brighouse.

Huddersfield.—The queue system of loading tramway cars was put into operation for the first time in Huddersfield last week. Though, owing to the narrowness of the causeways, no barriers have been erected, the system is said to work satisfactorily.

Rochdale.—TRAMWAY ACCIDENT.—An accident occurred on Thursday, last week, to a Corporation car travelling between Whitworth and Bacup, 12 passengers being injured. The car got out of control on a gradient and jumped the points; it was put back on the line and ran backwards, and again jumped the metals, finally colliding with an electric standard, and overturning in such a position that it hung balanced on a low wall overlooking a valley.

Rotherham.—NEW CARS.—Owing to the rapidly-increasing traffic on the tramways, tenders are to be invited for the supply of six new double-decked cars. Mr. Edward Cross, the tramway manager, reported that it would take from six to eight months to obtain delivery.

Sheffield.—The number of passengers carried on the Corporation tramways during October was 11,493,379, as compared with 9,771,602 for the corresponding period of 1915; the receipts were £43,341, as compared with £36,755.

The Tramways Committee recommends the purchase of land at Pickmere and Fitzgerald Roads, at a cost of £1,965, for a depot.

U.S.A.—On Wednesday a Boston car left the track and fell over the bridge at Fort Point Channel, 54 passengers being drowned.

Winchester.—ELECTRIC VEHICLE.—The Electricity Committee has had under consideration the desirability of purchasing a small electrically-driven van, which, while serving as a demonstration car, could also be used with advantage by the department in the delivery of stores; before, however, coming to a decision the Committee is causing further inquiries to be made as to whether such a vehicle could do all the work required as cheaply as by the present method. The Mayor stated that up to the present about a dozen vehicles (ten tractors and two private) had been recharged at the works.

Wolverhampton.—YEAR'S WORKING. The report of the year's working of the Corporation tramways to March 31st last, shows a gross profit of £24,893, which, with £1,459 added on motor-omnibus account, makes a total of £26,353; after meeting charges for interest and sinking fund, there remained a net profit of £13,271. The reserve and renewal account now stands at £36,598. The Tramways Committee give the following statement of traffic receipts for the first six months of the financial year commencing April 1st, 1916:—Car-mileage, 590,685; passengers carried, 7,516,858; receipts, £33,259, being 13'5d. per car-mile. The figures for the same period of last year were:—Car-mileage, 585,614; passengers carried, 6,617,061; receipts, £29,525, or 12'11d. per car-mile.

TELEGRAPH and TELEPHONE NOTES.

Long Submarine Telephone Cables.—A 12-conductor telephone cable was recently laid across Vineyard Sound to connect Martha's Vineyard Island with the mainland of Massachusetts, and a six-conductor cable was laid at the same time to connect the island with Nantucket Island, a distance of nearly 20 miles. The latter island was previously without telephone connection.

The large size of the Vineyard Sound cable—2·69 in., and weighing 10·6 lb. per running foot—was necessitated by the strong tides prevalent in that body of water. It is one of the heaviest ever handled by a power, telephone, or telegraph company. The Nantucket cable is about 5 lb. to the foot. In the former cable each conductor is wrapped in double paper insulation, with a similar wrapping on the core, around which is a lead sheath $\frac{3}{8}$ in. in thickness. Around this are three layers of 100-lb. jute roving, bound by 23 armour wires 0·203 in. in diameter, also enclosed in two layers of jute roving, and finally bound in an outer armour of No. 4 steel wires, the final wrapping being two thicknesses of No. 16 three-ply jute yarns.

The Nantucket cable has double insulation, a lead and tin sheath $\frac{3}{8}$ in. thick; and three layers of 100-lb. jute roving bound in steel wire armour of 18 strands, 0·238 in. in diameter.

The Vancouver sound cable reached the point of departure from the cable car at 7.30 a.m. respectively 71,400, 71,500, 72,000, and 72,500 ft. these being among the heaviest reels on record.

The laying of the cables was done by the Western Union Telegraph Co. and the ship *Cordoba*.

The Vancouver cable is the longest electrical conductor under cover in the United States. Its total weight is 361 tons. *Electrical Engineer* and *W. Electrician*.

Telegrams by Telephone.—In view of the difficulty in making prompt delivery of telegrams by messengers on account of the growing dearth of boy labour, the Post Office authorities point out that the delivery of telegrams by telephone, with delivery by post of confirmatory copies, provides a good alternative. It would be of great assistance to the Post Office if the public would make greater use of the arrangement under which telegrams may be directed to a telephonic address, as, for example:—"Smith, Midland 245, Birmingham." Subscribers are recommended to print their telephonic addresses on their notepaper, and to advise their regular correspondents to address their telegrams accordingly.

CONTRACTS OPEN and CLOSED.

OPEN.

Argentina.—November 30th. Buenos Aires Municipality. Electric carbons required during 1917. Oficina de Licitaciones, Intendencia Municipal de la Capital, Avenida de Mayo, 325; Buenos Aires.

Australia.—SYDNEY. —January 22nd, 1917. Electrical plant (converter, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.*

January 8th. Municipal Council Electric Lighting Department. 33,000-volt switchgear. E.L. Department, Town Hall. Specification 10s. 6d.*

MELBOURNE.—December 11th. City Council. Supply and erection of coal transporter plant. See "Official Notices" September 15th.

NEW SOUTH WALES.—Time for sending in tenders for 50-ton electric overhead travelling crane for Yarra Street power-house, Newcastle, extended to January 3rd.*

Bradford.—November 11th. Stores for the Tramways Department. Tramway Offices, 7, Hall Ings. Deposit £1 1s.

Cape Town.—January 5th. Electric motors and starting panels, for the Corporation Electricity Department. Dock Road, Cape Town.*

Chatham.—November 15th. T.C. Annual contract for electric lamps, stores, &c. Borough Surveyor, Town Hall.

Durban.—January 3rd. Corporation. One 3,000-KW. steam turbine, alternator, and condensing plant. Specification No. S. 238; drawing No. P. 597, both at the office of the Borough Electrical Engineer, Municipal Buildings. Deposit £2 2s.

Enniskillen.—December 1st. Sligo, Leitrim & Northern Counties Railway Co. Twelve months' supply of telegraph materials. Mr. J. Duff, Secretary to the Company.

Grenada.—December 31st. Government. Electric supply at St. George's and suburbs. Tenders to Colonial Secretary, Grenada, British West Indies.

Johannesburg.—November 20th. Corporation. 500 or 1,000 trolley wheels for tramcars (Contract No. 181).*

November 27th. Corporation. 1,000 sets of single-pole, ironclad house-service cut-outs (Contract No. 187).*

November 27th. Corporation. 250 field coils for tramcar motors (Contract No. 192).*

December 20th. Corporation. Automatic pressure regulators for the a.c. turbo-generators at the power station.*

December 9th. Corporation. 1,427 A.C. and D.C. electricity meters and 100 time-switches. Specification (21s. deposit) from Mr. E. T. Price, General Manager's Office, Electricity Supply and Tramways Department, President Street, Johannesburg, W.*

January 3rd. Corporation. Iron axles and bushes.*

Liverpool.—November 22nd. Cheshire Lines Committee. General stores, including (6) telegraph materials and carbons, during 1917. Stores Superintendent, Warrington.

Middleton.—November 11th. Corporation. 4,000 tons washed or dry slack steam coal for the Electricity Department. Particulars from the Borough Electrical Engineer.

New Zealand.—DUNEDIN.—January 24th, 1917. Motor-generator, accessories and spares. City Electrical Engineer, Market Street Dunedin.*

Oldham.—November 13th. Electricity Committee. Steam coal for 8 or 12 months during 1917. Mr. F. L. Ordern, Greenhill Electricity Works.

Rhondda Valley.—November 20th. Electrical installation in screwed tubing for Messrs. David John & Co., brewers, Pentre. See "Official Notices" to-day.

Rotherham.—November 16th. Tramways Committee. Six electric double-deck, top-covered cars. See "Official Notices" November 3rd.

Salford.—November 13th. Covering steam piping, valves, &c. Borough Electrical Engineer, Frederick Road.

Stalybridge. Tramways and Electricity Board. Water-tube boilers, mechanical stokers and cooling towers. See "Official Notices" November 3rd.

Stretford. November 21st. Corporation Electricity Works. Twelve months' supply of best Lancashire rough slack coal, 12,000 tons. Tenders to Council Offices, Old Trafford.

Wakefield. November 20th. Supply of coal for the electricity works, Calder Vale, for a year. City Electrical Engineer, Old Town Hall.

Wigan.—November 15th. Twelve months' supply of firing slack for the electricity works. Mr. W. H. Tyrer, Town Clerk, Municipal Offices, King Street West.

York. November 23rd. North-Eastern Railway Co. Six and twelve months' supply of telegraph apparatus, telegraph wire and line stores. See "Official Notices" to-day.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Department in London.

CLOSED.

Australia.—Victoria Railways Department:—

100 motors for pumps for State coal mine. Aust. General Electric Co.

N.S.W. Public Works Department:—

5,000 volt switchboards, Homebush sub-stations, £1,453. A. T. Carter & Co.

Sub-station equipment for ditto, 2970. N. Garbridge, Ltd.

5-ton loco electric cranes, £1,260. Strachan, Murray & Shannan.

The Tenterfield (N.S.W.) Council has accepted the tender of the Commonwealth Electrical Construction & Supply Co. for the installation of electric lighting in the town. —Tenders.

Manchester.—Electricity Committee:—

Cable, R.L. & H. Cable, Ltd.; Western Electric Co.; Callender's

Cable & Construction Co., Ltd.

Turbine feed pump. G. & J. Weir, Ltd.

Sub-station switchgear. Ferranti, Ltd.

Tramways Committee:—

Copper trolley wire.—F. Smith & Co., Ltd.

Rotherham.—District Council. Accepted tender:—

Chadwick & Co. (Rotherham).—Extension of the boiler-house buildings at generating station, for the additional two water-tube boilers.

Salford.—Lighting and Cleansing Committee:—

Lancashire Dynamo & Motor Co. One No. 5 d.c. motor and accessories, £45s.

Sheffield.—According to a Sheffield paper, the Electricity Supply Committee is authorising the general manager to obtain tenders for the purchase of certain obsolete plant at the Shaf Street and Neepsend generating stations, and to accept the quotation of Messrs. C. A. Parsons & Co., Ltd., amounting to £19,000, plus an allowance of 5 per cent. for contingencies, for two turbo-alternators, switchgear, and alterations to pipework in replacement of the plant referred to, to be erected at Neepsend for working with the existing condensers.

Woolwich.—Borough Council. Accepted tender:—

G. & J. Weir. Feed pump capacity 10,000 to 12,000 gallons, £32s.

FORTHCOMING EVENTS.

Royal Society of Arts. Friday, November 10th. At 5.15 p.m. At John Street, Adelphi. Chadwick Lectures on "Fatigue and its Effect on Industry and Efficiency," by Professor Stirling.

Wednesday, November 15th. At 4.30 p.m. Opening address, "The Stability of Great Britain," by Dr. Dugald Clerk, F.R.S.

Physical Society of London.—Friday, November 10th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary meeting.

Chief Technical Assistants' Association.—Saturday, November 11th. At 3 p.m. At the Tavistock Hotel, Covent Garden. Discussion on "Coal and Ash-Handling Plant," to be opened by Mr. J. T. Baron.

Association of Mining and Electrical Engineers (West of Scotland Branch).—Saturday, November 11th. At 4.30 p.m. At the Royal Technical College, Glasgow. Lecture on "Friction Surfaces," by Mr. J. Oswald; demonstration of oxy-acetylene, by Mr. W. L. Brown.

City of Nottingham Industrial Development Committee.—Monday, November 13th. At 6.30 p.m. At the Exchange, Nottingham. Address on "War and Industrial Revival," by Mr. T. C. Elder.

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday, November 15th. At 7 p.m. At the University, Edmund Street. Kelvin Lecture, "Some Aspects of Lord Kelvin's Life and Work," by Dr. A. Russell.

(Manchester Local Section).—Tuesday, November 14th. At 7.30 p.m. At the Engineers' Club, Albert Square. Chairman's inaugural address.

(Scottish Local Section).—Tuesday, November 14th. At 7.30 p.m. At 207, Bath Street, Glasgow. Chairman's inaugural address.

(Newcastle Local Section).—Monday, November 13th. At 6.45 p.m. At the Mining Institute, Chairman's inaugural address.

Liverpool Engineering Society.—Wednesday, November 15th. At the Royal Institution, Colquhoun Street. Paper on "The Civil Engineering Profession and some Economic Problems," by Mr. J. Glover.

Greenock Electrical Society.—Thursday, November 16th. At 7.45 p.m. At 22, West Stewart Street. Paper, "A Criticism of the I.E.E. Rules," by Mr. H. Puggott.

Chemical Society.—Thursday, November 16th. At 8 p.m. At Burlington House, Piccadilly, W. Ordinary scientific meeting.

Institution of Mechanical Engineers.—Friday, November 17th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. General meeting. Research Committee. Report on the Hardness Tests.

Batt Wallalls Society.—Friday, November 17th. At 6.30 p.m. At Victoria Mansions Restaurant, Victoria Street, S.W. Informal Reunion. Dinner at 7 o'clock. Mr. W. W. W. will presiding. Members are asked to communicate with the secretary stating whether they will be present and the number of guests.

Junior Institution of Engineers.—Friday, November 17th. At 8 p.m. At 39, Victoria Street, S.W. Paper on "How to Memorise Formulae," by Mr. E. Flinders Etchells.

NOTES.

To Engineering and Allied Contractors.—The Ministry of Munitions is desirous of extending the output of:—

Casting and Stamping Fuse Bodies and Sockets.
Casting and Rolling Brass Rods for the Components.

Firms possessing suitable machinery and capable of undertaking such work are requested to communicate at once with the Central Clearing House for Engineering Resources, Ministry of Munitions, 8-9, Northumberland Street, Northumberland Avenue, W.C.

Lighting in Picture Theatres.—The Middlesex County Council Licensing Committee proposes to insert in the licences for kinemas a requirement that the building shall be so lighted that it shall be possible to see clearly over the whole of the auditorium throughout the whole of the performance. *The Times*.

"Callender's Staff Service Gazette."—We have received a copy of No. 8 of *Callender's Staff Service Gazette* (October, 1916), in which the full list is given of staff and employees of Callender's Cable and Construction Co. who are with the Colours. The editorial notes contain a great deal of very interesting information regarding the movements and experiences of the men who have been wounded or laid down their lives in the service of the country. Many letters from the men are published. A Supplement shows an excellent portrait of the late Mr. W. O. Callender, the founder of the company.

Appointments Vacant.—Boiler house superintendent for Rochdale; charge engineers for a public supply undertaking (certified). £130 + $\frac{7}{8}$ per cent. war bonus. See our advertisement pages to-day.

Siemens Bros. & Co., Ltd.—MERTONS AND THE MARCONI CO.—In reply to a Parliamentary question, on Wednesday, Mr. Pretyma said that Mr. George Chauvin was the managing director of Siemens Bros., Ltd., but Mr. Carl von Siemens was no longer a director. The firm was a controlled establishment doing Government work, and was under a supervisor. "It is greatly to the national interest that this business should be acquired by those British firms who can make the best use of it for the future development of the electrical industry of this country. Active steps to that end are now in progress, and in the meantime it is clearly necessary that the business should be fully maintained."

Mr. Pretyma also stated that Messrs. H. R. Merton & Co. had applied to be reinstated on the ground that the German interest was now eliminated.

Mr. Runciman, in reply to a question, says that he is informed by the Marconi Co. that certain of their directors were before the war on the Board of the Deutsche Betriebsgesellschaft für Drahtlose Telegraphie of Berlin, in which the Telefunken Co. holds the majority of the shares. He was informed by the Marconi Co. that they had not considered it in their interests to publish in their yearly accounts lists of their holdings in other companies since 1913, but that the information was at all times available to their shareholders. The Marconi Co. in 1913 concluded an agreement of a commercial nature between them and the Telefunken Co., which dealt in some matters with Australia, New Zealand, and Spain, but did not enslave the United States. This agreement has not been operated since the beginning of the war.

Electrical Goods in South Africa.—The *South African Export Gazette* says that electrical goods made in Japan are now being sold in South Africa. "The factory prices are even cheaper than similar goods of German origin in the pre-war days." Our contemporary says that electrical goods are arriving in South Africa from the United Kingdom more freely now, but contracting work has not improved.

An Industrial Truce for Three Years.—With reference to the proposal that Capital and Labour shall through their respective representative organisations adopt an industrial truce for three or five years, to which we have alluded on several occasions, the *Times* in its "Political Notes" states that a short time ago the Parliamentary Committee of the Trades Union Congress asked the Employers' Parliamentary Committee to meet them in order to consider the resolutions on post-war problems passed by the Congress at Birmingham in September. It has now been arranged, says our contemporary, that representatives of the two Committees shall meet in London next week to survey the ground. "If they can arrive at a preliminary understanding the full bodies will, no doubt, hold a joint conference without further delay. The movement is of the first importance. The resolution of the Congress on which the Parliamentary Committee are acting instructed them to approach the Government and the employers with the object of discussing terms that would secure industrial peace for three years after the war."

Banks and Industry.—Speaking at the meeting of the Russian Corporation recently, Mr. A. W. Tait, the chairman, said:—

"We have read a great deal recently about the necessity for financial assistance for the development of British industry after the war. I do not think we need infer from this that the industrial interests of this country have not received proper banking facilities or support from the existing joint-stock banks, because I believe they have been admirably supported in this connection. There is, however, a feeling that something more than this is necessary, particularly in financing the development of railways and public works in the various countries of the world, in which British

enterprise, ability, and experience are well able to take their part. Dealing for the moment with Russia, I am inclined to think that the existing institutions are able, in a very large measure, to supply the financial assistance required, and they are able and willing to grant facilities for the development of trade between the two countries. This might be further increased if there were a greater measure of reciprocity and co-operation, thereby preventing a considerable amount of overlapping and unnecessary competition. A great deal has been said about the necessity for Government assistance to financial institutions, but, personally, I do not see the necessity for this, particularly with regard to Russia, because the institutions are already in existence, and any step which might be taken either as regards assistance to or recognition of one institution would be manifestly unfair, and would have a prejudicial effect on the activity and usefulness of the other institutions which are probably quite as favourably situated to carry out business. The British Government could be of more real help to these institutions by instructing its Ambassadors and Consular representatives in the various countries to assist, when required, the British institutions to enable them to obtain the business in competition with the financial institutions of other countries which have in the past obtained this support. By this means there would be not only profitable employment for British capital, but proper safeguards could be made whereby such capital as might be required for the purchase of materials and plant would be utilised as far as possible for the benefit of British industry. In the past many issues have been made in this country where the British investor has been asked to subscribe the capital and the proceeds have been spent in foreign countries—notably in enemy countries. We must, therefore, benefit from the lessons of the past, and see that in future where this country supplies the money the interests of British industry are properly safeguarded. If proper regulations are made and the various banks and financial institutions of Great Britain insist on their being carried out where loans are granted and when new enterprises are financed this would be a most effective means of counteracting the hold which certain enemy institutions and industries had upon the greater part of the trade of the world."

Mr. Pretyma, in reply to a Parliamentary question, hopes that active steps will be taken to set up the British trade banking organisation suggested by Lord Faringdon's committee.

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, November 13th. Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10. Signalling Class. Recruits' Drill, 6.25—8.

Tuesday, November 14th. School of Arms, 6.7. Miniature Range, 5.30—7.30. Lecture, 7.15, "The Service Rifle," Platoon Commander A. Gerard.

Wednesday, November 15th. Instruction Class, 6.15. Miniature Range, 5.30—7.30. Platoon Drill, Platoon No. 3.

Thursday, November 16th.—Platoon Drill, Platoons Nos. 5 and 6. Ambulance Class, 6. Miniature Range, 5.30—7.30.

Friday, November 17th.—Technical for Platoon No. 10, Regency Street. Squad and Platoon Drill, Platoon No. 9. Signalling Class. Recruits' Drill, 6.25—8.25.

Saturday, November 18th.—N.C.O.'s Class, 2.30, Company Commander Castell.

Sunday, November 19th. Entrenching at Oxford. Parade Victoria (S.E. & C. Railway Booking-office), 8.45 a.m.

Inspection.—The Corps will be inspected on November 25th by Sir Desmond O'Callaghan. A full muster is highly important. Parade, 2.20. Uniform.

(By order) MACLEOD YEARLEY, Adjutant.

3RD (OLD BOYS' CORPS) BATT. COUNTY OF LONDON VOLUNTEER REGIMENT.—Battalion Orders by Major R. J. C. Eastwood (Commandant), Monday, November 6th, 1916:—

Entrenching Duties will be performed on Saturday and Sunday next, 11th and 12th inst.

Recruits' Drill, under Company Sergt.-Major Bretterth, will be held on Mondays, Wednesdays and Fridays at the Royal Exchange, E.C., at 5.30—7 p.m.

Tuesdays, 7.15—8.15 p.m., at the London Scottish Drill Hall, Buckingham Gate.

Thursdays, 7.30—8.30 p.m., at the London Scottish Drill Hall.

Daily recruit drills at Lord's Cricket Ground, under Sergt.-Major Alexander, as follows:—9.30 a.m.—10.30 a.m.; 11 a.m.—12.15 p.m.; 3 p.m.—4 p.m.

Evening recruit drills at Yeomanry Hall, Henry Street, St. John's Wood, under Sergt.-Major Alexander, on Tuesdays and Thursdays, 6 p.m.

Enrolment of Recruits.—The C.O. will be at Headquarters, Lord's, on Mondays, Wednesdays, and Fridays to enrol recruits, at 6—7 p.m., and to interview any men who wish to see him.

G. H. F. DUNCAN, Adjutant.

The Hardship of Premature Call-up Notices.—At a meeting of the Military Service Committee of the London Mercantile Chamber, held at 44, Bedford Row, W.C., on the 2nd inst., the following resolution was carried unanimously:—

That the War Office be petitioned to make such regulations as will relieve the financial hardships incidental to men who have been notified that they may be called up but who are not to understand that they will certainly be called up, and are asked to continue their civil employments, when such men, after the final decision of a Tribunal, are exempted for a certain time only, and sell their businesses or in consequence of their position leave their employments to hold themselves in readiness for their call and are obliged to live on their capital. If not eventually called up, such men can, under present regulations, have no allowance made them for their wives and children, and this Committee respectfully submits that great hardship ensues, and that steps be at once taken to remedy the grievances indicated.

Wages in Australia.—According to an Australian Government report issued in London the following are the wages paid in Australia for adult male electricity supply, &c., work in 1915-16.

Sydney.—Electrical installation.—Armature winders, 72s.; cable jointers, 72s.; fitters, 74s.; linemen, 66s.; mechanics, 66s.; wiremen, 64s.; other adults, 57s. Electrical Supply.—Armature winders, 72s.; cable jointers, 74s.; carboner (arc lamp attendant), 55s.; instrument makers, 70s.; linemen, 66s.; meter fixers, 66s.; meter testers, 70s.; patrolmen (night), 60s.; shift electrician, 74s.; switchboard attendants, 60s.; other adults, 57s. Electrical Trades.—Fitters, 71s.; mechanics, 66s.; wiremen, 61s.

Melbourne.—Armature winders, 65s.; cable jointers, 69s.; fitters, 69s.; linemen, 65s.; mechanics, 65s.; patrolmen, 63s.; wiremen, 60s.; wireman's assistant, 56s.; other adults, 56s. Electrical Supply.—Armature winders, 54s. and 63s.; cable jointers, 63s.; carboner (arc lamp attendant), 54s.; instrument makers, 68s.; linemen, 60s.; meter fixers, 55s.; 6d.; meter testers, 63s.; patrolmen (night), 66s.; shift electrician, 66s.; sub-station attendants, 60s.; switchboard attendants, 54s.; switchmen, 52s.; 6d.; other adults, 51s. Electrical Trades.—Fitters, 66s.; mechanics, 63s.; wiremen, 63s.

Brisbane.—Electrical Installation.—Armature winders, 63s.; cable jointers, 69s.; fitters, 69s.; linemen, 60s.; mechanics, 60s.; wiremen, 60s. Electrical Supply.—Armature winders, 63s.; cable jointers, 69s.; carboner (arc lamp attendant), 57s.; instrument makers, 69s.; linemen, 60s.; meter testers, 69s.; shift electrician, 63s. and 76s.; sub-station attendants, 54s. Electrical Trades.—Fitters, 69s.; mechanics, 69s.; wiremen, 60s.

Adelaide.—Electrical Installation.—Armature winders, 66s.; cable jointers, 69s.; fitters, 69s.; linemen, 60s.; mechanics, 60s.; patrolmen, 60s.; wiremen, 51s.; other adults, 48s. Electrical Supply.—Armature winders, 66s.; cable jointers, 60s.; carboner (arc lamp attendant), 48s.; instrument makers, 60s.; linemen, 60s.; meter fixers, 51s.; meter testers, 60s.; patrolmen (night), 60s.; switchboard attendants, 48s.; switchmen, 54s.; other adults, 48s. Electrical Trades.—Fitters, 66s.; mechanics, 60s.; wiremen, 51s.

Perth.—Electrical Installation.—Armature winders, 72s.; fitters, 72s.; linemen, 63s.; mechanics, 72s.; wiremen, 66s.; other adults, 54s. Electrical Supply.—Armature winders, 72s.; instrument makers, 72s.; linemen, 63s. Electrical Trades.—Fitters, 72s.; mechanics, 72s.; wiremen, 66s.

Hobart.—Electrical Installation.—Armature winders, 63s.; cable jointers, 60s.; fitters, 63s.; linemen, 54s. and 57s.; mechanics, 63s.; patrolmen, 60s.; wiremen, 57s.; wireman's assistant, 51s.; other adults, 51s. Electrical Supply.—Armature winders, 63s.; cable jointers, 60s.; carboner (arc lamp attendant), 54s.; instrument makers, 63s.; linemen, 54s. and 57s.; meter fixers, 51s.; meter testers, 60s.; patrolmen (night), 60s.; sub-station attendants, 63s.; switchboard attendant, 51s. Electrical Trades.—Fitters, 63s.; mechanics, 63s.; wiremen, 57s.

Electro-Harmonic Society. The next Concert (Ladies' Night) will be held at the Holborn Restaurant (King's Hall), on Monday, November 20th, commencing at 6.15 p.m. The artistes will be as follows:—Soprano, Miss Olive Storgess; contralto, Miss Dorothy George; bass-baritone, Sapper Joseph Farrington (by desire); solo violin, Miss Mary Law; light-comedy entertainer, Miss Mabel Adeane; Canadian entertainer, Mr. W. V. Robinson; entertainer at the piano, Mr. Harrison Hill; solo pianoforte and accompanist, Mr. Bernard Flandets, A.R.A.M. Evening dress is optional.

Institution and Lecture Notes.—**Birmingham and District Electric Club.** Mr. J. J. Richardson read a paper on "Sand-blasting and Sand-blast Machines" at a recent meeting of the club. He said that the sand-blast process was invented in 1870 by Mr. B. C. Tilghman, of Philadelphia. The abrasives used in the process include ordinary inland silicious sand, sharp builders' sand, powdered glass, emery from fine to coarse, chilled iron sand, and steel shot, and the streams of these "sand-blasting" mediums are forcibly projected through variously formed nozzles by means of steam, and by currents induced by exhaust air or compressed air. The action is extremely rapid; a momentary application depolishes glass over any space that can be covered by one stroke of the sand shower, instantly changing the previously bright surface to obscured. Stone, marble, slate and granite are equally amenable to its action. Iron, steel and other metals have their surfaces easily reduced and smoothly or coarsely granulated, according to the force and abrasive used; but all these materials, being less brittle than glass, take rather longer time.

The sand-blast process was first used in connection with glass marking and obscuring, and is to-day largely employed in the glass trade. It is in constant use for obscuring or producing a uniform granulation known as ground glass, on sheet glass, lamp and gas globes, the bulbs for incandescent electric globes and the like; also for the decoration of sheet or objects in glass with ornamental designs in which the pattern or the field may be left bright and transparent, of which there are numerous varieties, one being a glass of two or more thicknesses of different colours, to leave the design of one colour on a field of another, for perforating sheet and plate-glass for ventilators, or otherwise engraving and marking glass, bottles, advertising tablets, &c.

In using the process for engraving, lettering, or perforating glass, stone, &c., the parts of the surface which are not to be acted upon by the sand-blast are protected by various elastic and tenacious substances, varying in thickness and durability, according to the depth of the cutting required and the brittleness of the material under operation. The more elastic this protecting substance, the

less will be the impression made upon it by the sand-blast. For engraving table glass, bottles, lamps, globes and chimneys, and small articles in sheet-glass, a stencil is usually made of thin sheet-iron or steel, worked to the proper shape, and fitted on the article during the operation. These stencils, with care, last a long time, and about 2,000 impressions can be made with one stencil. For engraving advertising tablets, door panels and sheet-glass, an adhesive material is pressed upon the glass through a tin foil stencil. For a better class of work the glass is covered with prepared paper, upon which the design is sketched, and then cut out by hand.

The sand-blast process is also applied to the cleansing and finishing of new files, and is now found in nearly all the large file works in the country. In the metal trades the sand-blast is used for the removal of the hard scale so destructive to cutting tools, from castings, forgings, stampings, &c., also for the removal of the scale from sheet-iron and steel prior to enamelling, galvanising, nickelling, tinning, &c., the cleaning of tubes and brazed joints, largely used in cycle works, and the reduction to clean metal surfaces of larger parts. For large work in metal, say, for the removal of scale from armour plates, it is generally necessary to take the sand-blast to the work. The portable plant is used also for cleaning the ends of electric tramway rails before welding them, &c.

Such work as the cleaning of the brazed joints of cycle frames, twist drills, and hardened steel parts, frosting the inside of cigarette cases before gilding, and frosting such things as carburettor bodies before plating, is done in sand-blast chambers. These vary in size according to the work required to be done. The operator stands outside the chamber, and passes his arms through suitable openings, directing the blast on the articles to be cleaned, and observing the results through the window in front of which he stands. Special types of sand-blast machines are made for many purposes, including the cleaning of the inside of shells.

University College, London.—In the second of his series of lectures on "Long-distance Telephony," on Friday last, Prof. J. A. Fleming dealt with the conditions governing the flow of alternating-current waves through a cable and the methods of effecting the calculations involved. A brief explanation of the nature and mode of use of vectors led up to a demonstration of the vector-calculating rule devised by the author (described in the *Journal I.E.E.*, Vol. 52, No. 236), which greatly facilitated vector calculations for preliminary purposes, though not so accurate as the detailed and laborious calculations otherwise necessary. Pointing out that the formulae could be simplified by the use of exponential expressions, Prof. Fleming proceeded to explain the nature of the hyperbolic and hyperbolic functions, and substituting the latter in the fundamental equations, arrived at the final forms $V_1 = V_2 \cosh \beta l + Z_0 I_2 \sinh \beta l$, $I_1 = I_2 \cosh \beta l + V_2 / Z_0 \sinh \beta l$, where the values of V_2 and I_2 could be obtained from those of V_1 and I_1 , l being the length of the line and Z_0 the impedance of the receiving apparatus. The factors between brackets being complex quantities, the calculations must be made vectorially, and $\cosh \beta l$, for instance, had to be converted to the form $\cosh (a + j\beta l)$, leading finally to the form $\cosh a \cos \beta l + \sinh a \sin \beta l$, a being the "attenuation constant" and β the "wave-length constant." In dealing with these expressions, tables and curves published by the lecturer in the I.E.E. paper above mentioned were useful. Unless a is small, the attenuation length, was less than $1/2$, speech through a cable was not possible. It was shown that a increased with the frequency, and β also increased, but much faster than a ; the former indicated the rate at which the potential was attenuated in a long cable, whilst the latter determined the interval $(2\pi/\beta)$ at which the value of the potential recurred (except as attenuated) in the same phase throughout the length of the line. The nature of the transmission was aptly illustrated by a model consisting of a spiral row of radial rods, with lengths in geometrical progression, attached to a rotating spindle. As the frequency of the alternations increased the wave-length $(\lambda = 2\pi/\beta)$ diminished, and the velocity of the wave increased, tending to a maximum value: a also tended to a maximum. As the short waves travelled faster than the long waves and attenuated more quickly, the waves were distorted in their passage along the cable, the harmonics disappearing, with the result that speech eventually became unintelligible. Heaviside had shown that if $LS = CR$, or $R/L = S/C$, the formulae for a and β reduced to the simple forms $a = \sqrt{SR}$, $\beta = p \sqrt{LC}$, so that all the waves attenuated at the same rate and travelled with the same velocity; such a cable would be distortionless, but in ordinary cables, while R/L was of the order 88,000, S/C was about 100. The late Prof. S. P. Thompson had suggested increasing S , but this, unfortunately, increased a . C was decreased by the invention of dry-core cable, and R could be reduced by increasing the copper section, but commercial and technical considerations set a limit to this. Finally L could be increased, and the method of accomplishing this had received close attention during the past 15 years. Iron wire could be wound over the cable, but tended to increase C and the effective value of R . The work of Pupin, published about 1899, afforded a solution to the problem by adding inductance to the line at intervals.

Royal Society of Arts.—The following are among the meeting arrangements announced in the session's programme:—

November 22nd, at 4.30.—Leslie Ughart, "The Economic Development of Russia and Britain's Share Therein."

December 6th, 4.30.—C. M. Whittaker, B.Sc., "The Coal-Tar Colour Industry."

December 13th, at 4.30.—H. Wilson Fox, "The Development of Imperial Resources."

December 20th, at 4.30.—A. C. Benson, C.V.O., "Classical and Scientific Education."

At an after-Christmas meeting, Mr. J. H. Vickery will deal with "German Business Methods."

The Howard Lectures on November 27th, December 4th and 11th

(afternoon), will be delivered by Prof. J. S. S. Braine, on "Coal and its Economic Utilisation," and Prof. W. Ripper, on April 29rd, 30th, and May 7th, will give three lectures on "Works Organisation and Efficiency."

Institution of Electrical Engineers (Birmingham Local Section).—The provisional programme for this Section contains the following items, one meeting per month being arranged for:—

November 15th.—Dr A. Russell's Kelvin Lecture.
December 16th.—Mr. J. S. Peck, on "The Parallel Operation of Electric Power Stations."
January 18th.—Messrs. P. Gill and W. W. Cook, on "Principles Involved in Computing the Depreciation of Plant."

The meetings are to be held at 7 p.m., at the University, Edmund Street.

Institution of Electrical Engineers (Manchester Local Section). The programme for the first half of the session, which opens on November 14th with an address by the chairman, Mr. A. E. McKenzie, has been issued. The definite fixtures are:—

November 28th.—J. S. Peck, "The Parallel Operation of Electric Power Stations."
December 12th.—A. P. M. Fleming, illustrated lecture, "Some Aspects of Industrial Research, with Special Reference to American Research Activities."
January 17th.—P. Gill and W. W. Cook, "The Principles Involved in Computing the Depreciation of Plant."
January 30th.—J. Drummond Paton and J. Frith, "Fuel Economy."

Institution of Electrical Engineers (Scottish Local Section).—The programme for the session has been issued as follows:—

November 14th.—Glasgow. Chairman's Inaugural Address (J. K. Stothert).
December 12th.—Glasgow. J. S. Peck, "The Parallel Operation of Electric Power Stations."
January 9th.—Edinburgh.
February 16th.—Edinburgh. Kelvin Lecture, Dr. A. Russell.
March 13th.—Edinburgh.
April 3rd.—Glasgow.

At the Glasgow meeting next Tuesday Mr. C. P. Sparks, president, will be present. The Students' Section will not meet this session.

South African Institute of Electrical Engineers.—At the meeting of the Institute on September 20th, Prof. W. Buchanan, who presided, announced that the Council had decided that enemy subjects were ineligible for membership of the Institute. Any known enemy subject who might previously have been admitted had been removed from the roll of members. Afterwards Mr. C. J. Everet, on behalf of Major Dobson, read a paper on the main switchboard of the Johannesburg municipal electricity supply system.

Association of Mining Electrical Engineers.—The new session of the West of Scotland Branch opened at Glasgow on October 28th with the address of the president, Mr. J. B. Thomson. The syllabus for the session is as follows:—

November 11th.—Lecture on "Friction Surfaces," by J. Oswald; demonstration of oxy-acetylene welding, by W. L. Brown.
December 16th.—Social evening.
January 20th.—"Modern Switch and Fuse Gear: its Defects and Some Suggested Remedies," by A. M. Phail.
February 17th.—"Electrical Converters," by C. S. Buyers.
March 17th.—"Maintenance of Underground Plant," by M. Baird, jun.

Royal Institution.—At a general meeting of members held on Monday, Dr. H. E. Armstrong, Ph.D., F.R.S., was elected a member in place of the late Prof. S. P. Thompson.

Legal.—VICTORIA FALLS AND TRANSVAAL POWER SUPPLY CO., LTD., v. BRAKPAN MINES, LTD. AND THE CONSOLIDATED MINES SELECTION CO., LTD. In the Rand Division of the Supreme Court in September, Mr. Justice Ward delivered a lengthy judgment (12½ type-written pages) in this case. The action, as reported in 15 issue of October 6th, 1916, related to contracts for the supply of power. In the result judgment was entered for the plaintiffs for £692, and costs.

ELECTRIC AMBULANCE OR MOTOR-CAR?—An interesting case came before the Hampstead Magistrates on Wednesday morning last when Mr. Geo. Eliason, the inventor of the handy little electrically-propelled bath chair, which was described in our issue of March 17th last, was summoned for driving this little carriage without a registration plate attached, and for not holding a driver's licence; and Mr. Thompson, manager of Messrs. Carters, the well-known surgical engineers, makers of the Eliason-Carter electric invalids' carriage, was summoned for aiding and abetting him.

The evidence showed that the carriage was on a trial run, with Mr. Thompson walking beside it, and that no permission to use it had been obtained. For the police, it was stated that in a previous case, a motor tricycle capable of being propelled by steam had been deemed a motor vehicle within the meaning of the Act.

Counsel, representing defendants, said no doubt this was so, but the question was whether an invalid chair was the same thing; he also pointed out that the Local Government Board had written stating that a decision in the matter could only be determined by the Courts.

Evidence was given by Mr. Thompson as to the construction of the carriage, which could be drawn by hand, if desired, in the ordinary way. He pointed out that his firm were anxious to have some decision on the matter, and had had considerable correspondence with the Customs, Local Government Board, and the L.C.C. and this was summed up in the reply received from the Local Government Board mentioned above. The carriage had on previous occasions made similar runs with a maker's registration plate.

Counsel, addressing the Bench, pointed out the novelty of the appliance. Acts were passed to deal with the state of things existing at the time, and it was never contemplated at the time the particular Act was passed that a harmless little vehicle of that kind would come within the Act. If they had to decide between calling it a motor-car and an ambulance, all bounds of reason were on the side of the ambulance, and if they decided so, then it was

not subject to any duty. The carriage only required ½ h.p. to drive it, and for it to be regarded as a motor-car it would have to be presumed that it was of a h.p. exceeding ½ and under 12 (according to the Act), which was an absurdity.

The Bench decided that it was not an ambulance, but inflicted nominal fines, as they regarded it as a test case. They also agreed to state a case.

Fatalities.—Coroner Graham held an inquest at Dunston-on-Tyne on November 3rd on the body of John Ratcliffe, aged 37, an electric wireman in the employ of the Electro-Flex Steel Co. at Dunston. The evidence was to the effect that on the 1st inst. Ratcliffe was engaged in taking down some disused wires when he was found by James Wood, a craneaman, in a sitting position, apparently dead. Mr. J. A. Anderson, engineer, said that on examination he found that a fuse had been left in, which, in his opinion, was the cause of the accident. He regarded it as a terrible mistake on Ratcliffe's part. The jury found that death was due to asphyxia the result of an electric shock, received while attempting to cut a "live" wire.

Mr. T. Dowdall, who was accidentally killed during his employment at Queensferry, on Saturday last, was partner with his father, Mr. J. Dowdall, as an electrical contractor, at Gloucester Street, Dublin.

Sergeant-Major Reginald Dutchman, R.F.C. (T), an electrical engineer holding a position in a Government works, was examining his automatic pistol, when it exploded, and he received the charge just below the heart. He died in hospital.

Thomas Sullivan (26) was killed on the L. & Y. Railway, near Crumpsall, Manchester, on Friday afternoon last. He was an electric cable jointer employed by the railway company, and apparently he had touched a live rail whilst at work.

Society of Engineers (Inc.).—A paper on "Heating and Ventilating Private Dwelling-Houses" was read by Mr. C. T. A. Hansen on Monday last.

King's College, London.—On Wednesday last week, Mr. James Swinburne, F.R.S., read a lecture on "Science and Industry," dealing specially with the relations between academic and applied science.

Gas on Trains.—Reporting on a collision between two passenger trains at Warminster, on the Great Western Railway, on September 2nd, Major Pringle, the Board of Trade Inspector, stated that it afforded a further illustration of the risk of gas as an illuminant. The ignition of the gas on the Bath train was caused by a passenger striking a match.

Electrical Men's Wages at Dublin.—The Dublin Corporation, at its meeting on Monday, refused to suspend the standing orders on a motion by Alderman Byrne, M.P., for the purpose of considering a joint report of the Electricity Supply Committee and the Municipal Workshops Committee with respect to the application of the members of the A.S.E., who are employed, for an increase of wages.

Mr. J. Kelso, secretary to the Society, had intimated that if the wages were not increased, so as to bring them up to the scale paid by the city firms, the men would be withdrawn from service.

The Council's law agent stated that, as requested, he had made inquiry in the matter, and found that the rate paid by employing firms was 38s. 3d., with a war bonus of 4s. for a 51-hours week. The Corporation was paying, before an award by Sir John Griffith, 38s. 6d. under the Workshops Committee, and 38s. 3d. under the Electricity Committee, with a war bonus of 3s. per week. These figures were raised after the award to 40s. 9d. and 40s. 4½d., with 3s. war bonus, for a 50-hours week. The Electricity Committee was, in addition, paying a walking allowance; and Corporation employed had certain advantages which were denied to Trade Unionists outside, such as permanent employment in the case of the majority; no insurance payments; the latter, under a scheme entered into by the Corporation under the Insurance Commissioners, and applying both to health and unemployment insurance; payment in absence through illness on a generous scale, with pension on disablement; annual leave, one week or two weeks according to term of service, with pay; and double pay for bank holiday work, or payment for bank holiday when off duty. The Agent therefore advised that if the members in Corporation employment based their claim on the A.S.E. scale, as arranged with the Employers' Association, they were not entitled to any of these benefits.

The Corporation decided, on the Law Agent's report, not to consider the joint report.

Linking-up of Electricity Undertakings.—At a meeting held in Glasgow on November 3rd, when representatives from fifteen electrical undertakings in the West of Scotland attended, it was decided to appoint a Committee to discuss the question of linking-up electricity undertakings. Mr. Geo. Balfour (Scottish Central Electric Power Co.) was elected chairman and Mr. Wyrall (Greenock) vice-chairman and secretary; all those invited to the meeting were appointed to the Committee, and the following Sub-Committee was nominated, with the chairman and secretary, as members, *ex officio*: Messrs. Lackie, Starr, Churchward, Parkinson, Bexon, Brown and Wishart.

Foreign Trade.—THE OCTOBER FIGURES.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	Oct., 1916.	Inc. or dec.	For months 1916.
IMPORTS:—			
Electrical goods, &c.	£135,566	+ £48,797	+ £473,162
Machinery ...	551,639	+ 30,657	+ 559,772
EXPORTS:—			
Electrical goods ...	364,788	+ 118,948	+ 1,043,561
Machinery ...	1,820,929	+ 346,949	+ 571,580

U.S. Power Company's Wireless Plant.—The Montana Power Co. has installed a wireless station at its Rainbow plant, near Great Falls, as an auxiliary means of communication when telephone service is interrupted. It is expected that a considerable saving in tolls will be saved on long distance tolls when the private lines are closed. *Electrical World.*

Use of Coke-oven Gas Under Boilers.—With reference to an article on the above subject which appeared in our issue of October 27th, we are asked by Mr. Wilson of the Cumberland Gas Co., Ltd., in order to avoid any misapprehension, to state that the burner referred to by us as the "Altenheim burner" is known and sold in this country as the "Cumberland burner," and that Mr. Altenheim is not concerned in the management of the company, and lives in America.

OUR PERSONAL COLUMN.

The Editors note electrical engineers, whether connected with the technical or the commercial side of the profession and industry, who are interested in engineering and railway subjects, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

General. According to the *Times*, the Vice-Chancellor of Cambridge University has appointed Mr. R. T. GLAZERBROOK, C.B., Fellow at Trinity College, Director of the National Physical Laboratory, to the office of Reader on Sir Robert Reale's foundation for the ensuing year.

Mr. HENRY TERRY, Junr., electrical engineer, of Coventry, has been admitted a Freeman of the city.

The many friends of Mr. H. J. HAWKINS, who a few years ago resigned the appointment of borough electrical engineer to the Salford Corporation, will be pleased to know that he has accepted an appointment at Karachi as chief engineer to a London firm. Mr. Hawkins sailed for India on October 20th.

The following Civil Service appointment is announced in the *Gazette*:—Admiralty: First assistant electrical engineer in H.M. Naval Establishments, E. E. BENHAM.

The marriage took place at Manchester, on the 3rd ult., of Private WILLIAM TOWN, A.S.C. (late of Portsmouth Corporation tramways) and Miss Lucy Glynn, of Brooklands, Cheshire.

Roll of Honour.—The *Times* states that Captain HAMMINGTON S. HARRIS, Sherwood Foresters, reported killed on July 1st, was the youngest son of the late Mr. H. Graham Harris, of the late firm of Branwell & Harris, consulting engineers. He was employed in Canada by the Canadian General Electric Co. at the outbreak of war. His brother, Second-Lieutenant H. Lionel Harris, died of wounds last December.

The death is reported of Private T. W. NEWMAN, Middlesex Regiment, an electrician, and son of a Hornsey electrician.

Private THOMAS DAWSON, Grenadier Guards, who was an employee of Messrs. Johns & Phillips, Ltd., of Charlton, has fallen in action.

Quarter-Master-Sergeant C. EATON, A.O.C., who was on the postal telephonic staff at Enfield, N., has been awarded the Meritorious Service Medal in recognition of valuable services rendered during the war as a volunteer.

Sergeant W. BECKETT HILL, late of the staff of the City of London electric light station, has died of wounds.

First-Class P.O. J. SAUNDERS, R.N., and Corporal S. PARISH, 4th Queen's Royal Surrey Regiment, of the Croydon electricity works staff, and Privates W. S. REDKIN and H. BLUNDELL, 4th Queen's, and Private J. E. KARN, Army Service Corps Motor Transport, of the tramway staff, have fallen in action.

Bombardier E. H. EMERY, R.F.A., who was on the Rugby staff of the British Thomson-Houston Co., Ltd., has been accidentally killed at Salonika.

Second-Lieutenant H. E. BRITTON, R.F.A., who was in the engineers' department at the Rugby works of the British Thomson-Houston Co., Ltd., has died of wounds, aged 34 years.

Sergeant M. P. O. BROWN, Oxford and Bucks Light Infantry, who was in the foundry department of the British Thomson-Houston Co., Ltd., of Rugby, has fallen in action.

Lance-Corporal E. P. KITTLE, Oxford and Bucks Light Infantry, who has been killed in action, was with the British Thomson-Houston Co., Ltd., at Rugby.

Private A. J. SMITH, Oxford and Bucks Light Infantry, who enlisted from the British Thomson-Houston Works, Rugby, soon after the outbreak of war, has fallen in action.

Private E. MIV, Royal West Kent Regiment, for nine years on the staff of the Exeter Corporation tramways, has fallen in action, aged 26 years.

Sapper PERCY C. GAY, London Field Company, Royal Engineers, who has fallen in action on the Somme, was on the G.P.O. telegraph department engineering staff.

Private A. E. GRIFFITHS, London Regiment, killed in action, was prior to the war engaged with the Telegraph Construction and Maintenance Co., of East Greenwich.

Corporal W. THORNTON, of the West Yorks. Regiment, who has been killed at the Front, was on the clerical staff of the Bradford Corporation tramway department. He was 27 years of age, and the son of a Drighlington contractor.

Sergeant A. E. IRVING, an employee of the Burnley tram-

ways, who won the D.C.M., and was recently awarded the medal of the third class of the Order of St. George of Russia, has been wounded.

Private GEORGE BARWELL, who recently won the D.C.M. in East Africa, is an employee of the Railway Electric Light Department, Cape Town. He is a native of Essex, and went out from England early in 1900.

Private HARVEY MOSS, of the South African Scottish, who recently died of wounds received in France, was an apprentice with Messrs. Edward A. Shaw & Co., electrical engineers, of Cape Town.

Rifleman J. McGRAGH, Royal Irish Rifles, of Belfast, killed in action, aged 19, was in the electrician's department at Queen's Island before enlisting.

Captain W. E. DOWNEY has been promoted to the rank of Deputy Assistant Director, Ordnance Survey Service. He was formerly electrical engineer at the Pigeon House Fort, Dublin, and is now serving in Salonika.

Lieutenant E. R. WILMSHURST, Royal Fusiliers, son of Mr. T. P. Wilmshurst, chief electrical engineer to Derby Corporation, is in hospital at Ronen suffering from a serious gunshot wound in the head.

Obituary.—Mr. G. A. OGAN.—We regret to record the death, which occurred suddenly on November 1st, of Mr. G. A. Ogan, who was chairman of the Hackney Borough Council Electricity Committee during the initial stages of the scheme, when the late Mr. Robert Hammond was acting as consulting engineer.

Will.—The late Right Hon. EDWARD ARCHDALE, P.C., of Castle Archdale, Irvinestown, co. Fermanagh, described as formerly a civil engineer, who laid submarine cables in various parts of the world, left unsettled personal estate in the United Kingdom valued at £173,638.

NEW COMPANIES REGISTERED.

Milton Manufacturing Co., Ltd. (145,183).—Registered October 26th, by Tippett, 11, Maiden Lane, E.C. Capital, £30,000 in 41 shares (10,000 fully paid). Objects: To carry on the business of mechanical and electrical engineers, manufacturers of and dealers in all things for use in connection with electrical installations, electrolytic processes, electrolytic or chemical bleaching, and other appliances and apparatus, manufacturers of chemicals, chemical products and hydrocarbons, &c. The subscribers (with one share each) are: P. W. B. Tippett, 11, Maiden Lane, E.C., solicitor; J. Martin, 7, Church Road, Brixton Hill, S.W., secretary. Private company. The first directors (to number not less than three or more than seven) are to be appointed by the subscribers. Directors must be British subjects and free from foreign influence. Qualification, £100. Remuneration, £100 each per annum (chairman £150). Solicitors: Tippett, 11, Maiden Lane, E.C.

Leabank Manufacturing Co., Ltd. (145,180).—This company was registered on October 26th, with a capital of £9,500 in 7,500 paid shares of £1 each and 8,000 and shares of 5s. each, to take over, with the authority of the Board of Trade, the business carried on at Hoddeston, Herts., and elsewhere in England, by P. & F. Doerwaldt, as the Flender Co. (being a business the books and documents of which are liable to inspection under the Trading with the Enemy Act), and to carry on the business of manufacturers of and dealers in woodwork and metal pulleys, and other machinery and appliances for use in connection with power transmission, tool makers, engineers, timber merchants, &c.). Clauses for assuring the British character of the company are included in the Memorandum of Association. The subscribers (with one share each) are: G. W. Kent, 321, Rinking Road, Plaistow, architect and surveyor; C. F. Tippet, 385, Rarking Road, Plaistow, buyer and manager. Private company. The first directors are C. J. Mortimer, Broad Street House, E.C.4; F. W. Kent, Broad Street House, E.C.4; and C. H. Tippet, 385, Rarking Road, Plaistow. Qualification (except first directors), 500 shares. Solicitor: A. Bockett, Amberley House, Norfolk Street, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bourton-on-the-Water Electric Light & Power Co., Ltd.—Issue of October 24th, 1916, of £20 debentures, part of a series of which particulars have already been filed.

Notable Electric Co., Ltd.—Particulars of £1,000 debentures, created October 9th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £150. Property charged: The company's property, present and future, including undistributed capital. No trustees.

Derby Lamp Works, Ltd.—A memorandum of satisfaction in full of £100 debentures, dated October 30th, 1916, secured £2,000, has been filed. Second mortgage debenture dated October 20th, 1916, charged on the company's undertaking and property, present and future, including undistributed capital, to secure £5,000. Holders: W. E. L. Arkwright and H. S. Gidding.

CITY NOTES.

Auckland Electric Tramways Co., Ltd.—Mr. C. G. TROSTMEIER, presiding at the annual meeting at Electrical Federation Offices, London, on October 31st, said that in spite of the adverse conditions the traffic receipts increased by £6,989. They were at the rate of over £10,000 per route mile, and £2 15s. per head of the whole population. The increase in passengers was nearly a million. The completion of the Upper Queen Street extension was anticipated at an early date. They had no further capital in view, beyond that for this extension.

Their capital expenditure in the future must be influenced by a consideration of the fact that their concession from the Auckland City Council expired in 1932, when the Council had the right to purchase about nine miles of route line. The concessions from the various suburban authorities expired at different dates from 1934 onwards. The terms of purchase of both the city lines and the suburban lines were favourable to the company, being based upon going concern value, but the position would be unsatisfactory if the undertaking had to be split up into divided ownerships. With the great rise in the price of all materials that had taken place during the year, in some cases ranging between 50 and 100 per cent., they had been fortunate in possessing large stocks which were purchased under contracts made before the advance in price. That satisfactory position was one of the many advantages they derived from their association with the British Electrical Federation, which, amongst other services, arranged for the co-operative purchase of stores on behalf of the federated companies. Although they had run an increased car mileage, their actual working expenses showed a substantial decrease. Great credit for the results obtained was due to Mr. Walklate, the general manager, Mr. de Guerrier, the engineer, and the rest of the staff. An item in the expenses over which they had no control was New Zealand income and land tax, which, at £13,984, was £9,041 more than in the previous year. The liability of the company's profits to income-tax both to the New Zealand Government and to the Imperial Government pressed very heavily, and very unfairly, upon the shareholders. The matter has been before the Government, and some measure of relief has been provided in the Imperial Finance Act of 1916. The Government had also promised to set up a committee after the war to inquire into the working of the Income-tax Acts and the question of double income-tax. The report was adopted.

Anglo-Portuguese Telephone Co., Ltd.—Interim dividend of 3 per cent., less income-tax, on account of the year to December 31st, 1916.

Indian Electric Supply & Traction Co., Ltd.—Interim dividend, 2½ per cent., being at the rate of 5 per cent. per annum.

Edison Swan Electric Co., Ltd.—According to a lengthy notice appearing in the *London Gazette*, the petition of the company for the confirmation of alteration in its objects already approved by shareholders in meeting in July last, is to be heard on December 12th.

Dartmoor Electric Supply Co., Ltd.—At Exeter County Court, on 6th inst., counsel petitioned for the reduction of the capital of this company, which was incorporated in 1910, with an authorised capital of £4,000, divided into 4,000 shares of £1 each. Shares to the number of 2,690 were issued and fully paid, and debentures were issued. There was an overdraft of £900. Counsel said no profit had been made. Owing to depreciation in machinery and other causes, the company had lost its capital to the extent of £1,389, and it desired to reduce its capital by £2,000 by cancelling paid-up capital by 10s. per share, and writing down issued capital to the same amount. The shareholders had approved of the scheme. The Judge granted the order.

West India & Panama Telegraph Co., Ltd.—The report states that the amount to credit of revenue is £45,230, as compared with £36,454 in the corresponding half-year of 1915; the expenses have been £33,651, against £27,325. After paying the first and second preference dividends, a dividend on the ordinary shares at 6d. per share (free of tax) for the half-year is to be paid, and £2,280 carried forward. The traffic receipts for the half-year show an increase as compared with those of the corresponding period, business in the West Indies having been active at prices remunerative to the planters. Similar conditions have so far ruled during the current half-year.

Norway.—The *Ais Norsk Kabelfabrik*, located at Drammen, recently decided to increase its capital from 300,000 to 1,000,000 kroner. The new capital has been wholly taken up by the old shareholders. The objects of the augmented capital is an enlargement of the works, the site for which has already been acquired at Drammen.

France.—The *Société de Duralumin* has increased its capital from 200,000 francs to 1,800,000 francs by the issue of 16,000 100-franc shares, the new capital being allotted to the *Société Anonyme d'Aluminium Français* and the *Société d'Electro-Metallurgie de Dives* in varying proportions as consideration for the lease for terms of certain alloy smelting works, the properties of the two latter companies.

STOCKS AND SHARES.

TUESDAY EVENING.

The outstanding feature of the past few days has been the violent rise in the price of the 1½ per cent. War Loan—a rise due mainly to the anticipation that the stock will be avail-

able for subscription to a forthcoming loan, the advent of which is expected at an early date; while there is also a certain amount of speculative buying in the stock. This advance had the effect of strengthening the lists for Home Railway prior-charge stocks and of checking the downward course which they had been pursuing for the past three weeks.

The American Presidential election has only aroused a languid and transitory interest, so far as the London Stock Exchange is concerned. The days are gone, for the time being, when this contest caused keen excitement in Throgmorton Street, and when the effect of the result was felt upon issues far removed from those of the American railways, which were, of course, most appreciably influenced.

The Home Railway section continues in a state of dull stagnation, although the weakness is scarcely so pronounced as it was. The prices of the Steam companies' ordinary stocks, however, are mostly lower, and the dullness is reflected in a fall of a couple of points in Central London assented ordinary. On the other hand, Underground Electric 6 per cent. bonds are better, although the company's 6 per cent. income debenture stock is still heavy at 10½. The interest on the former, of course, is paid without deduction of tax. From that on the latter the tax is knocked off, which makes a very considerable difference in the flat yield. The stock, of course, is much the better security, *qua* security, of the two; but, having regard to the competition of the Government issues, it seems to be sufficiently high-priced at 10½. Threats of a strike on the London & South-Western, and a possible extension to other lines, make the latest light literature for those who hold Home Railway stocks.

Irritation has been aroused by the non-receipt of some of the letters of allotment in respect of the new issue made by the Consolidated Gas, Electric Light & Power Co. of Baltimore. The latest day for dealing in these was last Friday, as letters could not be shipped later than Saturday if they were to be in time for allotment. British holders of the stocks were told, as usual in such cases, that dealings in the new shares would not be permitted by the Treasury, but that these holders could sell their rights if they wished to do so. This, of course, many did, because the price was 1½–2 premium; and the irritation arose because of the fact that not all of those entitled to the rights received them in time for them to sell.

We understand, unofficially, that any belated arrivals will probably be accepted, although the final date for application has not been altered. Anyway, those who have the right to claim the new issue should immediately take steps to dispose of their letters. The company, we know, values its British proprietary, which is a fairly extensive one, and the directors are anxious that these holders should receive every consideration.

Anglo-American Telegraph ordinary stock shed 3 points, and the preferred is also down 2 at 96. The dullness has nothing to do with the position of the company, but is due to a little stock which has come on the market for deceased accounts. Cable stocks on the whole are firm, the principal favourite of the moment being Western Telegraph, the shares having risen 5s. to 14½. Eastern ordinary is up a point, but Globes shed ½ and Great Northern continue on the down grade, being quoted 10s. lower at 38. There is nothing much doing in Marconis, and at 2½ the price shows no change.

The only change in electric lighting shares is a fall of ¼ in City of London ordinary, which reduces the price to 11½. The electric supply companies of the country, it seems, are appealing to the Board of Referees in respect of the excess profits tax, claiming special consideration on account of the limitations and restrictions under which they are working and the fact that in the early stages of the undertakings it is impossible to earn an adequate return upon capital expenditure involved. We should imagine that shareholders in the London electricity companies will observe this with a somewhat pale smile, because the amount of excess profits on which they are likely to be called upon to pay duty may partake of something of the nature of a minus quantity. So far as the provincial undertakings formed of recent years are concerned, no doubt there is more to be said for the companies; but if the percentage is raised, it will, we should think, have only academic interest for proprietors of shares in the London electricity supply companies.

Brazilian Traction has gone back to 55, losing their rise of last week; and weakness in the British Columbia Electric Railway group is still pronounced. Mexican Light preferred shares are up a point. Vigorous rises have occurred during the past few days in the shares of a number of Canadian-American industrials, although up to the present the issues of the electric power companies have scarcely been affected.

Edison & Swan £3-paid shares fell ½ to 7s. 6d., and, amongst the big shares, Henleys are lower at 16. British Insulated at 12, showing a fall of 5s. each. The brisk demand for investments which was noticeable in June and July has given place to a more cautious rate of progress, and this, incidentally, forms the principal handle of those who contend that the Chancellor of the Exchequer missed his market in not floating a big popular loan during the summer.

The rubber share market is mending rapidly. There is much keener appetite for shares than there was a fortnight ago; and the effect of the disappointment felt with regard to the excess profits duty, as applied to rubber companies, is quickly wearing off. The iron and steel group is firm in

But, nevertheless, shares all round are holding their prices with comparative strength, while in the copper market, most of the offerings connected with the metal are quietly improving.

SHARE LIST OF ELECTRICAL COMPANIES.

		Dividend		Price		Rise or fall this week.	Yield p.c.
		1914.	1915.	Nov. 7.	1916.		
Brompton Ordinary	..	10	10	62	—	27.11	0
Clearing Cross Ordinary	..	5	5	30	—	7 1/4	4
do. do. do. 4 1/2 Pref.	..	4 1/2	4 1/2	8 1/2	—	6 1/4	4
Clapham	..	6	6	31	—	6 19	4
City of London	..	9	8	11	—	6 14	9
do. do. 6 per cent. Pref.	..	6	6	10 1/2	—	6 17	1
County of London	..	7	7	10 1/2	—	6 18	5
do. do. 6 per cent. Pref.	..	6	6	10 1/2	—	6 18	5
Kensington Ordinary	..	9	7	62	—	6 4	5
London Electric	..	4	8	12	—	6 10	5
do. do. 6 per cent. Pref.	..	3 1/2	3 1/2	4 1/2	—	6 11	4
Metropolitan	..	3 1/2	3 1/2	3 1/2	—	6 9	1
do. do. 4 1/2 per cent. Pref.	..	4 1/2	4 1/2	3 1/2	—	7 4	0
St. James' and Pall Mall	..	10	8	6 1/2	—	6 8	0
South London	..	5	5	2 1/2	—	6 16	1
South Metropolitan Pref.	..	7	7	1 1/2	—	6 7	8
Westminster Ordinary	..	9	7	6 1/2	—	6 13	0

TELEGRAPHS AND TELEPHONS.

Anglo-Am. Tel. Pref.	..	6	6	96	—	6 3	4
do. do. Def.	..	30 1/2	33 1/2	28 1/2	—	7 10	3
Chile Telephone	..	8	8	7	—	6 14	5
Cuba Sub. Ord.	..	6	5	8 1/2	—	6 8	6
Eastern Extension	..	7	8	12 1/2	—	6 16	6
Eastern Tel. Ord.	..	7	8	12 1/2	—	6 12	1
Globe Tel. and T. Ord.	..	6	7	12 1/2	—	6 13	0
do. do. Pref.	..	6	6	10 1/2	—	6 14	3
Great Northern Tel.	..	22	22	38 1/2	—	6 15	9
Indo-European	..	13	13	51	—	6 1	8
Marconi	..	10	10	2 1/2	—	3 9	8
New York Tel. 4 1/2	..	4 1/2	4 1/2	98 xd	—	10	0
Oriental Telephone Ord.	..	10	10	2 1/2	—	4	6
United R. Plate Tel.	..	8	8	6 1/2	—	6 18	6
West India and Pan.	..	1	—	1	—	—	—
Western Telegraph	..	7	8	14 1/2	—	6 8	4

HOME RAILS.

Central London, Ord. Assented	..	4	4	65 1/2	—	6 2	9
Metropolitan	..	12	12	24	—	4	0
do. do. District	..	Nil	Nil	16	—	Nil	Nil
Underground Electric Ordinary	..	Nil	Nil	11 1/2	—	Nil	Nil
do. do. "A"	..	Nil	Nil	5 1/2	—	Nil	Nil
do. do. Income	..	6	6	89 1/2	—	6 14	1

FOREIGN TRAMS, &c.

Adelaide Sup. 6 per cent. Pref.	..	6	6	4 1/2	—	6 1	6
Anglo-Arg. Trams, First Pref.	..	5 1/2	5 1/2	3 1/2	—	8	2
do. do. 2nd Pref.	..	5 1/2	5 1/2	2 1/2	—	7	2
do. do. 6 Deb.	..	5	5	7	—	7	5
Brazil Tractions	..	4	4	55	—	7	5
Bombay Electric Pref.	..	6	6	10 1/2	—	6 17	3
British Columbia Elec. Rly. Pref.	..	Nil	Nil	7 1/2	—	6	19
do. do. do. Preferred	..	Nil	Nil	6 1/2	—	6	19
do. do. do. Deferred	..	Nil	Nil	6 1/2	—	6	19
do. do. do. Deb.	..	4 1/2	4 1/2	66 1/2	—	6	7
Mexico Trams 5 per cent. Bonds	..	Nil	Nil	53 1/2	—	Nil	Nil
do. do. 4 per cent. Bonds	..	Nil	Nil	17	—	Nil	Nil
Mexican Light Common	..	Nil	Nil	17	—	Nil	Nil
do. do. Pref.	..	Nil	Nil	81	—	Nil	Nil
do. do. 1st Bonds	..	Nil	Nil	40	—	Nil	Nil

MANUFACTURING COMPANIES.

Babcock & Wilcox	..	14	15	2 1/2	—	5	4
British Aluminium Ord.	..	5	5	27 1/2	—	6	1
British Insulated Ord.	..	15	17 1/2	12	—	7	5
British Westinghouse Pref.	..	7 1/2	7 1/2	2 1/2	—	6	0
Callenders	..	15	30	12 1/2	—	8	0
do. do. 5 Pref.	..	5	5	4 1/2	—	6	17
Castner-Kellner	..	30	—	8 1/2	—	6	8
Edison & Swan, £3 paid	..	Nil	Nil	3 1/2	—	Nil	Nil
do. do. fully paid	..	Nil	Nil	12	—	Nil	Nil
do. do. 4 per cent. Deb.	..	5	5	62 1/2	—	8	0
Electric Construction	..	6	7 1/2	10	—	7	10
Gen. Elec. Pref.	..	6	6	10	—	6	0
do. do. Ord.	..	10	10	14 1/2	—	6	18
Henley	..	30	30	36	—	7	16
do. do. 4 1/2 Pref.	..	44	44	4 1/2	—	6	6
India-Rubber	..	10	10	12	—	6	8
Telegraph Con.	..	30	30	88 1/2	—	6	4

* Dividends paid free of income-tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of trains.	Total to date.		Route miles open.
		£	£		£	£	
Bristol (Trams)	Oct. 27	29,146	+1,833	43	217,166	+9,930	30 1/2
Cork	..	25	2 1/4 + 98	43	22,135	+ 283	9 5/8
Dublin	..	27	26,112 + 1,898	43	382,291	+ 3,615	54 2/5
Hastings	..	27	3,614 + 253	43	46,192	+ 2,970	19 1/8
Lancashire United	..	25	7,941 + 1,167	42	79,272	+ 4,072	42
Llandudno-Col. Bay	..	26	1,388 + 2 1/2	46	17,522	+ 1,089	6 1/2
Tyneside	..	18	2 1/2 + 218	16	11,347	+ 835	—
Anglo-Argentine	..	28	212,710 + 7,548	43	2,190,543 + 4,444	—	—
Auckland	..	20	885 + 24	16	84,288 + 1,160	26 5/8	—
Calcutta	..	21	18,792 + 614	42	1,134,747 + 8,654	—	—
Kalgoorlie, W.A.	August	3,021	—	40	20,179	—	20 1/2
* Madras	Oct. 15	2,153 + 295	—	41	49,139 + 2,965	—	—
Montevideo	October	28,729 + 1,541	—	52	347,712 + 17,171	—	—
Dublin-Lanc. Rly.	Oct. 27	607	—	87	3,070	+ 239	7

* Two weeks.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, November 8th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc./or Dec.
a Acid, Oxalic	.. per lb.	1/8	..
a Ammonia Sal.	.. per ton	£75	..
a Ammonium Sulfate (large crystal)	..	£54	..
a Bisulphide of Carbon	..	£31	..
a Borax	..	£31	..
a Copper Sulphate	..	£55	£2 inc.
a Potash, Chlorate	.. per lb.	2/6	..
a Potash, Chlorate	..	2/-	..
a Soda	.. per wt.	13/-	10/- inc.
a Sulfate of Magnesia	.. per ton	£16	..
a Sulphur, Sublimed Flowers	..	£14	£5 inc.
a Sulphur, Lump	..	£15	10/- inc.
a Soda, Chlorate	.. per lb.	1/-	..
a Crystals	.. per ton	120/-	..
a Sodium Bichromate, cakes	.. per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2 to 12 basis)	.. per lb.	1/8 to 1 1/2	..
c " Tubes (solid drawn)	..	1/4 to 1 1/2	..
c " Wire, basis	..	1/2 to 1 1/4	..
c Copper Tubes (solid drawn)	..	1/7 to 1/5	..
c " Bars (best selected)	.. per ton	£164	..
c " Sheet	..	£168	..
c " Rod	..	£168	..
c " (Electrolytic) Bars	..	£144 10	10/- inc.
d " Sheets	..	£162 10	10/- inc.
d " Rods	..	£163 10	10/- inc.
d " H.C. Wire	.. per lb.	1 1/2	£1 inc.
f Ebonite Rod	..	3/-	..
f " Sheet	..	2/6	..
g German Silver Wire	..	2/3	..
h Gutta-percha, fine	..	6/10	..
h India-rubber, Para fine	..	3/6 1/2	1 1/2 inc.
i Iron Pig (Cleveland warrants)	.. per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	..	£36	..
c Lead, English Pig	..	£17 13 6 to £17 16	..
e Mercury	.. per bot.	23 1/2	..
e Mica (in original cases) small	.. per lb.	6d. to 8/-	..
e " " " medium	..	8/- to 6/-	..
e " " " large	..	7/6 to 14/- & up.	..
e Silicium Bronze Wire	.. per lb.	1/8 1/2	£1 inc.
e Steel, Magnet, in bars	.. per ton	£95	..
e Tin, Block (English)	..	£185 10 to £196 10	30/- inc.
n " Wire, Nos. 1 to 16	.. per lb.	2/10	..

Quotations supplied by—

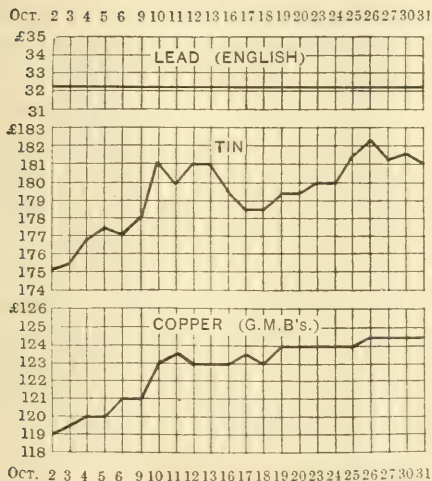
a G. Boor & Co.	g James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Tilt & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	j Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	k P. Ormiston & Sons.
	l W. F. Dennis & Co.

Books and Examinations.—Whatever some people may say to the contrary, we cannot get on without these things; and many of our readers have probably at some time sat for, or thought about sitting for, one of the various excellent electrical examinations conducted by the City and Guilds of London Institute. Though the examinations are excellent, the same can hardly be said of the lists of works of reference given in the "Programme" of the Institute under the syllabus of each subject. One reason is that some of the books are unobtainable, having been out of print for years; another is that some are obviously very much out of date. Our contemporary, *Electricity*, takes up arms, not for the first time, against this rather absurd state of things, and asks its readers to inform it of one or more books which they have found useful in working up for an examination, stating the grade for which they worked. From the replies, our contemporary proposes to publish representative lists, and these should certainly prove both interesting and useful. Our own readers could help this good work by sending in their opinions to *Electricity*, at 36, Maiden Lane, Strand, London, W.C. We are in cordial sympathy with the scheme, the results of which will be of use to ourselves also, as hardly a week passes without our receiving inquiries as to the best books for specified subjects. The only criticism we have to offer is that where a reader's experience is confined to the perusal of only one book on a particular subject, he is not in a position to express an opinion as to the best book on that subject.

Manchester Engineers' Wages.—The demand of the engineers in the Manchester and South-East Lancashire District for an advance of wages came before the Committee of Production at Westminster, last Friday, when Sir George Askwith and Sir George Gibb met representatives of the masters and delegates from the Amalgamated Society of Engineers. Mr. H. Mansford (of the Westinghouse Co.) was the principal representative on behalf of the Engineers' Employers' Federation, and the case for the engineers was put by Mr. W. H. Hutchinson and Mr. J. Binna. There were five groups of claims on behalf of the engineers and allied trades, and the increases asked for ranged from 5s. to 9s. a week. The proceedings, which were private, lasted for over two hours. Decisions will be announced in due course. —*Morning Post*.

METAL MARKET.

Fluctuations in October.



German Machinations in China.

—We quote the following comments on the present activity of Germans in China from *Eastern Engineering*: "In spite of the war German activity has by no means ceased in China. On the contrary, a lively propaganda is being carried on there, not only by German traders themselves, but by officials of the Legation at Peking and the various Consular officers throughout the country. Not content with making every preparation for resuming business after the war, we learn that Germany is actually supplying machinery to China through firms in Sweden and the United States either owned or controlled by Germans. As an instance of the underhand tactics that are employed to gain their ends, we may mention that German agents in China tell the Chinese that Great Britain is blockaded by the German fleet and submarines, and that, therefore, it is impossible for them to obtain machinery or anything else from that quarter. The fact that would-be Chinese buyers have written to British firms respecting the placing of orders, and have received replies to the effect that they are so full up with work that it is impossible for them to take further business, has lent some colour to the German campaign of lying. There can be no question that German traders have got their eyes fixed on China for exploitation after the war, and they are leaving no steps untaken to enable them to realise their object. Thus, it was recently stated that German prisoners are being taught the different dialects of the Chinese, and although at the present time Germany's trade with China is more or less at a standstill, she is retaining men of military age there to maintain her connection, and keep the market open until she is again able to enter into competition. It is also reliably stated that German merchants in China have secured sufficient contracts during the war to give them a good commercial standing immediately the war is over. These, it is true, have mostly been secured by graft and sharp practice. A traveller recently returned from China stated that at the beginning of the war the Germans refrained from quoting on any large contract, but lately most of the largest contracts have fallen into German hands. When the specification for any large contract is now given out they invite the head Chinese concerned to a magnificent dinner—most Chinese deals are settled over food, a point the Germans have been quick to recognise—convince them that the war will be over in a few weeks, make them a handsome present, and secure their permission to insert a clause in their quotation that the material is to be supplied a certain time after the conclusion of the European War. The British firm, not knowing what has transpired, quotes price for the material to be supplied at the present time. The German in this way secures good 'face,' as he has been able to quote lower than his competitors, and has secured the goodwill of the Chinese officials by a little 'cumshaw' or present, which in no way comes out of his pocket, as his price is higher than the after-war price would be. These and similar tactics are being freely employed in China by German traders, who are aided on the political side by the publication of pamphlets in Chinese spreading the most fantastic lies about Great Britain and her Allies. We trust, therefore, that adequate steps are being taken to counteract this pernicious propaganda in China, and that British traders generally will be on the alert to defeat German machinations there, such as those indicated above."

WAYLEAVES.

By "AN INTERESTED ONLOOKER."

IN view of the attention which is being directed to the various aspects of electricity supply in the United Kingdom at the present time, especially from the point of view of linking-up, it seems to be a favourable time to consider the question of wayleaves as affecting the problems connected with the transmission of electricity, both by overhead lines and underground mains.

It is well known that the development of the telephone and, to some extent, the telegraph undertakings has been hindered by the difficulties attendant on the procuring of wayleaves, and further reference will be made to this later.

In this article, we are mainly concerned in considering the subject of wayleaves viewed from the standpoint of the power companies and municipal undertakings, and it is useful to consider how far we can learn from the troubles of the engineers of the G.P.O. and the late National Telephone Co. Most supply engineers have met with the wayleave difficulty, and much has been written on the subject from their point of view during the past few years.

The educative campaign among landowners and others was well begun by the passing of the Telegraph Acts of 1863, 1878, and 1892, and continued under the auspices of the Institution of Electrical Engineers when Mr. Addenbrooke read a paper in 1905.* Later, in 1913,† Mr. Vernier devoted a considerable portion of his Chairman's Address to the Newcastle Local Section to the subject, and freely drew on his extensive experience arising out of his transmission work for the Newcastle Electric Supply Co. Mr. W. B. Woodhouse, chief engineer of the Yorkshire Power Co., has also enjoyed more than one tilt at it.‡ Attention was, however, particularly focussed on it by the I.E.E. paper on "H.T. Transmission Lines," which was contributed by Mr. Welbourn in 1914,§ and which was discussed in London and at most of the local centres. In this paper, Mr. Vernier's remarks on the inconsistent state of the law of wayleaves for overhead lines only were condensed as follows:—

1. The Postmaster-General possesses powers for erecting telegraph and telephone lines, but the procedure to be followed is so cumbersome as to be almost useless. Even these powers are denied to electric supply authorities.

2. Under the Electric Lighting Acts, the consent of the local authority must be obtained by a statutory undertaker previous to the erection of overhead wires, whether these are in the public street or on private land.

3. Non-statutory undertakers can dispense with the consent of the local authority, and both erect wires on private land and cross public roads so long as the wires cause no obstruction above the roadway.

4. Non-statutory undertakers may erect overhead lines without compliance with the Board of Trade Regulations, but the Board has power, if it thinks fit, to order such compliance.

Mr. Welbourn suggested that a strong case had been made out to justify the Council of the Institution in making representations to the Board of Trade for the benefit of the electrical industry with a view to removing the inconsistencies referred to, but no action appears to have been taken. Following up the progressive policy recently adopted, it is hoped that the Council will take the lead in this matter, and also arrange to give one evening during the session of 1916-1917 to a full discussion, and

*Journal, I.E.E., Vol. 34, p. 511—1905.

†Journal, I.E.E., Vol. 52, p. 17—No. 223.

‡Journal, I.E.E., Vol. 44, p. 802—1910.

§Journal, I.E.E., Vol. 52, p. 177—Nos. 226, 227, 228, 230.

then follow it up by appointing a committee to examine the points brought out and prepare a Bill in consultation with the I.M.E.A. and the I.A.E.P.C. The success attending the discussions in London and Manchester on Mr. E. T. Williams's paper this year should be of good augury! The suggested Bill should, *inter alia*, provide for:—

1. A curtailment of the absolute veto on the construction of overhead wires by a local authority.

2. The local authority's refusal of consent should be made subject to an appeal to the Board of Trade. At present, such an appeal is only allowed to power companies in *rural* districts.

In the discussion on Mr. Welbourn's paper, Mr. (now Sir) William Slingo referred to the uphill struggle which the Post Office engineers had faced, and were overcoming by the help of the various Acts of Parliament already mentioned, and he remarked that they would like the procedure to be *more certain and expeditious*.

The interest aroused in the question appears to have led to the passing of the further Telegraph (Construction) Act, 1916. Under this Act, the Postmaster-General has the right to have a "difference" between himself and the owner, lessee, or occupier who refuses or fails to give his consent to the placing of a telegraphic line under, in, upon, over, along, or across his land or building, within two months after being required to do so by notice, settled under the procedure laid down in Sections 3, 4, and 5 of the Telegraph Act, 1878.

This marks an advance, but the procedure referred to is still too clumsy. Something more expeditious is required in these hustling days than a delay of two months, then a hearing of the case by a magistrate, county court judge, or sheriff, whose decision can be appealed against before the Railway Commissioners. Just fancy a man wanting a telephone installed in a hurry in the country and having to await the result of all this legal procedure! And think of the possible cost to the G.P.O.! This, of course, takes no account of *war* telephone work, which may be carried out immediately and without wayleaves under the Defence of the Realm Act.

At this stage it will be well to set out some of the principal wayleave difficulties and hardships which are met with by electricity supply authorities, and then to consider what procedure might be followed in order to ensure a speedy and equitable settlement of differences.

1. *Cost of Wayleaves*.—Some landowners have altogether extortionate ideas as to the value of their agricultural land compared with the value of the electric line to be taken across it and the benefit to the community. One case came under notice a few years ago where it was proposed to cross a field in the open country with six wires, without any poles being planted in it. The owner demanded £1 per wire per annum for the use of the air above his field. Needless to say, no business resulted.

There seems to be a general agreement in England that the *average* capitalised value of the wayleaves for an overhead transmission line is rather more than £100 per mile of route, and it is considered that this is fully three times their real value. One power company has calculated in a number of cases that if it bought a strip of land 70 yards wide over the whole route, it would come to less than the capitalised value of the rents paid for what is only a very partial occupation of the land. Could anything illustrate the grievance more clearly than this?

There is not much experience in regard to wayleaves for cables across fields. In view of the possible and considerable shortening of routes for linking-up and other schemes, this method is likely to receive considerable attention in future. The shortening of a route by some 30 per cent. compared with a road route is often possible, and its adop-

tion would lead to a considerable saving in first cost. Also, the wayleave charge should be very low for a cable, as it would be laid sufficiently deep so that it would not interfere with the tilling of the fields.

Occasionally, a wayleave is required from a neighbouring supply or other authority to enable a "short cut" to be taken. A case in point was brought under the notice of the present writer, recently, where a supply authority desired to save about £6,000 by going for 50 yards through the road of a neighbouring authority. The blood-money demanded for the concession (in war-time, 100) was *half the savings*. Again, no business resulted!

Another supply authority's experience is that County Council charges are usually heavier than those of private owners, the conditions imposed are more stringent, and the negotiations take longer to complete. In one instance, it was desired to lay a connecting main between two portions of a district, and, without more than trebling the expense, this could not be done without running for a short distance under a public footpath alongside a county council school. A private owner would usually have taken an acknowledgment of 1s. to 2s. 6d. per annum, but the Council demanded £1 per annum, plus legal charges. On pointing out that this was a public utility main to feed the system from which the school was lighted, as well as the residences in the immediate neighbourhood, and that the land was owned by the community, and so a smaller sum would be in keeping with the easement granted, a peremptory reply was made to the effect that these were the only terms, and discussion of others was useless. In addition, the burden of keeping the *whole* of the footway in repair was thrown on the supply authority.

2. *Delays in Negotiations*.—Mr. Vernier has pointed out some of the vexatious delays which occur through local authorities having the right of absolute veto on overhead wires. He has also instanced a case of a landowner going to shoot in India and hanging up negotiations for six months.

The delay in Government action under the powers granted by the Electric Lighting Acts for compelling owners to come into line has made this method of procedure of very little general use. It is only when a delay of *months* can be allowed for that any hope of success can be entertained, and the speed with which the Government now rushes through any concessions required when Government war-work is at stake only makes the leisurely procedure of peace-time more exasperating.

In a certain case, permission was refused by an owner to the laying of a cable across partly waste open land, surrounded by disused coal pits, which was not likely to be of much use to anyone. Negotiations were opened with the Board of Trade, and a plan and full particulars were supplied showing the need for using this route. The owner's solicitors raised one point at a time, which meant a letter to the Board of Trade, a copy from them to the owner's solicitors, and the waiting for their reply, which was not unduly hurried.

Correspondence lasted for three months and showed no sign of terminating, and as the cable had become extremely urgent, a longer route had to be found, at an additional cost of £400.

3. *Delays from other Public Utility Authorities*.—Some railway companies are not disposed to give a wayleave across their railways for more than three or six months. This is objectionable, because railway companies are always promoting Bills, which sometimes have to be opposed by the supply authorities, who are thus exposed to the possibility of unfair pressure.

It is an anomaly that public utility services should be denied the use of bridges in some districts without having to pay exorbitant charges. A sum of 5s. per annum would be ample

compensation for the keeping of records of the cables and pipes passing over a bridge, but the usual charge, in some districts, is £1 per bridge if the structure of the bridge is not affected, and with increased rentals up to £5 per bridge if the structure is affected. Owing to the way in which many bridges have been built, it is impossible to effect a crossing without removing and rebuilding a few bricks at either end. Heavy wayleave charges are the result.

In some districts, also, water companies are frequently exempt because they were in existence before many of the bridges were built, but electricity supply authorities, not being in existence at the time, have no protection, and are entirely at the mercy of the bridge owners, although the bridge forms part of a public road, and the cable to be laid is for the public convenience.

4. *Permits from the G.P.O. and other owners of Telegraph and Telephone Lines and Road Authorities.*—Under Section 20 of the Electric Lighting (Clauses) Act, 1899 (62 and 63 Vict., ch. 19) the G.P.O. and other owners of lines may require an undertaker to adopt such precautions as they may specify to prevent any injurious affection of existing lines or lines afterwards erected for telegraph, telephone, or electric signalling purposes.

It is true that the requirements may be disputed, and resort had to arbitration, as provided in the Act, but in the case of new lines this leisurely method of procedure is of little or no use to supply authorities who have consumers waiting to be connected up.

In practice, therefore, the G.P.O. imposes its own terms, which amount to a prohibition of all wires crossing the Department's wires if the pressure on the proposed lines exceeds 3,000 volts. The result is that crossings have to be effected by underground cables in series with overhead power lines, in most instances, as the addition of capacity, by cabling the telegraph or telephone lines, is objectionable at their higher transmission frequencies. The cost of making these special crossings may easily add 20 per cent. to the total cost of a power line.

Frequently, also, crossing a main road by cabling is insisted on by county council and other road authorities, and it may result that, when everyone's claims are met, there is not much advantage in first cost in having an overhead line at all.

This is not the way to encourage the development of electricity supply. Most engineers now recognise that in the next few years we must deal with the transmission of electricity on such a huge scale that the raising of pressures is inevitable, and with the present restrictions this pressure is limited to that for which cables can be successfully and economically built. There is some uncertainty on this point, but probably no British cable makers would undertake in connection with overhead lines to build three-core cables for higher working pressures than 40,000 volts and single-core cables for higher than 60,000 volts A.C. on the star system.

It seems to the writer that it should not surpass the ingenuity of British engineers to devise some method of providing *absolute* protection for the Department's wires against injury from power wires worked at any voltage. The writer sees no particular difficulty in doing all that is needed by a combination of electrical protection for future power circuits in the form of, say, the Merz-Hunter split conductor system, and of mechanical protection in the form of a substantial earthed metal guard which might completely or partially surround the power circuits for the requisite distance, and which would be earthed to the satisfaction of the G.P.O. If the I.E.E., I.M.E.A., and I.A.E.P.C. are in earnest on this matter, there should be no difficulty about getting a round-table talk with the G.P.O. engi-

neers, and the assistance of Mr. Trotter should certainly be requested.

The road authorities may have to be met in another way. The writer thinks that supply authorities should have the right given to them, where no other wires exist, to cross all roads in rural districts with wires unless the road authorities appeal to the Board of Trade and successfully demonstrate that there are real objections in particular cases. Such a real objection might be a definite intention to build on the adjacent land within, say, five years.

Suggested Procedure.—It is well-nigh impossible to suggest any procedure which will satisfy everybody and, at the same time, ensure that wayleaves may be obtained speedily for overhead lines or underground cables. It is an indispensable condition that full justice shall be done to both parties to a wayleave dispute, and some machinery must be devised to secure this and, at the same time, to ensure that all avoidable delays in effecting a settlement shall be short-circuited.

Most Britishers prefer to compromise rather than to fight, unless some vital principle is at stake, and with this in mind, it is suggested that supply authorities shall have the *prima facie* right to go with their mains practically everywhere within their area subject, where necessary, to the owner's consent, in order to carry on their business to its fullest extent. This would be subject to the reservation that where an owner objected, and failed to come to terms with the supply authority within, say, one month of receipt of notice of intention to proceed with the work, the supply authority would have the right to lay the whole matter before the Board of Trade, who should be placed under a legal obligation to inquire fully into the case of both parties to the dispute within, say, one month, and give a decision within, say, a further two weeks.

The Board of Trade should have conferred on it the right to give a final decision as to the route to be followed, and to determine the amount to be paid to the owner or tenant for rent and by way of compensation for damage done during construction, &c. In order to be quite fair to our gas competitors, the writer would not oppose similar facilities being granted to them.

The plan outlined above could easily be elaborated with the goodwill of all the interested parties and the assistance of the Board of Trade into a workable one. It is essential to the electricity supply authorities that simplicity of procedure, combined with speed and a definite time limit, should be secured.

The present writer would like to see a further trial given to the so-called "voluntary" principle for a period of, say, three years, and working on the amended lines suggested above. If this failed in practice, we should automatically pass to "compulsory" methods, to which the nation is so rapidly becoming accustomed.

The ELECTRICAL REVIEW has, from time to time, called for compulsory wayleaves without defining exactly how this could be brought about, and it is hoped that these notes may be of some assistance in focussing public opinion on what is desirable and practicable. The urgency of the question can be measured from the fact that there are already about 1,500 miles of high-pressure overhead lines in the United Kingdom, apart from the numerous low and medium-pressure lines. Many supply authorities are expecting a big increase after the war as the result of the boom which electrical driving, &c., has enjoyed during the past two years. The electrification of railways, and the application of electricity to chemical and metallurgical processes will also bring much additional load. The transmission system for dealing with these loads and for enabling linking-up schemes to be carried out must not be unduly delayed by antiquated wayleave methods.

ELECTRIC COOKING AND HEATING.

By A. F. BERRY.

(Paper read before the ASSOCIATION OF
SUPERVISING ELECTRICIANS.)

A LARGE number of individuals have set in to me, from time to time figures showing the savings effected by the introduction of "Tricity" cookers in their establishments. The majority of the figures relate to private houses, but some relate to canteen and school equipments. It is clear that the butchers' bills in private houses that used to be over £50 per annum are reduced to £40 per annum; that a plate of meat in a munition workers' canteen is reduced in the ratio of 5d. to 4d., that the weight of meat used in a fern in a school of 100 is reduced in the ratio of 2,400 lb. to 1,950 lb., when the older methods of cooking are discarded and "Tricity" cookers are fully employed. It will be seen that the retention of the old methods of cooking means that approximately 25 per cent. more meat is being purchased than need be. There is an economy also in making jam, marmalade, &c. I found, for instance, that the additional weight of marmalade when made on an electric hotplate instead of on the coal fire was of sufficient value to pay for the total cost of cooking any way many times over.

My experience of the cost of many thousands of Tricity-cooked meals leads me to tell you that you must expect that a good square meal will cost one quarter of a unit per person—that is, for a number of people. In the case of schools, where one may take it that the meals served are the equivalent of two heavy ones daily, it has been found that rather less than one-half of a unit per day per person is required. In private houses, where the numbers are less and, perhaps, the meals more numerous, something like one unit per day per person will be required.

In making jam, I find that the cost works out at about one unit for each 8 lb. of jam; marmalade will cost more than this. If there are two boilings it will mean that 4 lb. can be produced for each unit of electricity consumed.

I do not think that those who do not use electricity in their homes for cooking, even though they are electrical engineers, can ever hope to convince others of the full advantage of electric cooking. They are certainly not in a position to express a personal opinion in regard to all the advantages of electric cooking if they have not made use of it themselves. The glib way in which nine persons out of ten will tell you that electricity "must be expensive" for cooking is a testimony to the slack way in which suppliers of electricity have talked about there being no heat with electric *light*, and it is also an equal testimony to the efficacy of the publicity of "the opposition."

The reliability of electricity for cooking purposes should be one of the first considerations. I think, however, the remembrance of early troubles accounts in a great measure for the apathy of some electrical engineers towards electric cooking. My experience has been that ordinary users of electric cookers are even more enthusiastic regarding them than many supply engineers and contractors.

The improvements in detail apparatus, such as fuses, indicators, contacts, terminals and switches have all helped to make electric cooking the solid proposition it now is. To the householder it did not matter what stopped the cooking—a faulty accessory or a faulty "boiling ring." The meals must be ready at the right time—excuses do not "feed the brute."

The use of indicators to show when hot plates, &c., are "on" is a great help in the direction of economy. The latest in combined fuses and indicators combines in a most cheap and practical form the fuse and indicating device we have found it necessary to provide. This is only one detail of many that have been brought up to a high state of perfection. If you will consider that in this small apparatus you combine a pilot lamp and fuse you will appreciate how much more robust, more easily replaceable and economical, both in consumption and space, electrical accessories have become.

I would like to impress upon you that electric cooking is here to stay, and that the sooner the whole electrical fraternity make the utmost use of it, the better will it be for themselves and for the community. Pray do not let anyone retain the impression that electric cooking is for the rich. I have personally been more than interested to find that the Tricity cooker is the friend of the artisan's wife. It goes to the palace and cottage too.

Turning to electric heating, the electric lamp radiator is with us still and is undoubtedly popular. It is an unfortunate fact that many of those who use a four-lamp radiator expect to get from it much more heat than they are entitled to. I venture to predict that when the lamps are so made that their filaments are run at such a temperature that the shorter wave-lengths of their radiant emissions pass through their clear glass surrounds readily and the filaments are screened from direct vision by suitable reflectors, then we shall find that our dwellings are warmed and lighted in a manner approaching most nearly that in which we receive light and warmth from the sun. This method of lighting and heating will be as near perfection as possible if we can also arrange, as I hope shortly to show that we can, to destroy the monotony of the lamp radiator as well as increase its efficiency.

The importance of good radiating effect from an electric fire and its capacity to hold your attention is considerable. You may have noticed that the only time a lamp radiator interests you sufficiently to hold your attention is at the moment of being switched on. A good log fire or a clearly burning coal fire interests you all the time. They are conducive to steady thinking, and the contemplative frame of mind that brings calm and the solution of one's little problems. For many years I and those who are working with me have endeavoured to introduce into electric fires more comfort and some features of interest that will hold one's attention sufficiently to make "sitting in front of the fire" a most agreeable occupation.

To-night I am able to show you for the first time what is generally considered by those who have seen it privately an effect of great value. As you are aware, a great deal of the life of a fire is indirectly due to the differing refrangibilities of the various vapours and heated air through which you see the burning fuel, and also to the varying degrees of redness caused by the play of air upon the fuel. I have endeavoured to combine these effects naturally in the "Tricity" Flame Fire which you see before you. The result gives a breadth of effect, and simulates in a perfectly natural manner the appearance of a coal fire at its hottest.

There are certain points in connection with the development of this side of our industry which should always be borne in mind when discussing the subject of electric heating. In the first place, electric heaters of small capacity should not be put forward to work miracles. A small fire is quite good and economical for heating ordinary black flairs, boiling water (not too rapidly), and warming small rooms or taking the chill off larger ones, &c. It is, however, a great mistake that has been made by many to install heaters that are too small. The next thing is that an electric fire must have a big radiant surface if it is to give a sense of comfort. It must also be sufficiently hot and powerful and attractive to draw one towards it, and then drive one back from it.

Another feature that should be borne in mind is that ordinary convector types of heater, and I am afraid some other types, have been designed in such a way that they would be most useful to us if we were flies and could sit with our feet on the ceiling. Warmth is wanted low down in the room, not high up. Just as one could appreciate electric slippers, one cannot imagine anyone wearing an electrically heated hat. Keep your head cool, but don't get cold feet. A judicious combination of radiant and convected heat is most welcome, and with electrical fires can be arranged for.

The fourth point is that electric fires should be designed to look like electric fires. The earlier samples were either made to resemble obsolete fires or else appeared to bear no resemblance to anything at all. Electrically, we are free from troubles due to fumes and, therefore, our originality can have full play in design. There is no need to make an electric fire look like a fireplace. It must be remembered, however, that the fireplace is the natural place in which to stand a powerful electric fire. It is useless to talk about the heat going up the chimney; steps must be taken to prevent it. We have sat round the fireplace for too many generations to get out of the habit. The design and arrangement of a room, too, the placing in a room of our household gods in the way of pictures, vases, &c., to say nothing of the fireplace on the mantelshelf, have been regulated by the fact that we shall be sitting round the fireplace. We must, therefore, bow to the inevitable, and for certain rooms make up our minds that electric fires will be wanted in their tens of thousands for putting into fireplaces. I do not think we shall need to follow the gas companies in their endeavour to pull out the coal grate, as we have no difficulty with regard to fumes.

It must not be expected that the economy alone of electric heating for rooms will force it upon householders in the way that electric cooking will do. The actual coal consumption of a private house for the various living rooms is small compared with that used in the kitchen. The economy in the consumption of coal, therefore, is very little worth. It is on the score of general convenience, cleanliness, and comfort that electric fires are making their way into the homes of the people. It is difficult to say how far the consumption of electricity can be reduced and the comfort of the individual maintained. I have come to the conclusion that for personal comfort the heating effect of one-fortieth part of a unit applied directly to the hands and feet of a warmly clothed individual would suffice to keep one warm when at work during very cold weather. It would appear that we may in time hope for something less than 100 times this amount, namely, 2½ units, to be made sufficient to warm a room efficiently.

New Zealand Trade.—Mr. R. W. Dalton, H.M. Trade Commissioner in New Zealand, states that when certain German companies were proclaimed enemy concerns, their liberal advertisements in New Zealand papers naturally ceased. Articles similar to, or better than, those which they formerly advertised are made by British firms, but such firms have not adopted any advertising campaign to make their goods known. One result of this may be that after the war present enemy concerns will have an opportunity for booming their goods again, and their real origin will be forgotten.

ELECTRIC VANS FOR LAUNDRY WORK.

WITH the steady progress in popularity of the electric vehicle in this country, it is surprising that laundries appear to be entirely unmentioned in the lengthy list of electric vehicle users which forms such an interesting feature of our quarterly contemporary, *The Electric Vehicle*. This is obviously a direction offering considerable possibilities, and it may be of some interest to refer briefly to American experience in this matter. As a result of an interview, Mr. JACKSON MARSHALL, the energetic secretary of the Electric Vehicle Section of the N.E.L.A., records the opinion of the manager of the Brunswick Laundry, New Jersey, that as soon as the all-round efficiency of the vehicle is realised by the laundry industry, most laundries will use the "electric," well-nigh to the exclusion of all other means of collection and delivery.

The daily load average of the Brunswick Laundry is approximately 1,500 lb., and at least 65 horses are necessary to do this work, allowing for emergencies. Under the same conditions 33 electric vehicles are sufficient, and during inclement weather the only extra preparation necessary is the addition of chains, and each driver can equip his car with non-skid chains in 15 minutes. The simplicity of the "electric" enabled the men who had been driving the horse to learn to operate the new vehicles very successfully in a few hours.

The comparative operating cost and upkeep of the electric vehicle and the horse are as interesting as the facts concerning the dependability of each.

The investment for a horse-drawn equipment, including stable room, was \$1,515; for an electric delivery car complete \$2,500. The extra investment necessary for the "electric" was, therefore, approximately \$1,000.

The monthly cost of 65 horses and wagons totalled \$1,713; while the monthly cost of one electric delivery car, including interest at 6 per cent., amounted to \$29, representing a total for 33 cars of \$957.

The depreciation of the car is balanced by the depreciation of the horses, wagons, harness, &c. Thus the "electric" shows a saving of over 40 per cent.

The "electrics" of the Brunswick Laundry average 25 miles per day, visiting all the outlying suburban districts. Some of the best drivers deliver as many as 900 bundles per week, and make an average of 32 miles per day. At an average of 25 miles per day, and a current cost of \$4 per month, the current cost per mile is about six-tenths of a cent on this basis; figuring 900 bundles delivered per week, the energy cost of each bundle delivered is about 1/100 of a cent.

Repair bills are a negligible quantity in electric vehicle operation. Every week an "electric" is taken down, carefully looked over, cleaned, and put in first-class order; thus every 33 weeks each car goes through a thorough overhaul.

The average life of the tires on the gasoline cars for long hauls is about three to four months, while those on the electric vehicles last from a year and a half to two years.

The advertising value of the electric must be considered, also the safety element should be mentioned. Collisions are very rare things with these cars, even in congested traffic, as they are started and stopped so easily.

The bodies of the delivery cars which the Brunswick Laundry use are 4½ ft. × 5 ft. × 7 ft. behind the driver's seat. The garage of the Brunswick Laundry is 50 ft. × 140 ft., and this is now being duplicated, which will provide space for about 45 electric vehicles.

The Keystone Laundry Co., one of the largest in Pittsburgh, recently decided to use the electric truck, and as a result ordered five vehicles. One of these "electrics" on a test-run over the famous hills of Pittsburgh showed 63 miles on a single charge of the battery. At all times during the run the car carried a load of 642 lb., in addition to the driver and an official observer. The cost of the electric current for this mileage was but 49 cents, or four-fifths of a cent per mile.

The Sanitary Laundry, of Hartford, on September 6th, 1913, installed one electric vehicle, and between that date and October 23rd of the same year the car had covered 1,545 miles. Before purchasing this "electric" the Sanitary Laundry was operating four horse-drawn wagons and 400 miles per week, or 100 miles for each wagon per week. Two teams were disposed of when the "electric" went into service, and the two remaining horses at that time were covering 70 miles per week, instead of 100 miles which they formerly covered, the difference representing additional work satisfactorily discharged by the electric vehicle.

The Charity Organisation Society, of New York City, reports that the three electric vehicles in the service of its laundry have reduced the cost of delivery at least 20 per cent., and the general results are much better.

The Salem Laundry installed one electric delivery car, and within six months an order was placed for six more cars of the same type. In four months after its first installation, the J. Arthur Anderson Laundry, of St. Louis, put four additional cars in service. Both the Pilgrim and Crystal Laundries, of Brooklyn, are operating three electric vehicles, repeat orders having been given for two cars each, after the first car had been well tested.

THE NATIONAL INSURANCE ACT, 1911.

THE following additional decisions have been published:—

(CONTRIBUTIONS ARE PAYABLE FOR

1,981 X. Armature and coil winders employed in the repair of electrical machinery.

1,982 X. Workmen engaged wholly or mainly in:—

(1) The manufacture (including generating and compressing) of acetylene gas.

(2) The manufacture of cylinders for holding the gas.

(3) Examining cylinders and filling them with porous material.

1,987 X. Workmen engaged wholly or mainly in the manufacture or repair of arc lamps.

(CONTRIBUTIONS ARE NOT PAYABLE FOR

1,985. Workmen (other than sawmillers, machine woodworkers, metal or leather workers) engaged in making small switch boxes or fancy boxes, whether covered with leather, cloth, velvet or similar material, or polished, and not intended for use in war (application 403 X).

1,986. Workmen engaged wholly or mainly in the preparation of non-conducting compositions for covering boilers, pipes and other parts of heating or refrigerating apparatus. (Application 403 X.)

1,988. Workmen (other than sawmillers and machine woodworkers) engaged wholly or mainly in repairing crates, casks, barrels, which are not intended for use in war.

1,993. Casual labourers employed on or about docks or wharves and engaged in loading and discharging cargoes and not employed continuously by the same employer on premises which are used mainly for the purpose of any insured trade.

2,000. Workmen (other than metal workers) engaged in making silk shades for electric light and gas fittings.

2,019. Workmen engaged wholly or mainly in washing slack for coke ovens.

ELECTROCHEMISTRY IN NORWAY.

A REVIEW of the situation of the electrochemical industry in Norway during the past two years has just been published in the French *Journal du Four Electrique*, which has now reappeared after a temporary suspension caused by the war. The review is written by our contemporary's correspondent at Christiania, who states that the electrochemical works were surprised by the war in full execution of orders for nations of the belligerent Powers, as the whole of the Norwegian production is exported. Certain of these contracts were broken by the force of circumstances, particularly owing to the impossibility of procuring ores and other raw materials which are indispensable to the industry, for almost all raw materials are purchased from abroad. The works had consequently to exist on their stocks, the impending exhaustion of which rendered the companies really apprehensive. But the war was then taking a new turn, and about the beginning of 1915 it became clear that, as hostilities were likely to last a long time, an important part would be played by those raw materials which served for the manufacture of munitions. The Norwegian works which produce nitrates, carbide and cyanamide, ferro-alloys and aluminium, then found themselves approached from various quarters, and the output was vigorously resumed. The difficulties of obtaining raw materials continued to be considerable, and prices and wages still moved upwards; but as sale prices also advanced, the final result has been that most of the electrochemical works realised large profits last year and are also doing so in the current year.

The dominant fact in Norway, from the economic and financial standpoint, during the past two years, is the constitution in the banks and private safes of monetary reserves having no precedent. Indeed, the war has enriched Norway, or at least every one concerned with armaments, shipping, and international trade in general. The current accounts at the banks have grown to such excessive dimensions that certain institutions have refused to accept further deposits. It is under these circumstances that the shipowners have turned their attention towards the industries, and this represents the great change which has taken place in Norway since the outbreak of the war. As is known, it was formerly almost impossible to raise a shilling in Norway for industrial undertakings, which had to be established with foreign capital, although it has to be explained that if no native money was forthcoming it was due to the absence or scarcity of capital for investment. Now, however, "a gale of industrial nationalism" is blowing over the country, and many undertakings have been established solely with Norwegian capital—as, for instance, shipping lines, and concerns for the utilisation of waterfalls and the production of wood pulp, chemicals, &c.

The correspondent proceeds to refer to certain works of the Nitrogen Products & Carbide Co., although a portion of his statements has been apparently eliminated by the French military censor. This company, which owns these works and the majority of the shares in the North-Western Cyanamide Co., has established a great industrial undertaking at the bottom of the Oddafjord, where over 70,000 H.P. are utilised in the production of ammonium nitrate, nitric acid, and perchlorates. The power is supplied by the Tysefaldene A.S., and new works are also in course of construction at Aura. Among new installations mention is made of the extension of the aluminium works of the Norske Nitrid at Eydehavn, whilst the company is building a second aluminium works at Tyssedal, in the Oddafjord. In the case of ferro-alloys, a

production has been made by the Høysand and Tysedal Works, as well as at the Perstunns Works, near the Høysand Co., which owns the Høysand waterfalls and operates electrochemical works with power, has now been taken over by the control of Norwégians, who have purchased three-fourths of the capital which were held by the Høysand-Schlenker Co. The nickel refinery at Christiansand has expanded its production, and a new works for ferrochrome has been erected at Tysedal. But the industries which are dependent upon the importation of foreign ores are far from participating in the general prosperity, owing to the comparative scarcity of raw materials and the high freight rates which prevail.

The activity of the group of the Elektrokemisk Industri has been applied to its branches—the Arendal Svøltverk, which produces carbundum and ferro-silicon, and the Bjølvefossen Works, which is erecting a large carbide and cyanamide works in the fjord of Hardang. A further national undertaking is the Høyang Faldene or Narck Aluminium Co., which has been formed exclusively with Norwegian capital amounting to £686,000, and which has commenced to utilise the falls in the Sognefjord and the construction of an aluminium works, the raw materials for which will be obtained from France. In conclusion, the correspondent refers to the formation of the Florli A.S., which proposes to lay down plant for the electrical production or refining of steel.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

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- 15,023 "Carriers for fusible cut-outs." W. LAWRENCE & MAYOR and COLSON. October 23rd.
- 15,027 "Mechanical appliance for switching off gas and/or switching off current of electricity at any desired time." D. BROUCHER. October 23rd.
- 15,033 "Contacts for electric switches, &c., and mounting of supporting same." A. CRAWFORD, W. PRESTON, and W. SANDERS & Co. October 23rd.
- 15,036 "Electrical distributing and/or intensifying system." W. A. CLARK, H. G. LONGFORD, W. W. LONGFORD, T. MORRIS & THE SPHINX MANUFACTURING Co. October 23rd.
- 15,041 "Electrical illuminating device in conjunction with walking-stick, umbrella, &c." E. J. WHIDDON. October 23rd.
- 15,053 "Electric candle fittings." H. GARDE. October 23rd.
- 15,054 "Control switches for electric measuring apparatus." O. ANDERSON. October 23rd. (Sweden, November 11th, 1915.)
- 15,072 "Vacuum tubes of the Audion type." J. BRIQUET. October 23rd. (France, October 23rd, 1915.)
- 15,076 "Overload electric switches or cut-outs." P. G. VAN WIJK. October 23rd. (Holland, June 15th.)
- 15,077 "Loading coils for superimposed telephone working, &c." C. E. HAY & H. W. SULLIVAN. October 23rd.
- 15,078 "Spark plug." A. R. HEMMING & C. T. WESTLAKE. October 23rd.
- 15,095 "Electric flashlamps." C. R. HALL. October 24th.
- 15,121 "Searchlight." J. THOMSON. October 24th.
- 15,123 "Automatic electric plug and switching contrivance." D. M. ECKARDS. October 24th.
- 15,137 "Electrolytic cells." F. G. WHIFLER. October 24th. (U.S.A., October 30th, 1915.)
- 15,153 "Electric radiant-heat fire." H. S. ELLIS & J. C. PETERSEN. October 25th.
- 15,177 "Portable electric signalling lamps." W. T. COLSON. October 25th.
- 15,187 "Electric transformers." THE BRITISH ELECTRIC TRANSFORMER CO. AND I. K. ROBERTS. October 25th.
- 15,236 "Electrodes for electrical furnaces." W. B. HAMILTON & J. HOLLAND. October 26th.
- 15,242 "Electric heating and melting furnaces." V. STORIE. October 26th.
- 15,252 "Process of uniting metals or alloys by electric welding." H. L. T. WHITE. October 26th.
- 15,279 "Electric measuring instruments." C. COLEMAN, E. L. EVERETT and P. HAMILTON. October 26th.
- 15,269 "Batteries for electric pocket lamps." HOLLANDSCHE ELEMENTEN-FABRIEK JULIANA. October 26th. (Holland, October 5th.)
- 15,274 "Generation of sustained electric oscillations for wireless telegraph systems." J. BEHNSON. October 26th. (France, November 5th, 1915.)
- 15,290 "Electric current rectifiers." H. WADE (Mills). October 26th.
- 15,310 "Means for the control of electric flashlamps." E. NUTTALL. October 27th.
- 15,327 "Electric working clothes." C. J. BEAVER & E. A. CLARKE. October 27th.
- 15,333 "Electric heating apparatus." B. J. CORDER. October 27th.
- 15,340 "Electric heating apparatus." J. BROWN & C. L. BUNDY. October 27th. (U.S.A., November 2nd, 1915.)
- 15,351 "Electric heating apparatus." J. BROWN & C. L. BUNDY. October 27th. (U.S.A., June 30th, 1915.)
- 15,358 "Wireless electric heating apparatus." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). October 27th.
- 15,359 "Electric heating apparatus." R. K. HEARN. October 27th.
- 15,365 "Trolley heads for electric trams." C. SYMONS. October 27th.
- 15,366 "Electric control lines." W. H. FINEY & H. LEHNER. October 27th.
- 15,378 "Lighting devices for underground engines." R. G. I. MURKHAM. October 28th.
- 15,401 "Adjustable marks or scales for compasses, dip-pend indicators, magnetic compasses, &c." AERONAUTICAL INSTRUMENT CO. October 28th.
- 15,419 "Form or sleeve for braided wire coverings on electric cables." A. POWELL & HAMMER, W. A. SHEPHERD & F. E. WILSON. October 28th.

PUBLISHED SPECIFICATIONS.

1915.

- 14,145 "ELECTRIC HEATING AND LIGHTING SYSTEMS." A. BLACKBELL. October 5th.
- 14,209. "AUTOMATIC GLASS-BLOWING MACHINES." British Thomson-Houston Co. (General Electric Co., U.S.A.). October 7th.
- 14,410. "PROCESS FOR THE PRODUCTION OF CERAMIC UNITS ELECTROLYTICALLY." R. HALL. October 9th.
- 14,464. "ELECTRIC GLASS VALVES." British Thomson-Houston Co. (General Electric Co., U.S.A.). October 11th.
- 14,477. "DYNAMIC ELECTRIC MACHINES." A. H. NORTON. October 11th.
- 14,495. "ELECTRIC HEATING (COOKING) DEVICES." L. HELL. October 12th. (CORRESPONDENCE, LONDON, 1914.)
- 14,468. "ELECTRIC ARC SOLDERING." F. H. JONES. October 13th.
- 14,433. "MEANS OF ELECTRICAL ATTACHMENT OF FRAMES OR CASES." H. B. PRENTICE. October 14th.
- 15,824. "CONSTRUCTION OF CIRCUITS FOR SECONDARY BATTERIES." G. A. SMITH. November 9th.
- 16,393. "ELECTRIC SWITCHES." A. C. WARD. November 20th.
- 16,406. "ELECTRIC CONTACT THERMOSTATS." R. P. GOSBLO. November 22nd.
- 17,504. "ELECTRIC HEATING AND COOKING DEVICES." J. SAYERS. December 11th.
- 17,844. "STARTING AND LIGHTING DEVICES FOR AUTOMOBILES." British Thomson-Houston Co. (General Electric Co., U.S.A.). December 21st.
- 18,137. "DYNAMIC ELECTRIC MACHINES." S. H. MARTIN. December 29th. (Concession date, January 2nd, 1915, U.S.A.)

1916.

The numbers in brackets are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

- 1,103. "RADIO-ACTIVE SIGHTING DEVICES FOR USE WITH FIREARMS." B. SOLARO del Borgo. January 30th, 1915. [100,050.]
- 2,068. "ELECTRO-MAGNETIC DRIVING GEAR FOR CLOCKS." J. LAMERIS. February 11th, 1916. [101,632.]
- 2,556. "ELECTRODE HOLDERS FOR USE IN ELECTRIC SOLDERING AND WELDING WITH FUSIBLE ELECTRODES." QUASI-ARC Co. & A. P. STROHMEGER. February 21st, 1916. [101,655.]
- 2,704. "MANUFACTURE OF ELECTRIC INCANDESCENT LAMPS WITH METALLIC INCANDESCENT BODY." Deutsche Gasglühlicht Akt. Ges. (Auerger). May 4th, 1915. [100,387.]
- 3,745. "ALTERNATORS FOR THE PRODUCTION OF HIGH-FREQUENCY ELECTRIC OSCILLATIONS." Soc. FRANCISCO Radio Electrica. March 13th, 1915. [100,184.]
- 5,528. "ELECTROLYTIC METHOD FOR REMOVING OXIDE OR RUST FROM THE SURFACE OF IRON OR STEEL." P. MARINO. October 7th, 1915. (Divided application on 14,230/15.) [101,667.]
- 7,517. "SPARKING PLUGS." A. E. LAMKIN. May 26th, 1916. [101,678.]

Amending the Corruption Act.—The following clauses are included in the new Bill which has been introduced by the Home Secretary for the prevention of bribery in connection with Government contracts:—

1. Any person convicted on indictment of a misdemeanour under the Prevention of Corruption Act, 1906, or the Public Bodies Corrupt Practices Act, 1889, shall, where the matter or transaction in relation to which the offence was committed was a contract or a proposal for a contract with His Majesty or any Government Department or any public body, or a sub-contract to execute any work comprised in such a contract, be liable to penal servitude for a term not exceeding seven or less than three years. Provided that nothing in this section shall prevent the infliction in addition to penal servitude of such punishment as under the last-mentioned Act may be inflicted in addition to imprisonment.

2. Where in any proceedings against a person for an offence under the Prevention of Corruption Act, 1906, or the Public Bodies Corrupt Practices Act, 1889, it is proved that any money or other consideration has been paid to or received by a person in the employment of His Majesty or any Government Department or a public body by or from a contractor, or agent of a contractor, holding a contract from His Majesty or any Government Department or public body, the money or consideration shall be deemed to have been paid or given and received corruptly as such inducement or reward as is mentioned in such Act unless the contrary is proved.

Electric Transport on the Rand.—The extent to which electric locomotives have been adopted for underground ore haulage—59 of one make alone being in use—shows that their advantages are already quite widely appreciated. Main haulage ways, designed for large tonnage, are in most instances best served by the overhead trolley type of locomotive. This generally involves the installation of a conversion plant for transforming alternating three-phase power direct current of suitable voltage (250 or 500 volts). For other levels, and especially those handling smaller tonnage, and from which several cross-cuts run off to the face, self-propelled locomotives, equipped with storage batteries, offer great advantages. Machines of this type are running successfully or are about to be put in use on several Witwatersrand mines—notably, Crown Mines, East Rand Proprietary, Kleinfontein and Government Areas. Such locomotives require for their charging comparatively small and inexpensive conversion plants. Electric lorries have also proved their worth for surface deliveries of mine stores—such as dynamite, coal and heavy stores. Large electric trucks, equipped with Edison batteries, are in use on the East Rand, Knights Deep, Simmer Deep and Crown Mines, and are effecting great savings of time and money. It appears, therefore, that economies of money and native labour can be effected by the further introduction of electricity in transportation.—*South African Mining Journal*.

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ITALY'S ELECTRICAL AWAKENING.

ON several occasions, since the outbreak of the war, we have referred to the industrial awakening of Italy as a result of the difficult conditions created through the European conflagration, and to the revelation of the magnitude of the past dependence of that country in various directions upon German firms for the supply of different classes of manufactures. Mention has been made in particular of the determination of Italian electrical engineers to emancipate, if possible, the country from the domination of the Teutonic element, and attention has also been drawn to the important part which the Associazione Eletrotecnica Italiana, whose central offices are situated at Via S. Paolo 10, Milan, is endeavouring to play from the commercial point of view of the problem. A further step has now been taken by the Association, whose Ufficio Centrale has just issued, at the sole expense of the Society, a pamphlet of 130 pages containing a new and complete list of all firms who manufacture electrical machinery and apparatus, and giving technical and financial information concerning each of the 175 firms incorporated in it, as well as showing the origin and national character of each. It is stated that 10,000 copies are to be circulated for the purposes of propaganda among members of the Association, the Government offices, provincial and municipal authorities, technical and industrial associations, schools, &c., whilst other copies will be distributed abroad to the Italian Embassies and Consulates, chambers of commerce, &c. We believe that in their study of the Italian electrical position our manufacturers and traders will receive considerable assistance from this directory.

The Association is also moving in other directions. At a conference held at Florence, on October 29th, the question of organising professional schools was discussed at some length, and a resolution was adopted in favour of establishing museums and laboratories in connection with the technical schools, of introducing technical apprenticeships, and of forming a more concrete connection between the schools and the country. Of greater importance to circles outside of Italy, however, is the question of future Customs tariffs, which was raised by Engineer Gatta at the same conference. A resolution was eventually agreed to in principle asking that the new tariff system should be prepared as soon as possible. It was suggested that a maximum and a minimum tariff should be introduced, and the former be twice the scale of the latter; that certain items concerning machinery should be abolished or modified, and that a protectionist tariff be framed against foreign competition. The conference further had under consideration the question of the institution of a closer connection between the Government and manufacturers, and the president was requested to approach the Government with a view to the Association being consulted in respect of all legislative schemes concerning the electrical industry in general, and particularly in the case of projected utilisation of public waterways and the erection of telegraph and telephone installations.

It will be observed from the foregoing that Italy, like ourselves, France, Russia, and Belgium, has its own peculiar electro-industrial problems arising from the war situation. The electrical men of all these countries are possessed by the same inflexible determination to secure their emancipation from Teutonic influence. Each of the Allied countries

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- ROME: Loescher & Co., Corso Umberto 1° 307.
- STREY: The Mining & Engineering Review, 273, George Street; Gordon & Gotch, Pitt Street.
- TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon & Gotch, 132, Bay Street.
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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's)

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will desire to be self-dependent, utilising to the full its own resources and abilities wherever it is economically practicable to do so, but possibly, almost certainly, there will be directions in which Allied co-operation may fill in some of the gaps, mutual interworking rendering the Allies in the future independent of Germany and Austria for lines which without such co-operation might need again to be obtained from what are now obnoxious sources. It seems to us that there ought to be some way for the electrical authorities of all of the Allied countries that we have mentioned, who know thoroughly their own national electrical situation, facilities and possibilities, and also can speak with intimate knowledge concerning the schemes that are actually developing for meeting the situation, to confer together, putting their information, if need be, into a common pot, enabling the electrical activities of the Allies to be developed for the good of them all along the most intelligent, because the best informed, lines. We throw out the suggestion for what it may be worth, feeling that unless something in the way of personal conference is arranged, the Allied countries will fail to reap the fullest advantage from the many discussions and investigations that have taken place separately, and without any co-ordination, since the war began. There is nothing to be lost, but everything to be gained, by the cultivation of the closest possible relations between the electrical men of the Allied nations. Many of them, most of them, in fact, are mainly occupied with war activities at present, but it is not too early for somebody to take the lead, if only by way of preliminaries. What about the I.E.E. and the B.E.A.M.A.?

Is a Truce Possible? We gather from the newspaper Press that a preliminary meeting is being held some time this week at which employers and Labour delegates will together consider the question of a basis for an industrial truce. It is understood that this will be quite a preliminary gathering attended by only a few representatives from either side, but it is expected to lead to larger conferences when both employers and employed will be represented by properly authorised delegates. We sincerely hope that this means that actual negotiations of a very definite character will soon develop. The atmosphere will not be improved if the matter be allowed to hang fire too long. We have evidence to this effect before us as we write, first, in the form of a report of a conference held last week-end at Leeds with the object of securing a fusion of all the existing Unions in the engineering trade "with the ultimate object of securing complete control of the industry." Mr. Tom Mann is reported to have declared that the Union officials were waiting for the rank and file to give them a mandate to "move towards obtaining the control of the industry." The resolution passed urged such control for the purpose of securing "the complete abolition of the wages system," and there was talk of the usual kind about "idle shareholders and capitalists." We fear that conferences of such a kind and resolutions of this nature will not help to create an atmosphere suited to the cultivation of industrial harmony. The other piece of evidence consists of a memorandum issued by the Employers' Parliamentary Council on "matters relating to the future of industry and the interests of employers." Here, again, there is a good deal of hard-hitting at the other side. No doubt much of it is justified. We quite agree that if the future is to be successful there must be *working* and not *shirking*, and that if higher wages are to be paid they must be *earned*; also that restriction of output and other curses of the past cannot be permitted unless we are going to court industrial suicide. But we are bound to recognise that the Government, wisely or un-

wisely, made a bargain with Labour involving the reinstatement of the old rules after the war; also that there has been wrong on the side of the employer as well as on that of the employed. The Leeds report and the Employers' memorandum seem to us to prove that, whatever the spirit of the trenches may be, Labour and Capital at home, if these two examples are to be regarded as typical of the feeling of the whole of the country, are still very far apart, and there is urgent need of a conference in which, with as little use as possible of the cudgels, they may seriously strive after that greatly-needed basis for a truce.

Science and Industry.

ELSEWHERE in this issue we print abstracts of two interesting lectures: one, on the life and work of, perhaps, the greatest scientific technologist that these islands have ever brought forth, by one of his most gifted pupils, Dr. Alexander Russell; the other, on the relations between science and technology, or, as the author prefers to put it, between "academic science" and technology, from the pungent pen of one, also a scientific technologist of high attainments, whose witty comments on men and things are now unfortunately only too seldom heard—Mr. James Swinburne. Widely divergent as are the points of view and the subject-matters of these two essays, there is nevertheless much in common between them. Mr. Swinburne delights in exposing the fallacies and delusions which we mortals hug to our breasts, and in attacking views which, by reason of their popularity, are generally regarded as orthodox, and in pursuing these aims he is apt to overshoot the mark, like most reformers; but we doubt whether he expects or intends all his remarks to be taken quite seriously. The career of Lord Kelvin, however, affords a striking illustration of some of the contentions which he puts forward. The early training of William Thomson was highly "academic" in the sense in which Mr. Swinburne uses the term, but the soundness of the solid foundation thus laid was abundantly demonstrated by the superstructure of technology which he erected upon it. As a teacher he achieved but a qualified success in imparting information; his energy and enthusiasm soon carried him far beyond the bounds of the subject chosen for the day, and his lectures sometimes ended on a topic very remote from that with which he commenced. But, on the other hand, as Mr. Swinburne remarks, he kindled in the hearts of his pupils a desire for knowledge and an appreciation of the delights of original research which far outweighed his deficiencies as a mere teacher of facts, and aroused in them an affectionate admiration which was reflected in the triumph of his jubilee at Glasgow. Moreover, we would emphasise the fact that many of his greatest achievements were the fruit of the untiring application of his mathematical genius not only to the practical ends of "technology," but also to what appeared to be the most abstract and unpractical problems of "academic science."

With some of Mr. Swinburne's remarks on the manufacturer and his problems we cannot wholly agree; that the British manufacturer, when he is on his mettle, is the equal of, or superior to, any in the world, we do not doubt, but the fact that he has problems to solve, and knows it, has been fully demonstrated during the war. As a case in point we may cite the electrification of textile fabrics, which is at present the subject of research at Leeds University, and this does not stand alone. The difficulty attending the publication of researches undertaken at universities has already been clearly recognised, and means are being devised to cope with it. As for Mr. Swinburne's child-like faith in the truth and virtue of economic theory, we can only say that in view of his iconoclastic tendencies in other relations, we are surprised at him. Is this his one weak point?

LINKING-UP ELECTRIC POWER STATIONS.

[COMMUNICATED.]

It is now pretty well agreed by everyone who has taken the trouble to investigate the matter, that material benefits are to be derived from linking-up electricity supply stations: but while there has been some progress in this direction, a great deal remains to be done before the full advantages of the scheme are realised. The difficulties involved in interconnecting the London electricity supplies are much more formidable than daily newspaper writers seem to imagine, for their idea, apparently, is that it is simply a question of joining together a few cables or wires, when a thoroughly reliable supply of electricity for London will be assured. Unfortunately, however, the problem is much more difficult. Had it been realised in the early days of the electrical industry that the coupling-up of electrical systems would, in time to come, lead to marked economy, as well as greater reliability and a reduction in the total amount of plant, it is more than likely that greater uniformity in voltages and frequencies would have been aimed at. As it is, stations have been erected with frequencies ranging from 25 to 100 cycles per second, and there is also considerable diversity in voltage. Even the frequencies of some of the larger and more recent stations which might advantageously be interconnected are not by any means in conformity.

In America, where coupling-up has been practised on a much greater scale than it has been here, very similar conditions prevail. The frequencies of the American stations are 25, 33, 40, 50, and 60 cycles. In the past, there were 125 and 133-cycle stations, but these have now practically disappeared. The two frequencies most commonly used at the present time are 25 and 60 cycles, and there appears to be no very logical reason why any other values should be adopted in future. It is claimed that modern rotary converters will work quite well on 60-cycle circuits, so that there is no need to adopt 40 or 50 cycles on this score. The lower frequencies were originally adopted mainly with a view to facilitating the successful operation of rotary converters, for it is well known that the early 60-cycle converters were very troublesome machines. Some American engineers maintain that 60 cycles might now be adopted for practically all classes of service, apart from single-phase railways, but this, of course, is a matter of opinion. The lower frequencies impose limitations upon designers, especially in connection with speeds. Small two-pole, 25-cycle motors cannot run at a higher speed than 1,500 R.P.M., whereas 3,600 R.P.M. and intermediate speeds are permissible with 60 cycles. Twenty-five-cycle motors and transformers are also more costly to build than those designed for 60-cycle circuits; moreover, they are heavier. Transformers and motors of given output increase in cost and weight as the working frequency decreases. What applies to motors and transformers also applies to turbo-generators, especially those below 10,000 kW. capacity.

So far as America is concerned, there appears to be a distinct tendency to adhere in future to 60 and 25 cycles, and to eliminate other frequencies as occasions arise. To link-up American systems many frequency-changers have been built, and when similar work is seriously commenced in this country there will undoubtedly be a big demand for these machines. Having equipped our stations with complete disregard to the possibility of linking-up, we are in the unhappy position of having stations working at 25, 33, 40, 50, 60, 83, 85, 90, and 100 cycles per second. Moreover, there are many different voltages, and some stations supply single-phase current, a few two-phase current, and the bulk of the large and most modern stations three-phase current. There are also, of course, some three-wire continuous-current stations which may eventually be converted into substations and fed from larger plants, or be interconnected with them, as in the case of other stations. In linking-up, the particular kind of current supplied to consumers need not be considered, unless it happens to be the same kind of current that is generated, for linking-up is done between station bus-bars and not between distributing systems. If it is merely a question of dealing with different voltages, no great difficulty is involved. By the aid of static trans-

formers, switch-gear, and cables, stations having different voltages can readily be connected together. Two- and three-phase stations having the same frequencies can also be interconnected by using transformers connected in accordance with the scheme devised by Scott; but when it comes to coupling-up single-phase stations with two- and three-phase stations and coupling stations of different frequencies, the task is less simple.

The conversion of single-phase current to three-phase current, or *vice versa*, cannot be accomplished with static transformers, even if the frequencies of the two stations are the same. A single-phase load represents power which is pulsating or varying periodically from zero to a maximum value, whilst a balanced polyphase load represents continuous power of constant value. Obviously it is not feasible to transform from continuous power to pulsating power, or *vice versa*, without some method of storing and returning power. This result cannot, of course, be achieved with static transformers. True, attempts have been made to do this, and in some cases it has been possible to obtain equal currents on the three phases, but balanced currents do not necessarily represent balanced power loads. Equal currents in the three phases have been obtained by causing part of the current to lead and part to lag, but the resultant reactions and unbalancing effects of these lagging and leading currents have the same effect on the generating system as the single-phase load would have. To maintain a proper balance on the three-phase side when transforming from three-phase current to single-phase current a rotating machine must be used. The difference between the energy delivered by the three-phase system and that taken by the load is stored as part of the momentum of the set, and this stored energy is delivered as electrical energy at the proper moments. The inverse transformation from single-phase current to polyphase currents is, for the same reason as stated, impracticable without a revolving machine. A motor-generator consisting of a three-phase and a single-phase machine mechanically coupled together will, of course, give the desired transformation without any trouble at all, and where periodicity transformation is desired as well as phase transformation, a machine of this kind is absolutely essential. The single-phase and polyphase loads are then quite independent. But where transformation from single-phase to polyphase current, or *vice versa*, does not also involve a change in periodicity, it would appear that part of the single-phase load could be delivered directly from one phase of the three-phase system, whilst the other part of the load could be dealt with by a phase converter. Phase converters, as used on the locomotives of the Norfolk and Western Railroad, might be employed for the transformation of three-phase current to single-phase current, or *vice versa*, but their suitability for interconnecting systems has not yet been demonstrated. In a paper read before the Association of Edison Illuminating Companies in 1914, Mr. B. G. Lamme discussed the question of using these converters for obtaining single-phase loads from polyphase systems. The growing demand for single-phase current for working single-phase railways, electric furnaces, and so forth, has led American engineers to look into this question. As, however, the suitability of this type of converter for coupling-up purposes has not as yet been demonstrated, and as single-phase and polyphase stations having exactly the same frequencies are not often met with in this country, this particular kind of phase converter need not at the present time be further considered.

Synchronous motor-generators—*i.e.*, sets consisting of two synchronous machines mechanically coupled together—provide a positive coupling between the two interconnected stations; that is to say, if the speed of the steam sets in one station increases, that of the sets in the other station increases correspondingly. An induction-motor-generator, on the other hand, gives a certain amount of slip, and the coupling between stations is, consequently, not so rigid. This slipping property of the induction-motor-generator is an advantage in that an increase in the speed at one station is less liable to result in a large transference of load which may prove too much for the motor-generator. Owing to this difference in the characteristics of synchronous and induction-motor-generators, it is advisable, in

the interests of safety, to use synchronous motor-generators of sufficient capacity to cope with the full load of either of the interconnected stations. Evidently nothing serious can then happen, even if one station be completely shut down. The flexible coupling which the induction-motor-generator provides would appear to be its principal advantage, but it is to be noted that when an intentional transference of load is made, quite an appreciable difference in the speeds of the two interconnected stations is necessary. An induction motor that has, say, 3 per cent. slip when running at full load, will have to run 3 per cent. above synchronous speed before it will give full load as an asynchronous generator, so that if such an induction motor were used on a motor-generator, the transference of full load from one direction to the other would involve a difference in speed between the two stations of as much as 6 per cent. One station might, of course, run 3 per cent. high, and the other 3 per cent. low. A synchronous motor-generator set, on the other hand, will transfer full load from one direction to the other without any difference in speed at all.

It is sometimes claimed that induction-motor-generators are superior to synchronous motor-generators on the score of easy starting, but, in the light of modern practice, there does not appear to be much in this argument, for with a rotor on one side of the machine wound in the same way as the rotor of an induction motor, synchronous motor-generator sets can be started without a special starting motor, and it is only necessary to synchronise on one side. Such machines are started at reduced pressure with the aid of a compensator or auto-transformer, and when the machine comes up to speed, exciting current is supplied to the slip-rings. But when the machine is running in synchronism on the motor side, the generator voltage may, or may not, bear the proper relation to the voltage of other units, and before the machine can be paralleled at the generator end it may be necessary to slip the poles by reversing the motor field current; in fact, one or two reversals may be necessary before the correct relation is secured. When operating synchronous frequency changers in parallel certain small difficulties are met with which do not manifest themselves when running other kinds of machines in parallel. For instance, if one frequency-changer is carrying load, and it is desired to synchronise another frequency-changer with it, the switch should not be closed at the instant when the synchroscope indicates perfect synchronism. The load on the working machine acts like a mechanical drag on the rotor, with the result that there is a corresponding angular displacement of the revolving fields. To parallel two such sets satisfactorily, the switch should be closed when the synchroscope needle deviates by some angle from the exact synchronism mark, the angle depending upon the amount of load the working machine is carrying. When, however, the frequency-changers are both in the same station, the effect of closing the switch when the synchroscope indicates exact synchronism is not, as a rule, serious. But if the machines are in different stations, and it is necessary to parallel them over a transmission line or cable, the disturbance may be more pronounced. The resistance tends to lower the synchronising power.

In order that synchronous frequency-changers may operate satisfactorily in parallel they must either be made with extreme accuracy, both mechanically and electrically, or means must be provided for adjusting the stator of one of the machines composing a unit. The latter arrangement, which is provided on modern machines, enables the operator to obtain the desired division of load between different sets. The stator of either the motor or the generator is mounted in a cradle, so that it is capable of being rotated through a small angle. By the aid of a small motor geared to the movable stator and connected to a control switch on the switchboard, any desired division of load can be obtained with the greatest ease. If the steam sets in two interconnected generating stations are to run at their exact speeds, the combination of poles on a synchronous frequency-changer may result in the use of a frequency-changer running at only 300 revolutions per minute. In the case of small and medium-sized machines, this is a troublesome limitation, since it hinders economical design. In the following table, some pole combinations are given, from

which it will be seen that 25- and 60-cycle stations call for a motor-generator running at this low speed.

Frequency.		Poles.		Speed.	Generator frequency.
Motor.	Generator.	Motor.	Generator.		
25	62.5	4	10	750	1.17 per cent. high.
25	62.5	8	20	375	1.17 per cent. high.
25	60	10	24	300	Exact.
25	58.3	6	11	500	2.78 per cent. low.
25	56.3	8	18	375	6.18 per cent. low.
60	26.7	18	8	400	6.8 per cent. high.
60	25.7	11	6	511	2.8 per cent. high.
60	25	24	10	300	Exact.
60	24	20	8	360	1 per cent. low.
60	21	10	4	720	1 per cent. low.

If it be simply a question of changing from one periodicity to another, and no interconnection between stations is involved, a periodicity on the generator side, which is slightly above or below the actual value required, may not in some cases be a very important matter; but when it comes to coupling-up generating stations, the conditions are, of course, different. With induction motor-generators greater flexibility can be secured, for with a little permanent resistance in the rotor circuit the slip can be adjusted, and the correct frequency on the generating side so obtained, although, unfortunately, permanent resistance in the rotor circuit involves a reduction in efficiency. Further, it is to be remembered that an induction motor cannot work as a generator unless it runs in parallel with a synchronous machine, for it always must take its exciting current from the line, and it always draws a lagging current, irrespective of whether it is generating or motoring.

Load cannot, of course, be transferred from one station to another by adjusting the field rheostats of the steam-driven generators. Such adjustments will simply give rise to a flow of wattless current. The manner in which the stations share the load depends on the setting of the engine or turbine governors, and not upon the exciting currents of the generators. With the governors in the two stations set for the same drop in speed from no load to full load, each station will automatically deal with its proportionate share of the load; if, on the other hand, the governors in one station give twice as much speed-drop as those in the other station, then, assuming that the capacities of the two plants are equal, the station with the closer regulation will take up automatically twice as much load as the other station.

Engineers must decide for themselves which of the two types of motor-generators will best suit their requirements. Of course, when it is desired to shut one station down completely, and feed the bus-bars of that station through the motor-generator, the induction-motor machine is useless, unless the motor happens to be on the running station side. Since an induction motor can only act as an asynchronous generator when it is running in parallel with synchronous machines, it follows that if the generating station to which it is connected be shut down, the motor-generator cannot take over the load. The synchronous machine, on the other hand, being excited on both sides with direct current, will, of course, supply current in either direction, irrespective of whether it runs in parallel with other machines or not. Moreover, it is possible, with synchronous motor-generators to correct the power factor on both of the interconnected stations. Hence, although there are, as shown, certain small difficulties in operating synchronous frequency-changers in parallel, these machines are, nevertheless, pretty extensively used.

When linking up continuous-current stations with alternating-current stations, rotary converters or motor-converter are employed. Motor-generators would, of course, answer the purpose, but since they are less efficient than rotary or motor-converter, they are not, save under exceptional circumstances, likely to be adopted. The connections for the rotary correspond with the usual sub-station connections; that is to say, the slip-rings are connected to the alternating station through static transformers, and the commutator end is connected through suitable switches and circuit-breakers to the bus-bars of the continuous-current station. When the machine is transferring load from the con-

tinuous-current station to the alternating-current station the voltage generated by the rotary on the direct-current side must be a little below that on the direct-current bus-bars. To a certain extent the interchange of energy between the two stations is automatic, the two stations sharing the load according to the adjustment of the governors; but, as a rule, a certain amount of field adjustment is necessary. Of course, when the rotary is connected through the transformers to the alternating-current bus-bars, it runs as a synchronous machine and its speed is fixed, but if the alternating-current station be shut down and current is still drawn from the alternating-current side of the rotary it runs as a direct-current motor. The speed then depends upon the field strength, and if from time to time there is a material change in the power factor, caused, for instance, by the starting of induction-motors, the speed of the rotary may, as a result of the demagnetising effects of the lagging currents, vary considerably and attain a dangerous value. For such conditions the makers of motor-converters claim superiority. The best machine for these conditions is the motor-generator, since the generating and motoring sides are entirely independent of one another, but rotary converters have been used under these conditions by exciting the field with a separate exciter driven by an induction-motor taking its current from the slip-rings of the rotary. A small increase in speed results in a rapid increase in the exciting current, which compensates for the demagnetising effects of the lagging currents.

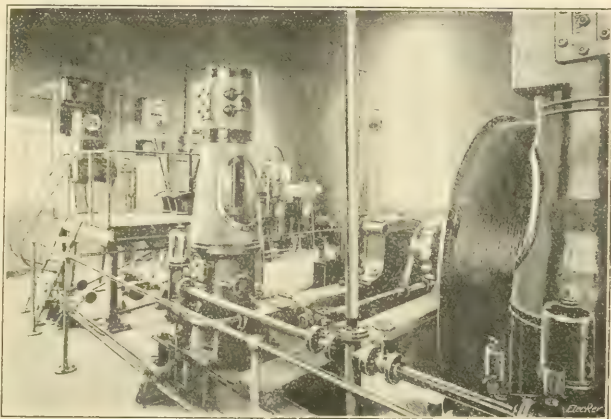
In connection with linking-up continuous-current stations with polyphase stations, an interesting suggestion has been put forward by Mr. J. S. Peck. It is well known that it is not easy to build large continuous-current turbo-generators, and in order to avoid the use of continuous-current generators running at turbine speeds two schemes are practicable. One is to gear a comparatively slow-speed dynamo to the turbine, and the other to couple a turbo-alternator to the turbine, and electrically connect the alternator to a relatively slow-speed rotary converter. If the latter scheme be adopted, then polyphase stations can be coupled up with continuous-current stations with very little trouble or expense. The current from the polyphase station would be transformed down, so that the pressure corresponded with that across the terminals of the alternator, and the mesh-connected secondaries would be connected, after synchronising, to the leads between the turbo-alternator and the rotary converter. With the transformers disconnected from the turbo-alternator, continuous current would be supplied to the bus-bars of the continuous-current station in the ordinary way; for, of course, under these conditions the polyphase station is not coupled up. If, however, the transformers were synchronised with the alternator and the rotary converter disconnected from the alternator, the latter could supply polyphase current through the transformers to the polyphase station; or with the alternator in the continuous-current station still disconnected from the rotary, current could either be supplied from the polyphase station through the transformers and rotary converter to the continuous-current station bus-bars, or current from these bus-bars could be supplied through the rotary and transformers to the polyphase station. Under the latter conditions, the rotary would work inverted.

When larger power systems are interconnected, the possibility of very heavy currents flowing in the mains at times of short circuits must be kept in view. The use of current-limiting reactances demands, under these conditions, very careful consideration, especially when the stations contain large turbo-alternators. When the stations are at a considerable distance apart, the transmission lines or cables interconnecting them provide a certain amount of protection; in fact, in the case of some of the large interconnected water-power schemes, nothing beyond the transmission

lines has been necessary to keep the short-circuit currents within permissible limits, for the lines act in a similar way to reactances connected between sections of station bus-bars. But it is to be remembered that many of these water-power stations contain large low-speed generators with comparatively low short-circuit currents. Much depends on the sizes and characteristics of the plants and the distances between stations. On some of the interconnected systems in America, current-limiting reactances are used pretty extensively, and there is little doubt that as the capacities of stations in this country increase, and as one by one they are interconnected, this practice of using reactance coils in generator leads, between sections of station bus-bars, and in feeder circuits, will become more general than it has been hitherto.

ELECTRIC WINDING PLANT AT A YORKSHIRE PIT.

MESSRS. NEWTON, CHAMBERS & Co., LTD., of Sheffield, have recently introduced an electrically-driven winding plant at their Staindrop Pit, Skiers Spring, near Wentworth



CONTROLLING GEAR OF WINDER.

Station, for the following particulars of which we are indebted to the British Westinghouse Electric and Manufacturing Co., Ltd., who supplied the equipment.

The plant has two steel winding drums, 10 ft. in diameter \times 4 ft. 3 in. wide, and is gear-driven by a 220-B.H.P. slip-ring induction motor.

The drums are capable of holding 420 yards of rope in one layer. One drum is loose on the shaft, and is connected thereto by means of a clutch, the clutch and brake gear being suitably interlocked. The engine is designed to raise and lower men from a depth of 350 yards, the assumed duty being as follows:—

Weight of cage and chains	2 tons.
Weight of men per wind	3,400 lb.
Circumference of rope	3 14 in.
Winding time	60 sec.
Decking time... ..	30 sec.
Distance between headgear sheaves	5 ft.
Distance from centre of drum and centre of headgear sheaves, not less than	80 ft.

The equipment is also suitable for use for sinking with a total unbalanced load, including the weight of the rope, of 5,220 lb., and for coal winding with a total unbalanced load not exceeding 5,220 lb. At present the winder is being used for sinking purposes, and is accordingly fitted with one of the drums only; as soon as the shaft is completed the second drum will be fitted, and the winder will enter into full winding service with two cages.

There are two brake paths, arranged one on each drum: the drum shaft is 13 in. in diameter, and runs in three

12-in. x 15-in. bearings, supported on a continuous horizontal support, which is extended to carry the motor.

The pump is mounted on an independent shaft, running in two bearings, and is coupled to the motor by means of a flexible coupling. The brakes are of the post type, weight-applied, and controlled by means of an air-brake engine; they are arranged to come into operation automatically in case of overwind, overload on the motor, or failure of supply voltage. There is also an emergency lever included with the driver's control lever.

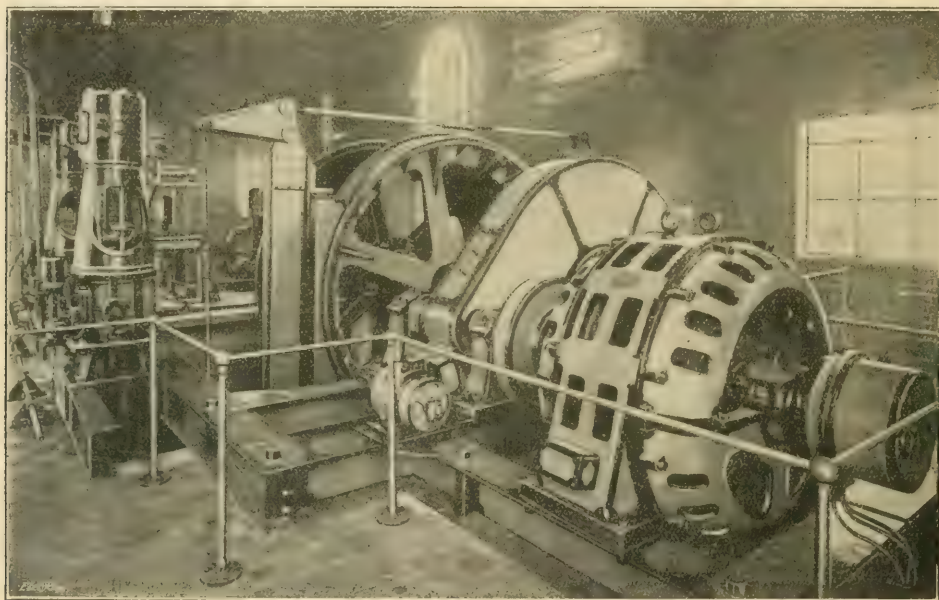
An auxiliary motor-driven air compressor, with receiver piping and fittings, is provided.

The depth indicator is of the vertical screw type, gear-driven from the drum shaft, and fitted with an overwinding trip.

The chief feature of the overwind limit-switch, fitted by the British Westinghouse Co. to all their winders, is the absolute safety obtained; also, the switch is so arranged that a second, or even a third, overwind can be dealt with should the driver accidentally start the winder in the wrong direction again.

governed by the height of the weir over which the solution has to fall before flowing back into the bottom tank. The weir is arranged for operation with the same lever as the reversing switches. The rate at which the top tank fills, and therefore the rate of acceleration of the motor, is adjustable by means of a stop valve on the delivery side of the pump. The cooling system is of the condenser type, with straight tubes, arranged so that the tubes can be cleaned by removing one end-plate of the system; or the whole system may be removed from the controller for this purpose. Any tube is easily replaceable if necessary.

The main switch-pillar is of the totally-enclosed type "S" design. It is fitted with a three-pole oil circuit-breaker, with two overload trips, two trifurcating boxes, and a mechanical attachment, by means of which the circuit may be opened in case the brake should be applied under any emergency condition. A hand-trip switch to put on the emergency brakes, if it should be necessary, is also provided, and is mounted on the platform in a convenient situation. The connections to the transformer are taken from the machine side of the main switch, the bus-bar chamber being fitted with interconnecting bus-bars for this



WESTINGHOUSE 220-H.P. MOTOR DRIVING WINDER.

The driver's platform is sufficiently elevated to give the driver a full view of the winding engine, and carries the necessary control and brake levers, with quadrants and latches.

The motor is nominally rated at 220 H.P., and runs at a speed of 360 R.P.M., taking three-phase current at 50 cycles and 3,000 volts. It is arranged with the shaft extended to take a flexible coupling, and a trifurcating box is fitted on the motor frame for the stator connections. The motor is of specially robust construction, and is capable of dealing with overloads momentarily up to, and even exceeding, $2\frac{1}{2}$ times full-load torque.

The controller is of the liquid type, with motor-driven circulating pumps and mechanically-operated reversing switches of ample capacity; the primary connections are fitted with trifurcating boxes. The controller consists essentially of two wrought-iron tanks, one mounted on the top of the other, a motor-driven circulating pump, electrodes for the rotor circuit, and two oil-immersed reversing switches. The bottom wrought-iron tank contains the solution, and is fitted with a cooling system; the solution is pumped from the bottom tank into the top one, flowing past the electrodes. The height of the solution in this tank, and therefore the area of the electrodes immersed, is

purpose. To control the low-tension circuits to the solenoid controller, pump motor, and compressor motor, there are provided two sets of three-pole enclosed switches and fuses.

The auxiliary apparatus, also supplied by the British Westinghouse Co., comprises:—

1. A 10-K.V.A. three-phase, 50-period, 3,000/440-volt oil-insulated self-cooled transformer, to supply the solenoid controller, pump motor, and compressor motor.

2. A "no-volt" solenoid arranged to be operated by the emergency trip-gear for the brakes in case of failure of voltage, or through the action of the overload trips on the main circuit-breaker on overload, also by hand on emergency.

3. A set of driver's instruments, ammeter and voltmeter; these are of the illuminated dial type, with large open scales, and are mounted on a suitable bracket on the depth indicator, so that the driver can keep in view the instruments and the depth indicator simultaneously.

4. A squirrel-cage motor of 5-H.P. capacity for driving the air compressor.

5. A Westinghouse over-speed device, which can be arranged in conjunction with the other emergency gear to operate the brakes and cut off the supply of power to the motor in the event of a predetermined speed being exceeded

during any part of the wind, either acceleration, full-speed run, or retardation. This device consists of a small direct-current series-wound generator, driven from the shaft of the winding drum or motor, and arranged to operate in conjunction with a rheostat controlled by the depth indicator in such a way that a certain voltage is never exceeded, provided the acceleration or the speed is kept within a predetermined limit. In the event of the predetermined acceleration or speed being exceeded during any part of the wind, the voltage of this small machine rises, and so operates a relay in conjunction with the circuit-breaker and the emergency brakes.

The mechanical parts for the winding engine were supplied by Messrs. Robey & Co., of Lincoln, and the steel headgear in connection with the shaft was manufactured by Messrs. Newton, Chambers & Co. at their Thorncliffe Ironworks.

The current for the winding engine is generated at the Rockingham Colliery, which is about two miles away.

LORD KELVIN'S LIFE AND WORK.

IN the eighth Kelvin lecture before the INSTITUTION OF ELECTRICAL ENGINEERS last week, Dr. ALEXANDER RUSSELL reviewed the life and work of Lord Kelvin, drawing freely upon his own notes and recollections of the great scientist.

William Thomson's first important paper—written at the age of 16, just before he entered Cambridge University—related to an analogy between the flow of heat in a conducting solid and the problem of the electrostatic field in an insulating medium. The lines of flow in the heat problem are coincident with the lines of force in the corresponding electrostatic problem. From the mathematical point of view the problems of thermal conductance, electrostatic capacity, and electric resistance are the same, and Dr. Russell points out that Thomson's work helps us to study how the resistance of the "earth" of an earthed conductor varies with the shape of the conductor which is in contact with the ground.

In 1844, being second wrangler and first Smith's prizeman, Thomson devoted himself to the investigation of physical problems with the help of mathematics, specially studying the problem of the distribution of electricity on two spherical conductors when near one another. Sir W. Snow Harris in 1834 had made careful experiments on the attractions between charged spherical conductors which seemed to throw doubt on the accuracy of Coulomb's law. Thomson therefore attacked the problem and obtained a complete solution, using the method of "electric images" with which his name will always be associated. This method is useful in the theories of heat, hydrodynamics, sound, &c., and also in pure mathematics. Thomson proved that the behaviour of electrified conductors as described by Snow Harris was in exact accordance with theoretical deductions from Coulomb's law, though he did not publish the solution of the problem until 1853. Similarly, in 1846 he gave the solution of the problem of the distribution of electricity on a spherical bowl—one of his greatest achievements—but did not publish the method of solving it until 23 years later; during this period no other mathematician had been able to supply a proof. By weighing the attraction between the spheres the voltage between them can be readily found, and Dr. Russell points out that this method can easily be applied to measure the voltage of high-pressure transformers: the voltage is completely determined when the dimensions of the spheres and the force of attraction between them are given, and in standardising a voltmeter of this kind no electrical measurements are necessary.

By 1851 Thomson had found that all the effects of electromagnetic and electrodynamic induction could be explained by the principle of the Conservation of Energy, and in that year he published a remarkable paper on the application of the principle of mechanical effect to the measurement of electromotive forces and of galvanic resistance in absolute units, in which he determined the E.M.F. of a Daniell cell approximately from the dynamical equivalent of the chemical action in the cell. He also pointed out that knowing the heat developed in a wire, and Joule's equivalent, if the current in the wire were measured in absolute units (with a tangent galvanometer, for instance), the resistance of the wire and the electromotive force could also be determined in absolute units; up to that time experimenters' results could only be expressed in terms of apparatus, cells, and wire in the possession of the observers. In many cases, therefore, it was impossible to compare their results. The idea of measuring resistance in absolute units was due to W. Weber, and Kirchhoff made the first determination in 1849. Thomson was the first, however, to show how the fundamental electric units could be determined from the principle of energy.

In 1833 Thomson read an epoch-making paper on the oscillatory discharge of a Leyden jar, explaining the reason

why, as Helmholtz had observed, a steel needle magnetised by the discharge current from a Leyden jar had its north pole sometimes at one end, sometimes at the other. Thomson proved mathematically that the discharge was oscillatory in certain cases, and suggested that his conclusion might be experimentally verified by means of Wheatstone's revolving mirror, which was done by Peddersen in 1859. The invention of the oscillograph has enabled us to study these discharge currents in detail and prove that Thomson's theory is very approximately correct. The great practical importance of this paper lies in the fact that it led many physicists to study the problems of oscillatory discharge most carefully, and wireless telegraphy was the direct although unexpected outcome of their labours. It has to be remembered, however, that Thomson's theory is not complete. Of the energy originally stored in the jar we know that some is radiated into space. In many cases this amount is negligibly small, and Thomson's theory is directly applicable. But he did not show how the radiated energy could be taken into account or state the limitations of his formula.

In 1856 Thomson published a paper on the "peristaltic induction" of electric currents. The phenomena observed when testing submarine cables proved to him that the capacity effects between a wire and the sheath, or between neighbouring wires, were most important. In this paper he neglects the effect of electromagnetic induction, as this is permissible for slow signals. Thomson had very clear views about the electrostatic coefficients of neighbouring conductors. His work on the forces between electrified spheres proves this. He saw that when we have several wires in a cable and they have static charges the potentials of each wire can be found by means of these coefficients. This is still true when the charges are in motion. They present a very perfect analogy with the mutual influences of a number of elastic tubes bound together laterally, and surrounded and filled by a liquid which is forced through one or more of them. Borrowing a medical term he called this "peristaltic" induction. As the electricity was in motion it seemed to him illogical to talk about "electrostatic induction." He gave the solutions for cables containing two, three, four, and six wires, and Dr. Russell draws attention to the fact that the solutions of these problems are also the solutions of three-phase, single-phase, two-phase, and six-phase power-transmission systems. He left out of account the leakage conductance and the electromagnetic coefficients; but for a first solution of the problem it is wonderfully complete. Thomson's equations can easily be made rigorous and give the complete solution of the electric transmission of power in a polyphase system. The resulting equations are only a slight extension of the equations Thomson solved in 1851, the outcome of his thorough mastery of the problem of the electrostatic induction between two spheres.

After referring to Thomson's work in connection with the early Atlantic cables, and the invention of the mirror galvanometer and the siphon recorder (which was the prototype of the moving-coil galvanometer), Dr. Russell describes his investigation of the E.M.F. required to produce a spark in air between parallel metal plates, with the aid of his absolute electrometer, carried out in the cellars of the Old Glasgow College. His paper on sparking distances was the forerunner of many by other physicists, showing that the voltage at which the disruptive discharge occurs or a corona first appears depends on the maximum value of the potential gradient, provided that the electrodes are farther apart than about one-tenth of an inch. This question has become of importance from the engineering point of view in connection with the corona or brush discharge between overhead wires, the loss in watts per mile of single main being proportional to the square of the excess of the effective pressure between the mains over the pressure at which corona first appears.

Dr. Russell next discusses Thomson's work on the motion of vortex rings in a liquid or a gas, which he perceived was analogous to the magnetic forces due to an electric current flowing in a ring or to the magnetic forces due to a small magnet, and passes on to the theory of the conduction of heat, as handled by Thomson in 1852. Two years later he read a paper on the efficiency of clothing for maintaining temperature, and showed that under certain conditions the effect of clothing may be to cool a body. This leads to a consideration of the case of an insulated (covered) wire carrying a current, which has a less rise of temperature than a bare wire under otherwise similar conditions. Dr. Russell suggests that insulating overhead transmission wires with a suitable material would not only prevent the losses due to the formation of a corona, but would allow more power to be transmitted without overheating the wires.

Thomson devoted his best energies to determining the age of the earth and sun, and estimated that it was about a hundred million years since the surface of the earth was molten; but the discovery that a small mass of radium can emit spontaneously an enormous quantity of heat has made it probable that his conclusion will have to be modified. He was unable to accept the view that the energy of the radium (90 calories emitted per gramme per hour) could be derived from the element itself, and held that the energy was supplied by ethereal waves from outside.

Another subject dealt with by Thomson was the variation in the density of a high-frequency current in a cylindrical conductor over its cross-section; he pointed out that at very

high frequencies the current was practically confined to the surface of the conductor, and gave a formula for the effective resistance of the conductor, with tabular data which have been used also in other physical problems. The problem of the high-frequency resistance and inductance of a cable has been discussed by Dr. Russell on the lecture given by Thomson, and in an appendix to the lecture the solution of the problem is given. These solutions, however, neglect the effects of capacity.

Various other examples of Thomson's activities are mentioned, such as his advocacy of the generation of electricity "in bulk" as long ago as 1878, of the use of the electric arc for street lighting in 1879, and of the development of the storage battery in 1881. The wonderful series of electrical measuring instruments which Thomson invented is also referred to; Dr. Russell states that three of his ampere balances have been in use practically continuously at Faraday House for the last 27 years under ordinary commercial conditions, and are as accurate and useful now as when they were bought.

The first published tests of lamp efficiencies were published by Sir William Thomson and Mr. J. T. Bottomley in 1881, and in this connection the author draws attention to interesting phenomena observed in testing the new gas-filled series lamps. In certain lamps, when rotated, the candle-power continually increases with the speed of rotation; at 180 revolutions per minute the light may be about 15 per cent. greater than when the lamp is stationary, and the current 1 or 2 per cent. less at constant voltage. These results are due to the effect of centrifugal force on the convection currents of gas inside the bulb and the rise in resistance of the hot tungsten filament with temperature.

The mathematical processes used by Thomson neatly always had a physical significance; he solved problems in one branch of physics by methods suggested by other branches, much of his success being due to his ability to grasp quickly the analogy between such problems. With pure mathematics he had little sympathy; he regarded it merely as a tool.

In conclusion, the author points out that he has dealt only with a few aspects of Lord Kelvin's life and work which are of general interest to engineers; as an imaginative thinker, a powerful reasoner, and a skilful inventor, Kelvin was probably unique.

The lecture was accompanied by a number of appendices relating to the subject-matter.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Final-Grade Classes in "Electrical Installation Work."

Glancing through a reprint of Mr. A. P. Trotter's recent paper before the Association of Supervising Electricians, we read that "elementary and advanced evening classes for electrical wiremen are held at the Northampton Institute, Clerkenwell, and at the South-Western Polytechnic, Chelsea." This subject (formerly termed "Electric Wiremen's Work," and now much more appropriately called "Electrical Installation Work") is, of course, of fundamental importance, and is sought after by many other kinds of student besides wiremen.

While we know that Grade I classes are held at several different centres, it seems that we are to gather from Mr. Trotter's remarks that there are only two places in London where the Final Grade is dealt with.

If this be so, it is not too much to say that the authorities at other polytechnics and institutes appear to be rather neglecting an extremely necessary feature of their electrical side. Under its old name, the subject has been in the City Guilds' programme for the last ten years.

"Electrical Installation Work" is going on in practice in every district in London; and advanced as well as elementary instruction in the subject should certainly be available at every polytechnic and technical institute. We are not thinking here of the junior evening technical classes held at various Council schools. In their case it is obviously only possible to give very elementary instruction.

We venture to disagree with a previous statement in Mr. Trotter's paper: "The demand for trade classes in any special subject must precede the supply." As Mr. Trotter was addressing supervising electricians, we presume he was not thinking of "soap manufacture," or "leather tanning," or "cotton spinning," but of "electrical installation work." Now, why should this be looked upon as a special subject, when the work is going on all round us? Not one person in a hundred would trouble to ask for the establishment of a class that didn't already exist at his nearest technical institute. One obvious reason is that the applicant would think to himself that by the time the class was established, he would have learnt what he wanted some other way, or grown too old, or died. You might almost as well expect a person to ask someone else to open a shop because he wanted to buy something.

It surely stands to reason that classes in electrical installation work, in plumbers' work, in plasterers' work, and in other work which is common in every community should be conducted as a matter of course in every technical college in the country.

Apologising for trespassing so much on your space,

A. P. Lundberg & Sons.

London, N., November 10th, 1916.

[Referring to the last paragraph in Messrs. Lundberg's letter, we think our correspondents have in mind "trade schools" rather than "technical colleges," which do not, and should not, concern themselves with handicrafts. We agree, of course, that electrical installation work is an important subject, and ought to be taught in the advanced as well as the elementary stage.—Eds. Elec. Rev.]

Between Two Stools.

My attention has been drawn to the letter of "Victimus" in the current issue of the REVIEW. It would be extremely interesting to your readers, and necessary for their complete protection, to have the names of the persons concerned; they appear to be afflicted with the same species of moral hydrophobia as the Prussians, and it may prove to be equally desirable that they be isolated accordingly until such time as they may see and acknowledge the error of their ways. Ergo, full names and addresses, please!

Australian.

More About Discounts.

Some time ago a correspondence took place in the REVIEW re the needlessly complicated discounts in use. The Tungsten Lamp Association afterwards brought out their simple scale of discounts, which has proved a great boon, but, unfortunately, the cable makers so far have not followed their good example. The following account for R.C. cable, stupid though it is, is only a sample of thousands of accounts now being sent out. The account reads as follows:—

To Cable	£2 18 11
Less 20 per cent.	11 10
	£2 7 1
Plus 25 per cent.	11 10

The result of calculations is the original figure £2 18 11

In other words, clerks are working overtime at night working out calculations like the above, when all they had to do was to put down the list price with the word "net" opposite.

In our school days we used to laugh at Chinese methods of working, but surely the Chinese must grin at us for employing stalls of clerks in war-time to work out discounts, when there is not any discount on the invoice. With our scrap-heaps of weights and measures, and absurd system of coinage, we have in some respects taken the place which the Chinese used to have, but which they are leaving behind.

The reason given for all the unnecessary complication in discounts, whereby we add so much and then deduct so much, is that sellers should know how to charge their customers. But this difficulty could easily be obviated by the use of a rubber stamp reading as follows:—

Note.—The retail selling price of these goods is . . . per cent. above list.

The figure could be filled in by pen. This would ensure that all sellers were charged on the same basis. If this simple expedient were adopted by wholesale dealers, the saving of labour would be so great that quite a number of clerks could be released for the war. One feels that the matter only needs to be brought before the notice of those in authority for the change to be made. Perhaps those in touch with the accountancy departments of our C.M.A. firms (and many others also) will draw their attention to the problem, and point out that not only do they waste their own time, but also that of the overworked clerks in the offices of buyers.

Simplex.

"Summation Watt" Capacity of Field Rheostats and the Like.

Referring to Dr. Garrard's letter of November 6th, unless such formulae are based on a physical meaning, i.e., on the area enclosed by a curve plotted between (rheostat current) and rheostat ohms, it seems to me to be of little use advocating any formula for universal benefit, as the limitations of different designs vary very considerably. In other words, unless so based a formula has, no meaning except for comparison of an individual manufacturer's rheostats.

On this theoretical "summation watt" basis their relative accuracy can be tried out by those of your readers interested, and without further discussion.

To obtain a very large "R" in an ordinary rheostat compared with field, or other external constant resistance, increasing the resistance beyond a certain point does not materially increase the actual "summation watt" capacity required.

The greater the resistance in a potentiometer the less the

actual "summation watts," as the only variable (*i.e.*, constant watt loss) will be less.

Whether either above will in practice appreciably increase the size of rheostat (not the "summation watts") will depend entirely on the design and the particular case involved.

I. Boothman.

Street 11, November 1st, 1916.

SCIENCE AND INDUSTRY.

By J. SWINBURNE, F.R.S.

A lecturer on this subject is expected to discuss the dependence of industry on mathematics, physics, chemistry, bacteriology, botany, and to a less extent a few other branches of science, such as biology, geology, and astronomy; and he is expected to show how the universities can help the industries of this country in two directions. The first is training men in the different branches of science, so that they can go into industrial work and be of the greatest value; the second is helping manufacturers directly by the advice of university professors and by carrying out technical research at college laboratories.

Many branches of industry are the direct application of scientific knowledge or discovery, made without any idea of its practical value. The foundation principle of wireless telegraphy is a good example of this. Again, few students of Routh's rigid dynamics would have thought of making a gyrostad serve as a compass. Problems of capillarity seemed to have only scientific interest, yet Elnore's process for the separation of complex ores and its various modifications, which have been worth hundreds of thousands to those concerned—except the inventor—depends on differences of surface tensions. In short, every industry in the country has its technology, or applied science, and the better this is understood by those in charge the better it is for the industry and for the country.

It is not my duty to discuss science as the root, or even a branch, of education in itself. To my non-expert mind, education ought to have four main objects. First, to enable one to earn his living, because if he cannot make his living nothing else is much use. Second, to let one know enough about his health to secure it. It is no use making a living or anything else if, owing to your own ignorance, your health is wrecked and you are prematurely buried. Third, to make one a good citizen. Fourth, to enable one to enjoy his well-earned leisure properly. These principles appear to be wrong, for they do not in the least fit education as commonly indicted.

All the same, I will assume that under the first head there is a question of university teaching of science, with the object of its connection with industry. The main question is, then: How can universities best fit students to make their living by science in industry? To make the discussion complete, we ought also to discuss the question: How can business men make the best use of universities and of the men trained by them? This last question need not be discussed here, except in so far as the attitude of business men must react on universities attempting to work in conjunction with them.

In discussing its relation to industry, we must understand what we mean by science. Mathematics is the science of quantities and their relations. Pure mathematics is a study by itself. Mathematics may be applied to solve problems in astronomy, physics, mechanics, chemistry, and statistics. We thus have pure mathematics and applied mathematics. Sometimes the same man, Newton, for example, makes advances in both pure and applied mathematics. In science generally we have the same distinction. Science itself is a complicated fabric of organised knowledge of Nature. The man of science devotes his life to extend this fabric of knowledge in new directions, the object being to make the wonderful fabric complete in all its parts. In a sense this is of no use; but surely it is the noblest exercise of the human intellect. This is called pure, as opposed to applied, science, because it has no direct ulterior purpose. The term is bad, as pure and applied are not opposed, and all kinds of science are quite pure. I will, therefore, use the word academic to specify science pursued as an end in itself, without any regard to any external or ulterior use, the object of the pursuit being the attainment of knowledge and the development of the intellect. The word also fits as this kind of science is developed mainly by teachers.

Nearly all great advance in academic science is, and has been, made by professors in universities and colleges and their assistants—or in short, by teachers. It might be supposed that a body undertaking the education of young men would choose the man best able to explain matters to students. This is not the practice, however. A university gets the most eminent scientific man available, or chooses a young man who promises to become eminent. He is given

every assistance to make himself as famous as possible as a scientific discoverer; and apparently scientific distinction is his sole aim, the education of the students being of no account. This curious arrangement seems to work splendidly. It secures men of great ability, and they do good work, which would hardly be done otherwise at all; and instead of the students being neglected, they get fired with their leader's enthusiasm, and become assistants and co-workers, and eventually carry on the great work themselves.

We have thus academic science; we also have utilised science or technology. The technologist, as such, is not interested in the fabric of organised Nature knowledge, or academic science. He takes bits of the knowledge and uses them in manufacture. Sometimes the technologist is first, and his work is fitted into its place in academic science afterwards. Academic science generally develops it, so that the technologist is helped further forward. The technologist generally studies the branches of science which concern him till he knows more about them than those who have the more balanced knowledge of academic science. But this is not all: he has to look at matters from a different standpoint. He has always to consider prices and costs. He has to make his works pay.

Academic science thus does not cover technology. The knowledge is not there in the right form, and it is not in the right proportion, and it is entirely independent of all questions of cost, which are fundamental in technology. Here we have the great difficulty. The science teacher and the general public confuse academic science and technology, and think that the science taught at school or at the university is what is wanted in industry. This is a serious mistake.

The idea that academic science includes technology does harm in several ways. It prevents the science teacher understanding technology or realising what the manufacturer wants. It leads to his looking down on manufacturers as ignorant people, because they have not his particular kind of knowledge.

The question is, what ought universities to do? The obvious answer is that they should drop academic science and cultivate only technology. When a course seems quite obvious, and is not at once followed by competent people, it is generally wrong. If we dropped academic science we would drop technology, too, and lose all. Academic science depends almost entirely on universities, and great technological advance is possible only in conjunction with academic progress.

The spirit of academic science does not necessarily render a man less useful as a technologist. Quite the reverse. As long as it does not lead him to look down on technology, or to think he knows all about it without any special study, it helps him.

Whether it is possible to teach technology satisfactorily in college courses is an open question. A professor of academic science can be in the van of his subject, as he is himself taking part in it. A professor of any branch of technology must be behind his subject, as he has to learn from what is going on in works, which in many cases are not open to him at all.

I hold that the training at the university should be on thoroughly academic lines, because those are the lines on which the teachers are able to go far and well; and the whole of a student's available time is not too long to be devoted to a good groundwork of systematic coherent knowledge on which he can raise any desired superstructure of technology. The point I would insist on again is that he must not confuse the foundation with the superstructure. Many think that professors and schoolmasters are experts in education. You might as well say that a shunting engine is an expert in locomotion. It goes back and forwards along the lines for which it is designed. Those who take interest in the community want to get the locomotives off the old lines on to tracks suitable for the times, and such changes can be made by outside influence only against the bitterest conservatism.

Universities do now train men to earn their living by practice in law, and more especially in medicine and surgery. Nothing analogous is available in industry. Imitations of engineering and chemical workshops have always the drawback that they are only imitations. The elements of time and price do not come in, and they are vital.

Technical schools, unlike universities, have the definite object of training students to make their livings in industry; and they make their course as practical and as little academic as possible. A technical school is sometimes connected with a university; and we cannot in any case consider university training for industry without taking technical colleges into account. It must be admitted that if the best type of science training, even for industrial use, is the academic, the technical colleges are on wrong lines, and as technical colleges are doing splendid work, the idea put forward appears to be wrong.

But it is not urged that the academic training is the best in every way; but that, on the whole, it is best because, first, the professors are able to effect it best; second, because a student has so little time to spare that it can best be laid out in acquiring a good, sound foundation; thirdly, a well trained mind with the academic can easily acquire the technical outlook, too; and, fourth, because academic science trains the mind to reason rather than to memorize, and deals with the facts of nature instead of the ideas or doings of other men just as foolish and illogical as ourselves. More than this, if the universities converted themselves into technical col-

* Abstract of a lecture delivered at King's College (University of London) on November 8th, and forming one of a series which will be published by the College in due course.

fact, rather, science and with it technology would get moribund. Whether technical colleges are on the best lines is another question.

Recently, I have heard a great deal about universities helping in scientific research. Research in academic science has little to do with national industry. All such research is published, and technologists all over the world utilise the results wherever the research is carried on. Research in academic science has no direct effect on national industry, but it has a great influence in raising scientific enthusiasm, which is most important. But the outcry for scientific research for the benefit of industry is made chiefly by people who have no clear idea of the difference between academic and technical research, or of their circumstances. It is largely due to science teachers backed up by newspaper writers. The idea behind it is that manufacturers are ignorant and unscientific, and science teachers could put them right if allowed the chance. For example, we are told repeatedly that we are wasting coal, first, by burning it in badly-designed furnaces; secondly, by refusing to extract the valuable hydrocarbons and ammonium; and that it will soon be used up at present rates, and England will be ruined. The technologists know infinitely more about coal distillation than the science masters, and they know what can be done commercially now and what cannot. If the science masters made some discoveries that could be utilised, well and good; but to tell technologists that they are extravagant and ignorant is quite useless.

Can industrial research be carried on in teaching laboratories? During the war excellent work has been done, more especially in connection with such matters as dyes, drugs, and glass. In these cases we were merely taking substances that had already been made, and finding out how to make them. Finding out how to produce an existing dye is little in comparison with inventing the dye.

The vague idea seems to be that manufacturers have a number of definite problems they want solved; but they are too ignorant to solve them. They ought, therefore, to seek the advice of the universities, who would put them right. Manufacturers have no such problems. Half or more of the merit of an invention is realising that an improvement is wanted in any particular machine or process. One of the greatest difficulties the inventor has is to discover the "long felt want."

Take the question of recovery of hydrocarbons and ammonium from coal; students may carbonise coal in bits of gas barrel, distil tar, and fractionate the distillates and investigate them; but everything will be on a small scale except the mess. It is not the least likely undergraduates would find out anything in this way, and teach it to manufacturers; and they would be merely wasting time, and learning practically nothing.

But even if a research on tar distillation, for example, could be carried out satisfactorily in an educational laboratory, it could not be carried out in connection with an industrial distiller, because he would not work in with the laboratory unless he was to have a monopoly of the result. If the work is for publication, the tar distiller is not in the least interested, as it concerns his rivals here and abroad as well; so he will give neither information nor help. Results which are to be the common property of all, British or foreign, do not appeal to the individual manufacturer.

There is also a confusion between research and invention. It is not the least use turning a man or a group, and least of all, a committee, on to invent. Industrial progress depends on invention, and we are the most inventive people in the world; not because we are the cleverest, but because we are the most individualistic, and the least numbed by education. Inventions may be divided into two classes—improvements in machines or processes which can be made only by those in close touch with them inside the works; and broad inventions, which are generally made by complete outsiders whose minds are not in conventional grooves. In neither case can the university help.

Nothing is said about the shortcomings of the manufacturer, because I am not addressing him. He will not employ scientifically trained men, and he will not think very much of science generally until he finds that the technically-trained men come to the front. English manufacturers are, I maintain, the most competent of all. Eventually they may be better and they may employ science more; but to get them to do so science must adapt itself to industrial application.

Industry does not by any means depend alone on the types of science we have discussed. As a whole, it may be helped by the members of the community knowing something of economics, and acting on their knowledge; and it can be obstructed very effectively by the well-intentioned interference of those who know nothing of economics.

Economics is a curious science. Though it is broadly about wealth, it does not help the individual to become wealthy. To an engineer the skilful application of the knowledge of the various physical sciences means success in manufacture, which is good for him, and, being good for him, is good for the country. But a study of economics will not help him directly in his business at all; it is useful to him only as helping to make him a sensible citizen. He becomes a unit of sound opinion on labour problems, and on the action of Government in connection with industry. Unless, therefore, a man has the peculiar bent of mind which makes such a subject interesting in itself, he has no motive to lead him to

read economics, until he recognises it as a duty he owes to society.

Economics is peculiar in another way. But a man who is sublimely ignorant of economics is quite unconscious of his blind spot. He will lay down the law on such subjects as the relations of Capital and Labour, the birth rate, old age pensions, and, especially, international and colonial trade, with a cock-certainty, and a wealth of catch-words and circumambient balderdash that is almost good enough for a leading article in a daily paper. More than that, he will insist on acting according to his darks, and he is one of the units that determine the acts of the nation.

That economics is not taught efficiently is abundantly clear not only by the nonsense talked by what we call educated men on questions involving it, but more especially by the fact that people do not seem to realise that there is any such science. As to politicians, they do not limit their ignorance of science to economics; they make hay of all sciences and all facts with impartial irresponsibility.

Not only the industry of the country, but the happiness of our people may depend on economics. At present we have practically the whole of the hand-working classes dissatisfied, and, therefore, unhappy. The social problem is the most important in the world at present. Its solution must depend on economics. Is it not worth while to study economics with such a purpose, instead of trying all sorts of schemes which are economically pernicious? It may be true that economics has not so far provided any cut-and-dried way out; but until people realise that the science which ought to shed light on this path exists, and that it ought to be studied and developed, drawing the best intellects to it, there is no hope for any end, or even alleviation, of the miseries of civilisation. I would urge that the first step is for the universities to teach economics, in which I include closely related branches of sociology, with the vigour and insight the subject deserves.

There is a popular delusion that business has to do with economics, and that business men understand economical matters in a peculiarly practical way. In fact, the business man is the most dangerous of all, because he knows no more of the subject than other people; and he is not only unconscious of his ignorance, but he is, if possible, more certain he knows all about the matter. The opinion of such a body as a chamber of commerce on after-war trade conditions is most dangerous. It will be accepted as authoritative, it will be stated without any alleged reasons, and it will almost certainly be wrong.

Such a calamity as the war is not broadly somebody else's fault. It is the fault of all of us, but especially the fault of education, of which universities are at the head, in not educating us in such a way that such a catastrophe is out of the question.

Broadly, the great change wanted is in public opinion. Until people consider knowledge of the world we live in and the economical, sociological conditions of our life, as coming first, and the study of the sayings, doings, and languages of other men, especially of those that lived when the knowledge of everything except human nature was in its babyhood, as quite secondary, we will no doubt go on with all the miseries of poverty, disease, discontent, and war.

WAR ITEMS.

Exports to Liberia.—The "London Gazette" for November 10th contains a list of corrections in the names of persons and bodies of persons in Liberia to whom exports may be consigned.

Japan and Enemy Trade.—A Tientsin dispatch in the *Westminster Gazette*, states that the forthcoming Japanese enemy trading legislation is very drastic, and provides penalties for indirect trading with the enemy similar to those imposed by the French system. Pronouncement of the new laws is expected shortly.

Foreign Trading Prohibitions.—The "London Gazette" of November 10th contains further lists of persons and bodies of persons with whom trading is prohibited, under the Trading with the Enemy Act, in the following countries:—Argentina, and Uruguay, Bolivia, Brazil, Chile, Colombia, Denmark, Ecuador, Greece, Japan, Liberia, Morocco, Netherlands, Netherlands East Indies, Norway, Persia, Peru, Portuguese East Africa, Spain, Sweden, Venezuela. A number of removals from, and variations in, previous lists are also given.

To be Wound Up.—The Board of Trade has ordered the following companies to be wound up under the Trading with the Enemy Amendment Act:—

Radium, Ltd., 93, Mortimer Street, London, W., dealers in radium preparations. Controller: C. R. Beeby, 66, Basinghall Street, E.C.

Corner & Co., Ltd., 83, St. Paul's Churchyard, E.C., transfer manufacturers and dealers, and luminous and glass sign makers. Controller: P. Leask, St. Mildred Court, Bank, E.C.

Milnes Daimler Mercédès, Ltd., 135, Long Acre, London, W.C., motor-car company. Controller: F. G. van de Linde, 4, Fenchurch Avenue, E.C.

Leaving Certificates Refused.—At the Newcastle Munitions Tribunal, a tester's assistant in electrical apparatus works applied for a leaving certificate on the ground that her present occupation was detrimental to her health, and that she had a better position to go to. She did not put in a medical certificate, and the application was accordingly refused.—At the same sitting an application for a leaving certificate by an assistant driver with an electric supply company was also refused.

Hard Labour for Restricting Output.—According to the *Morning Post*, George Morris, local Secretary of the Workers' Union, was prosecuted at Coventry by the Ministry of Munitions for an alleged attempt to restrict the production of war material. The work of three men was affected. The Justices convicted, saying that the machines were idle because of the defendant's action. They felt the penalty must be substantial, and sentenced Morris to three months' hard labour. Notice of appeal was given.

Lord Balfour's Committee.—According to a statement published in the *Daily Chronicle*, Lord Balfour of Burleigh's Committee has had before it an interim report which will "probably be found to favour the prohibition of all imports from enemy countries for a period after the war." It is added that some members favoured a one-year period, and others a shorter term.

The *Times*, commenting on the same matter on Tuesday, said that there was some disappointment with the slow progress which had hitherto been made by Lord Balfour's Committee. "It is understood that the Committee will meet more frequently in future. The first and most urgent need is an Imperial trade policy, and the demand for the assembling of an Imperial Conference becomes steadily more insistent."

The Union Cable Co., Ltd.—In the House of Commons, on November 9th, Mr. George Terrell asked the President of the Board of Trade whether approximately 96 per cent. of the share capital of the Union Cable Co., Ltd., was owned by the Deutsche-Kabelwerke Co. of Berlin, and whether this company was still continuing to carry on its private trade in competition with British firms under the direction of its pre-war manager. According to the *Financial Times*, Mr. Pretyman replied that the share capital of the Union Cable Co. was held as stated, but the Public Trustee had now negotiated a sale of the shares to British subjects. The tenders made by the company to the Corporation of Coventry were investigated by the supervisor of the business last March, and he reported to the effect that the tenders were at a price which showed a fair trading profit. The company was subject to the same provisions with regard to income-tax and excess profits tax as any other company carrying on business in this country.

Exemption Applications.—At the Southampton Tribunal, the cases of between 30 and 40 tramway employes of the Corporation were considered. Ald. E. A. Dunsford, the Chairman of the Tramways Committee, told the Court that out of 350 men originally employed by the Tramway Committee, 150 had joined the Colours. The men were dealt with in groups, according to their occupations. On behalf of the chief clerk at headquarters, it was urged by Mr. Robson, the tramways manager, that his work was of the most intricate character, and it had taken him 15 years to acquire his knowledge of tramway methods. Three months' final was given. Pleading the cause of 19 motormen of military age, all married, Ald. Dunsford explained, according to the local Press, that they were all men of tried experience and many years' service. Young and less experienced men in the darkened streets at the present time were a danger to the public and themselves, and he appealed most strongly for exemption, if they were to keep the service going, and take the munition workers to their work. If these men were taken, the service would have to be curtailed.—Eleven of the men, all over 35, were granted conditional exemption while in their present occupation, six were given three months' extension, with leave to apply again, and the remaining two were given till January 1st, final.

At the Barnes Tribunal, the renewed application by F. H. Filford, electrical engineer, was considered at some length, it being the view of some of the members of the Tribunal that if applicant was called up there would be no one in East Sheen available to do electrical work in cases of emergency. Exemption for two months.

At Nuneaton, on November 7th, Mr. P. H. Howe (28), electrical engineer, asked for exemption beyond November 1st, and stated that he had a number of motors to attend to. He was allowed until February 1st.

At Maidstone, Mr. Oswald Jones, electrical engineer, asked the Tribunal to reconsider their decision with respect to two men recently appealed for, but the request was refused.

At Canterbury, on November 6th, Mr. O. A. Blaschek, chief engineer at the city electricity works, appealed for Mr. Tapsheld, shift engineer, and stated that, including himself, the staff now numbered 17. Before the war they had five shift engineers; now there were only three, and he had no stand-by men at all. Mr. Arrowsmith (Military Representative): I do not think we can reduce the staff of the electricity works any more. The point is whether, instead of granting a conditional, it would not be wiser to grant a temporary certificate. The Mayor: That is what we have done. Three months were allowed. Mr. Blaschek being asked to do his

best to get a substitute.—The Military applied for the withdrawal of a conditional certificate granted to G. B. Pearson, late of the electricity works staff, and who has taken a similar position at Marylebone, London. Mr. Pearson wrote stating that he had tried to get a commission in the Royal Engineers, and into the Air Service. Mr. Arrowsmith stated that exemption was granted because at Canterbury they were short of men, but they did not know anything of the circumstances prevailing in London. He asked for the cancellation of the certificate, and let the matter be dealt with in London. The conditional exemption was withdrawn.

At Lewisham, an electrical engineer (35), passed in Class C1, applied for exemption, and said that there was a great demand for skilled electrical engineers. The Military Representative said that they could do with applicant for electrical engineering work in the Army. The appeal was refused, and applicant said that he should appeal.

At Wolstanton (Staffs.), the Bradwell Joint Isolation Hospital Committee applied for the retention of their electrical engineer, and three months were conceded.

At Oxford, Mr. J. H. Grant appealed for E. G. Syrratt (36), electrician, engaged on work at Cowley Barracks. The Military Representative said that the work at the Barracks could be allowed to slide. The Tribunal refused exemption on condition that the man was employed by the Army as a fitter. Mr. Grant said he should appeal.

The North Metropolitan Electrical Power Supply Co., Ltd., appealed at St. Albans for further exemption for A. Brown (25), senior clerk and cashier, passed in Class B1, but the appeal failed.

An engineer in charge of an electrical pumping plant was applied for by Mr. A. U. Kemsley, of Shoeburyness, and he was allowed until December 14th.

Before the Newcastle-under-Lyme Tribunal, on November 3rd, a fitter and an engine driver were appealed for by the Corporation electricity department. The Military Representative suggested that the electricity and gas works might very well be merged into one, instead of being worked separately. The Mayor said that they were working the electricity works with the minimum of labour, and the engineer stated that the demand for current was double what it was before the war. He could not keep the works going with a less staff. Col. Heath suggested women labour. The Mayor: Is it possible for you to substitute a woman for one of these men? The Engineer said that he would try and substitute the engine driver by a woman. Each was given exemption until the end of the year.

At Stony Stratford, a Swiss firm, contractors for the electrification of railway trains, applied for an employe at Newport Pagnell. The Military Representative urged that the new electric trains were not a necessity, and that the war was of more importance than a foreign company's work. The firm's manager said that they were winding up for the time being until after the war. Asked if they imported all their material, he replied, "One-third of the stuff we use comes from Switzerland. All the raw material is bought on the English market." A member: It's a mystery to me how the thing is ever allowed to go on—stuff like that coming in from Switzerland! The appeal was dismissed, with a month's grace.

Before the Farnham Rural Tribunal, the Electric Light Co. appealed for three members of the staff—an improver (20), a junior shift engineer (21), and a night cleaner and switch-board attendant (24). The Chairman intimated that the company could not be permitted to retain men of such age, and the appeals were respite for a month for them to be replaced.

An electrician at Cuckfield (Sussex), who is nearly 41, and has just received his calling-up notice, has been given 14 days' exemption only.

At East Ham, three months' exemption has been allowed to A. Oughton (41), a picture palace electrician.

At Folkestone, W. R. Varley (39), electrician at the Playhouse, passed for labour abroad, has been conditionally exempted.

Two motormen with the Mexborough and Swinton Tramway Co. were appealed for at Rawmarsh. One was given nine weeks, then to be medically re-examined, and the other was directed to go before the Medical Board forthwith.

At Sheffield, the India-Rubber Co. appealed on business grounds for the retention of H. S. Harrison (37), electrical assistant, and he was given until the end of January.

Colchester Corporation Electricity Committee appealed, on November 6th, for a stoker, on the staff for a year, but fully competent. Exemption was allowed until the end of the year, with the hope that the stoker will be replaced by that time.

Mr. T. Anderson (21), partner in a firm of electrical engineers and armature winders, appealed at East Ham for conditional exemption. Appellant's brother, who is the senior partner, said that he himself had been rejected on medical grounds. The firm had a number of large contracts, including one for the War Office. Exemption was refused.

At Walthamstow the Fuller Electrical & Manufacturing Co., Ltd., appealed for P. Smith (29), electrical engineer; S. Fekett (29), electric motor winder; and C. H. Gould (27) and A. Gardner (29), fitters. The firm, it was stated, were engaged on important work. The Chairman said they recognised the importance of the undertaking, but thought that the firm should get ineligible men to do the work. The firm's representative said that the number of

In the mean time was taken it would be better to have a certificate and that if the authorisation was not given that they would be badged. The Military Representative stated that no badges were being issued at the present time. The Tribunal reserved its decision.

At Redruth, the Electric Power Co. appeared for nine members of the staff, eight being tramwaymen. Mr. Hards, for the company, stated that they had lost about 70 men. They had before the war 225 men; now they had about 180. Two of the appeals were refused; the others were each exempted for three months.

Whitstable Tribunal, on November 4th, conceded conditional exemption to Mr. E. C. Spray (40), electrical engineer.

The West Kent Appeal Court, on November 7th, allowed a Military appeal against exemption granted to F. W. Robins, electric wireman, of Bexley, and granted one month's postponement.

At Southwray (Halifax), the case of H. V. Richardson, electrical engineer, in the employ of Messrs. Barraclough Bros., electrical and mechanical engineers, Brighouse, was brought on for decision at the request of the Military Representative. Besides being badged, Richardson also held an exemption certificate. It was resolved that the certificate be cancelled as it was only given for the bridge.

Dorset Tribunal has given conditional exemption, on his obtaining work of national importance, to G. W. Loveless (34), electrician at the Winton Picture Theatre, Poole.

Hereford City Tribunal has given exemption until January 1st, with no leave to further appeal, to Mr. R. E. Walker, electrical contractor.

At Barrow Military Appeal Tribunal, a Special Military Representative objected to a number of exemption certificates which had been granted to men under 30 years of age. Included in the objections were H. Hotchkiss (22) and W. Edmunds (20), in the employ of the Barrow Corporation electricity department. Mr. H. R. Burnett, the borough electrical engineer, contended that both men were essential. He also referred to one of his employees who had been sent back from the Army to work in munition works, where he was not doing as useful work as when he was at Barrow. The Tribunal decided to withdraw the exemption certificates as from January 1st.

At the Scarborough Tribunal, the Military Representative asked that the certificate of conditional exemption granted to a tramway foreman, aged 26, should be withdrawn on the ground that another man in the employ of the company could do the work, and also act as inspector. Temporary exemption was granted until January 1st, but the Tribunal thought the company should try to get another man.

LEGAL.

CENTRO ELECTRICAL CO. v. C. A. S. GOODMAN.

ON November 4th, before his Honour Sir W. Lush, sitting in the Marylebone County Court, the plaintiffs, of Willesden, sued Messrs. C. A. S. Goodman of the Gem Theatre, Gillingham (Kent), for £30, being the amount of the unpaid due instalments of the price of a hired electric motor.

MR. R. O. B. LANE, counsel for the plaintiff company, said that in December last the plaintiffs supplied to the defendants an electric machine on a hire-purchase agreement, the price (£75) to be paid in weekly instalments of 25s. Plaintiffs had previously fitted the Gem Theatre with a three-phase motor of 100 volts, 50 amperes, and the new motor was to be of the same type and power as the former. On December 24th the motor was sent to Gillingham and fixed. A number of small complaints followed as to its efficiency, and these were remedied; it then ran satisfactorily. So far as he (counsel) was aware the machine was, in every respect, quite suitable and as efficient as that already in the defendants' cinema, which had been made and supplied by the plaintiffs. Application had been made for payment of the instalments, but there was no response, and he (counsel) was not aware of any counterclaim being made.

A Witness for the plaintiff said that there was no mention of horse-power in the agreement. They made a general arrangement that the new machine was to be similar to the previous one. When it had been fixed, a suggestion was made that some one should be sent down from the works to adjust it, as "it was not running satisfactorily." He (the witness), the electrician, was sent, and on his return he reported it "all right."

MR. S. GOODMAN, for the defence, said that the new machine was not sent down, and when it was sent he increased the weekly current to 150 amperes. He was quite prepared to pay the instalments so soon as the plaintiffs adjusted the machine so that it used no more current than the old one. He said that using more current was not "running satisfactorily."

His HONOUR: It could not be satisfactory if it was using 150 amperes more current. Can it be adjusted yet?

MR. RICHARDSON: Certainly it can.

His HONOUR: And have the same consumption as the first machine?

MR. RICHARDSON: Yes, yes. We are going to send to take the machine back to our works and adjust it.

His HONOUR: Well, do so. Meantime, there will be judgment for the plaintiffs for £15 and costs.

BRITISH THOMSON-HOUSTON CO. LTD. v. A. AND A. ELECTRICAL CO. LTD. INFRINGEMENT OF ELECTRIC LAMP PATENT.

THE plaintiffs claimed before Mr. Justice Sargant, in the Chancery Division, on November 9th, an injunction to restrain defendants from infringing their patent for improvements in incandescent lamps. Plaintiffs complained of the sale by the defendants of six half-watt lamps. Mr. A. J. Walter, K.C., with Mr. Colefax, K.C., and other counsel appeared for the plaintiffs and the defendants did not appear. The case for the plaintiffs was that their invention gave an efficiency of 5 watt per c.p., whereas if any previous lamp was run at that efficiency it would be destroyed in a short time; that the filament could be raised to a much higher temperature than was practicable in a vacuum lamp without vaporisation or deterioration or excessive shortening of useful life; that by adopting their invention, lamps could be manufactured to be run at a greater efficiency than anything done before; and that it had resulted in a reduction of the consumption of electricity by more than 50 per cent.

His LORDSHIP granted the injunction, with costs, and made an order for the delivery up of any infringing lamp.

PEMBROKE URBAN DISTRICT COUNCIL v. THE DIESEL ENGINE CO. LTD.

ACCORDING to the *Freeman's Journal*, an application was made before Mr. Justice Kenny, last week, to have a consent made a rule of Court. The Urban Council brought the action against the defendant company for damages for breach of a contract for the supply of a 180-KW. Diesel generator set and fittings at a cost of £2,977. In the course of the trial working of the engine, it proved defective.

MR. JAMES LARDNER, M.P., for the Pembroke Urban Council, moved to make a consent settling the action a rule of Court. The settlement provided that judgment should be entered for the Council for the sum of £1,904 6s., with costs of the action, including costs of discovery; and that on the counterclaim judgment was to be for the Council also, with costs, the amount lodged by the plaintiffs with their defence to be paid out to them.

MR. JUSTICE KENNY received the consent, and made it a rule of Court.

BUSINESS NOTES.

Australia.—The *Board of Trade Journal* mentions the following inquiries:—A Perth firm desires to obtain agencies in Western Australia for three-phase motors, incandescent electric lamps, and electrical material generally. Another Perth firm wishes to represent British makers of A.C. and D.C. generators, motors and accessories. A third Perth firm desires to represent a British maker of high-class metallic filament lamps.

The Commercial Intelligence Department.—It is announced that an Inter-departmental Committee, presided over by Mr. Harcourt, has now arranged the respective spheres of work and co-operation, in dealing with commercial inquiries, of the new Commercial Intelligence Department of the Board of Trade and the Imperial Institute, which in recent years has become a central department for information and investigation respecting the sources and uses of the raw materials of the Empire. In future, the Technical Information Bureau of the Imperial Institute will answer all commercial inquiries respecting the sources of supply, technical uses, and value of raw materials within the Empire, and will be responsible for supplying all information required in order to bring the producer overseas in touch with the manufacturer at home. Inquiries as to immediate supplies may be addressed either to the Board or to the Institute, as may be most convenient, but the Commercial Intelligence Department of the Board of Trade will, as a rule, be prepared to deal with inquiries for immediate supplies of well-known raw materials which can be obtained at once through ordinary trade channels. In answering those inquiries in which special statistical or trade information is required in addition to technical information, the Board and the Institute have arranged to co-operate. Investigations of the possible industrial uses of raw materials will, as heretofore, be dealt with by the Imperial Institute. The arrangement proposed by the Committee has now been accepted by the Secretary of State for the Colonies, the President of the Board of Trade, and by the Executive Council of the Imperial Institute.

For Sale.—The Leeds Corporation Electricity Department is offering surplus lengths of unused cable for sale. Particulars appear in our advertisement pages to-day.

Trade Within the Empire.—The Council of the Sydney Chamber of Commerce has affirmed the principle that all Government departments, municipalities, and other public bodies spending public money should purchase Empire-made goods, and place all contracts with British firms where possible.—*Tenders.*

A Works Canteen at Leigh.—In the presence of the directors and about 1,000 of the workpeople, a canteen was opened on Tuesday, November 7th, at the Anchor Cable Works, Leigh, by Mrs. James Callender, wife of one of the directors.

Catalogues and Lists.—**MESSRS. SIEMENS BROS. & CO., LTD.**, Woodwich, Supplement No. 2 contains a very fully illustrated description of the "Skidiv," an apparatus designed for fixing and holding patients during radioscapy.

MESSRS. SIMPLEX CONDUITS, LTD., Garton Lane, Birmingham. Leaflet No. 644, giving illustrated description and prices of their Universal girder clamp.

MESSRS. WM. WATSWORTH & SONS, LTD., Bolton. "Twenty-four-page attractively illustrated pamphlet showing representative examples of their electric passenger and goods lifts, transporters, jib cranes, &c.

THE SCEANDO LAMP CO., LTD., 7, Blackfriars Street, Salford, Manchester. "Folder giving prices of their 'Sceando' drawn-wire metal lamps. Axial lamps, and standard type lamps.

Book Notices.—*The Air Supply to Boiler Rooms.* By R. W. Allen, M.Inst.C.E. From the Author, Queen's Engineering Works, Bedford. "While this work relates specifically to the boiler rooms of modern ships of war, it contains much matter of interest to engineers engaged in other branches of construction. The author deals with the whole of the subject, from the top of the air trunk to the stokehold, and as he has made a special study of the matter, the data which he gives will prove very useful, especially in view of the scarcity of reliable information on problems of ventilation. The book comprises 14 short chapters, giving particulars of the pressure required to set air in motion at given speeds, the air speeds recommended in the trunks, the effect of sudden changes in the area of the air passages, the design of the eye of the fan, inlet rings, and casings, the use of deflectors to prevent interference between adjoining fans, the amount of air required for the combustion of oil fuel, and progress in the design of fans, besides many details relating only to naval practice. Remarkable improvements in efficiency, output, and economy are demonstrated as the results of the application of scientific principles to the subject.

"Scientific Papers of the Bureau of Standards." No. 290. "A Variable Self and Mutual Inductor." No. 292. "International System of Electric and Magnetic Units." Washington: Department of Commerce.

"General Cargo: an Introduction to Salesmanship." By R. E. Goddard. London: Constable & Co. Price 4s. 6d. net.

Italy.—The liberation of the Italian electrical industry from the pre-war dominance of German enterprise has taken an important stride forward by the constitution of the Società Nazionale per Imprese Elettriche—an Italian company formed with 10,000,000 lire capital for the purpose of buying out German participation in Italian undertakings, and notably that of the Siemens-Schuckert group. As an actual fact, the purchase will not be made directly, Siemens-Schuckert, foreseeing the inevitable, having already disposed of their interests to a Swiss consortium. The interest of the German group in the various Italian electrical concerns amounted to some 20,000,000 lire.

Trade Announcements.—**MR. S. T. JOLLEY** has retired from the Diamond Accumulator Co., accumulator manufacturers, of Bournemouth Park Road, Southend-on-Sea, and the business will be continued by Messrs. E. & L. Tickett.

MESSRS. T. REYNOLDS & CO., LTD., electrical engineers, of Coventry, have removed their showroom premises to over their establishment at 19, High Street.

In connection with the arrangements which British firms are making for extension of business to cope with orders that are likely to mature when the war is over, we have received from **MESSRS. CREED & CO.** particulars of arrangements that have been completed for a general expansion of their business. They have purchased the patents in wireless telegraphy, plant, &c., of the Indo-European Telegraph Co. and the Galletti Wireless Telegraph and Telephone Co. The Indo-European and Telegraph Co. have subscribed for a considerable number of shares in Creed & Co. and two of their directors—Sir William R. Broke, K.C.I.E. formerly Director-General of Telegraphs of India, and Mr. T. W. Stratford-Andrews, the managing director of the Indo Co. have been elected to the board. Mr. Stratford-Andrews has taken over the managing directorship of Messrs. Creed & Co. Mr. Creed, who is known to all telegraph men, remains chairman of the company, and will advise the board on technical matters. Mr. Donald Murray, whose systems of printing telegraphy are well known, has sold his patents and business to Messrs. Creed & Co., and has joined the board. The company has also secured the services of Mr. H. H. Harrison, whose knowledge of telegraph matters is very extensive. The technical staff of the company has been added to. Amongst others, Mr. Rivers-Moore will devote his services to technical research, and Mr. Morse will look after the wireless side of the undertaking. The company has already started a research department, and there will be showrooms, where specimens of the various apparatus manufactured by the company can be viewed under working conditions. We hear that the Indo-European Co. had already achieved very considerable developments in the design and construction of wireless sets of comparatively low power, and these sets are now undergoing the important process of standardisation.

On November 18th, the offices of both the **WORTHINGTON PUMP CO., LTD.**, and **JAMES SIMPSON & CO., LTD.**, will be temporarily transferred to Queen's House, Kingsway. This change is due to the fact that the War Office have requisitioned the present offices of the two companies at India House.

LIGHTING AND POWER NOTES.

Accrington.—A resolution was introduced at Accrington Trade and Labour Council, on November 9th, that a protest be made against the financial loss in the electricity undertaking, and urging the need for an expert to be called in to ascertain whether the concern could become a profitable one; and, in the event of the loss being attributable to the geographical position of the electricity works, that immediate steps be taken to have them removed to a more suitable site. Eventually, however, the matter was referred to the Executive Committee for consideration, and it will be brought before the next meeting for discussion. Mr. Emmett (Weavers' Secretary) said a grievance existed, and so far as the weavers were concerned, they were having a lot of trouble. Two mills in the town were run by electricity, and the workpeople were being sent home constantly. Sometimes in one week they had lost nearly half a week's work. The result was that the weavers were demanding compensation at the Weavers' Offices. If a local manufacturer were to blame for this state of things, they would call upon him to remedy it, or the mill would have to be stopped; but they could not go to the electricity department and tell them to stop the concern until everything was made right. It was decided that the Executive should discuss the situation and draft a suitable resolution for the next meeting.

Australia.—The Sydney city electrical engineer has reported, after experimentally using locally-made earthenware pipes in place of the fibre conduit, suggesting that the shipment of fibre conduits on order be proceeded with.

The Electricity Committee recommends that a supply of electricity be given to Messrs. Kilbourn & Willicks, the firm guaranteeing a minimum payment of £260 per annum for five years. With reference to the supply of electricity to the Australian Electric Steel Co., Alexandria, the Committee recommends that the company be permitted to use electricity for auxiliary machinery during the hours in which it is not permitted to use electricity in its furnaces, at the same rate as for the main supply, provided that the maximum demand in K.V.A. of the auxiliary machinery shall not exceed 10 per cent. of the maximum demand in K.V.A. of the furnaces, and subject to the condition that 2 per cent. of the total supply estimated as the energy consumed in prohibited hours be charged at the higher rate of 1½d. per unit. The arrangement to be for a period of six months.

With regard to the report as to the question of providing additional plant at the power house, the Committee recommends that consideration be deferred for six months, but that the specification for the supply of a 12,000-kw. turbo-alternator be approved for use if the same be required.

The Committee recommends that an underground duct system be constructed to connect to the six additional submarine H.T. cables to be laid across Darling Harbour, at a cost of £5,811.

The Committee has considered the question of the rate of hire for electric motors, and strongly recommends that the increased rates remain in force.

The Kandos (N.S.W.) Cement Co. has obtained permission from the Shire Council to install electric lighting in the township.

The Tweed Shire Council (N.S.W.) has decided to borrow £1,300 for the purposes of an electric light distributing system for Tweed Heads. *London.*

Bettws-y-Coed.—The village was in temporary darkness on Friday evening last, owing to a large eel causing an obstruction in the water-power plant; the water is derived from Elsie Lake, several hundred feet above the works.

Bognor.—**PRICE INCREASE.**—The U.D.C. has received from the Gas Co. an intimation that the charge for electricity will be increased from 8d. to 7d. per unit, with a charge for a minimum number of 20 units per quarter whether consumed or not. The U.D.C. has decided to send a protest to the B. of T.

Bo'ness.—**PLANT EXTENSION.**—The T.C. has agreed to borrow, on the security of the burgh general assessment, £12,000 for the purpose of defraying the capital cost of the extension of the electricity works. The money is to be advanced by the Treasury at 5½ per cent. The loan is repayable in 20 years. The contract price of the extension is £12,300.

Callington.—**E.L. SCHEME.**—The U.D.C. has decided to apply for a L.G.B. inquiry, with reference to the purchase of Frogwell Mills in connection with an electric lighting scheme.

Continental.—**FRANCE.**—In order to conserve for national purposes an adequate supply of gas and electricity, the Prefect of the Police of Paris has from Wednesday, November 15th, forbidden the lighting of shops and stores in Paris, and the Department of the Seine, after 6 p.m. by either gas, electricity, petroleum or spirit, with the exception of grocers', bakers', druggists', and hair-dressers', shops which may be lighted as usual. The shops are not compelled to close at six, but if they remain open they must find some other means of illumination.

NORWAY.—The Commune of Biri, near Lillehammer, has decided to raise a loan of 250,000 kroner for providing electric lighting service.

The Orms-tos Kvattakteselskap is the style of a company, formed on October 26th, with a provisional capital of 200,000 kroner, to develop the water power of the Malde River in the Væstra distriet. The water-power station is estimated to cost 2,000,000 kroner.

The Krato Carbide and Smeltwork is increasing its capital from 1,000,000 kroner to 1,250,000 kroner, with a view, it is said, to make new factories in the electrochemical industry.

The Aktieselskab Norske Elektrokoderne is a company about to start the manufacture of graphite electrodes, and thus render Norway independent of German imports. It is intended to build a large factory capable of turning out from 1,000 to 8,000 tons. A waterfall in Westland, yielding 10,000-12,000 H.P., has been secured. The nominal capital of the concern is fixed at 1,050,000 kroner, secured by the Norske Credit Bank's guarantee, the maximum capital will be 1,500,000 kroner. It is expected to start working next year.

Epsom.—**PRICE INCREASE.**—The U.D.C. has fixed the following maximum price of charges for energy from December 1st:—Lighting, flat rate, 7d. per unit; power and heating, 3½d. per unit.

Halifax.—**ANNUAL REPORT.**—The review of the year's working of the Corporation departments shows a record of steady progress in the electrical undertaking. The total units sold (13,583,633) was an increase of 2,507,710 on the previous year. The outstanding feature had been the heavy increase in the supply of power for industry. The private lighting supply was much below the normal, due largely to the Daylight Saving Act, and street lighting supply had been practically nil.

Huddersfield.—**ANNUAL REPORT.**—The departmental reports for the past year show that the electricity department has had a busy year, particularly in meeting large demands for power. The coal supply has given great trouble, and necessitates a further increase in price for energy of 12½ per cent. on pre-war charges, after the current half-year. The three-phase motors connected during the year were equal to 1,050 H.P., bringing the total of three-phase to 12,756 H.P., whilst the single-phase motors connected during the year equalled 95 H.P., bringing the total to 2,723 H.P., a total for both systems of 15,479 H.P. The number of consumers was reported as 6,556.

Ipswich.—**YEAR'S WORKING.**—The annual report of Mr. Ayton, chief engineer, on the working of the Corporation electricity undertaking during the year ended March 31st last, shows that the units sold advanced from 2,967,000 in 1915 to 3,734,158 last year, the great increase being in power units, while public lighting fell to insignificant proportions. The total revenue amounted to £33,969, while working expenses were £23,030, and after meeting interest and sinking-fund charges, also £1,022 revenue expenditure on capital account, a deficiency of £2,086 resulted. Although the units sold increased by 26 per cent., the cost of coal increased by 81 per cent., to partly counterbalance which the price of energy was raised. The working of the power station was rendered difficult owing to the lack of coal-handling facilities, the provision of which was hindered by the L.G.B., but, owing to the intervention of other authorities, has since been sanctioned. Mr. Ayton draws attention to the high ash content of the coal, 20 to 23 per cent., and suggests that as this uses up railway accommodation and fuel for haulage, the Committee dealing with coal saving might be better employed in looking into the working of collieries rather than adjuring electricity supply undertakings to reduce their consumption by methods which will not produce in practice the result aimed at. Early in the year a turbine broke down, and has had a new set of blades. The report refers to the increasing use of electric vehicles, and the charging facilities provided.

Kirkheaton.—**E.L. PROPOSALS.**—The B. of T. has intimated its inability to entertain applications from the Huddersfield Corporation and the Electrical Distribution of Yorkshire for an Order for the supply of electricity within the urban district.

Leeds.—**PROSPECTIVE EXPENDITURE.**—In reply to an enquiry from the L.G.B. as to the execution of works after the war, the electricity department estimated that there would be an urgent need for the expenditure of £115,000 and the tramway department of £150,000.

London.—The L.C.C. Finance Committee recommends the sanction of the Council to the borrowing of £4,236 by the Poplar B.C. for electricity mains.

The Metropolitan Asylums Board has agreed to a 10 per cent. increase in the charge for electricity supplied by the South Metropolitan Electric Tramways and Lighting Co. to the Queen Mary's Hospital and the Downs Sanatorium.

The L.C.C. has entered into a fresh agreement with the Erith T.D. for the supply of electricity to the Southern Outfall Sewage Works.

New Zealand.—As a result of a poll of the ratepayers of the Borough of Pukekohe (North Island), it has been decided to borrow the sum of £12,000 for, amongst other purposes, the installation of electric lighting in the borough.—*Board of Trade Journal*.

Newport (Mon.).—**YEAR'S WORKING.**—The annual report on the Corporation electricity undertaking for the year ended March 31st last shows that the receipts amounted to £51,275 and the working expenditure to £30,339, leaving a gross profit of £20,935, which was rather less than the previous year's figure, £21,607. Allowing for accrued interest, &c., and deducting interest and sinking-fund charges, war allowances for two years, and other items, there remained a deficit of £993, as against a profit of £744 in 1914-15. The energy sold for all purposes amounted to 5,015,074 units, as compared with 4,789,240 units in 1914-15. The maximum load was

2,961 KW. and the load factor 2673 per cent.; 1½ lb. of coal were used per unit generated. During the year a breakdown occurred with the 3,000-KW. turbo-alternator plant; the Mill Parade sub-station was temporarily completed, and the new rotary converter plant put into operation. A steady increase has occurred in the demand for heating and cooking purposes, which it is expected will exceed one million units during the current year, at 1d. per unit plus 20 per cent. Very little benefit was derived from the large factories which have been connected up during the period under review.

PLANT EXTENSION.—The borough electrical engineer has been instructed to prepare a specification and invite tenders for additional plant at Mill Parade sub-station; also to dispose of a 150-KW. motor. As a result of a conference between the Chief Constable and the borough engineers, the street lighting has now been extended.

Southend.—**WAR BONUS.**—All male employees at the electricity works who have been in the service of the Corporation for 12 months, are to be granted a war bonus of 2s. a week, commencing November 23rd; employees already receiving a war bonus are to have the sum named as an addition.

Sheffield.—**NEW GENERATING STATION.**—The City Council has adopted the recommendations of the Electric Light Committee to erect a new generating station, and has agreed upon a site. The present Neepsend plant is unable to meet the demand.

Wadebridge.—**PUBLIC LIGHTING.**—The Electric Supply Co. having received an application for current from Clapper, has asked the U.D.C. whether, if the extension is made, the public lighting will be extended to the locality after the war. The Council has replied that at present it is not in a position to give a definite reply.

Walsall.—Owing to the second turbo-alternator for the new generating station having been requisitioned, it will be necessary to keep the Wolverhampton Street station fully manned and running until a second set is installed at Birchills. The Corporation will in due course make a claim in respect of the loss sustained by reason of the commandeering of the second turbo-alternator.

TRAMWAY and RAILWAY NOTES.

Accrington.—**ELECTRIC VEHICLE.**—The General Purposes Committee has considered a proposal from the Health Commissioners to purchase an electrically-driven wagon, at a cost of about £1,000, for the collection of the refuse of the borough. It is claimed that a motor-wagon will effect a saving of 10 per cent. to 15 per cent. compared with the hire of team labour at the present price.

Continental.—**FRANCE.**—According to the *Financial Times*, a movement has been started in France for the creation of a great trans-European railroad to link up the Atlantic coast of France with Italy and South Russia. The line will commence at Bordeaux, and pass through Lyons, Turin, Milan, Venice, Trieste, Fiume, and Agram to the banks of the Danube, traversing Serbia and Roumania, and terminating at Odessa. It will be 2,500 km. in length, and will closely cling to the southern slope of the great mountain ranges of Europe. The numerous waterfalls and the character of the country will admit of the line being electrified throughout its entire length. The line will link up Switzerland directly with the French Atlantic seaboard, and greatly facilitate trade between Italy and the West of France; for this reason the Italian Government is said to favour the scheme, and the Swiss are keenly alive to the advantages of the French section, as it would enable them to link up Switzerland and Swiss products directly with Bordeaux, Nantes, La Pallice, and other Atlantic seaports.

Halifax.—**YEAR'S WORKING.**—Reviewing the year's work of the various Corporation departments, the Mayor of Halifax, on re-election, said the income during the year on the tramways had been £112,937, an increase on the previous year of £1,145. There had been a satisfactory net surplus, which had enabled them to give £6,240 to the relief of rates. The car-mileage had been 2,195,980, and the number of passengers carried 21,024,003, the latter an increase over the figure of 20,707,071 last year. The revenue from the motor-buses was £2,430, or 9'252d. per bus per mile. There were now 88 women conductors on the system.

Huddersfield.—**TRAFFIC STATISTICS.**—The departmental reports for the past year show that the total receipts on the tramways from November 1st, 1915, to September 30th, 1916, amounted to £136,612, an increase on the corresponding period of the previous year of £12,325. The town's tramway track within and without the borough now covers 56 miles, and further extensions have been prevented by the war. The car-mileage, including the running of coal trucks, was 2,611,967, an increase of 25,754, and the number of passengers carried was 26,328,482, an increase of 2,899,229. The total number of employes of the department now on military service is 160, and there are now 65 women conductors.

Glasgow.—At the first meeting of the T.C., a finding of the Tramways Committee will be considered, asking that all female employees in the tramway department work under the same terms and conditions and be paid on the same scale of wages as the male employees.

Ipswich.—**YEAR'S WORKING.**—The annual report on the working of the Corporation's tramway shows a total revenue amounting to £28,287; working expenses amounted to £19,179, war service allowances to £587, and, after meeting interest and loan repayments, there was a profit on the year of £2,757, which compares with a loss of £2,105 in the previous year. The passengers carried numbered 6,798,589, and the car-miles 620,115, which compare with 5,610,332 passengers and 642,092 car-miles in 1915. The reserve, or renewals fund, now amounts to £19,970. Mr. Ayton, the manager, refers at some length to repairs and maintenance; much of the track requires renewal, and in one section the subsoil will require drainage. When the time comes for relaying the line in Norwich Road the question of abandoning the distant section running into Whittton should be considered, this having always involved a dead loss; the same applies also to Burrell Road and Bath Street. If the war lasts long, Mr. Ayton suggests that rails in these streets should be taken up for repairing busy routes.

Leeds.—**WAGES.**—The overhead equipment staff of the city tramways have been granted increases of wages from a 4d. to a 4d. per hour, with overtime at the rate of time-and-a-quarter.

London.—**WAGES.**—The Highways Committee of the L.C.C. has received an application from the women employed at the central car repair depot for an increase of wages of 6s. per week. The Committee has decided that an increase of 4d. per hour, or 2s. per week, should be made to those women over 21 years of age; this has been declined, with a request that the matter be referred to the appropriate Conciliation Board. The Committee recommends that the advance of 4d. an hour be approved, the question of a further advance to be referred to the Conciliation Board. The war bonus of 3s. per week to car examiners and car washers is to be increased by 1s. per week, as from March 1st last.

Newport (Mon.).—**YEAR'S WORKING.**—During the year ended March 31st last, the Corporation tramways carried 10,017,515 passengers and ran 921,133 car-miles, these figures comparing with 9,410,109 passengers and 964,895 car-miles in the previous year. The total income amounted to £45,141, and the working expenses to £30,461, leaving a gross profit of £14,680, as against £11,748 in the previous year. After meeting interest and sinking fund charges, &c., there remained a net profit of £5,409, as compared with £2,417 in 1914-15.

A serious street car accident on the Stow Hill route, due to a collision, was the subject of a report by the electrical engineer. He said there was little doubt that the collision was occasioned through the absent-mindedness of the motor-man, also to the fact that the slipper-brakes on his car were not down in accordance with regulations. Although there were no serious casualties except to the motor-man, who had both his legs broken, the cost of repairs will be heavy. Arising out of the collision the electrical engineer had given consideration to the question of improving the present arrangement of the track, so as to prevent, if possible, a similar accident, or reduce the possibility of serious consequences.

Northenden.—A year's extension of time for completing the tramways in this parish has been applied for by Manchester T.C.

Stockton.—The T.C. has appointed a Sub-Committee to inquire with regard to the power of the Corporation under the various Acts relating to the Imperial Tramways Co. for tramways in the borough.

Stretford.—The clerk has been instructed to communicate with the Manchester and Salford Corporation tramways department, with a view to effecting an improvement in the Trafford Park service during the busy evening hours. During the past month 112,936 units were sold for traction purposes, as compared with 100,278 units in the corresponding month of the previous year.

Walsall.—The Tramways Committee has under consideration a memorial from the Workmen's Union asking for an advance of 4d. an hour. In order to deal more satisfactorily with the question of missed fares, instructions have been given that the fares of all passengers who propose to travel on the top deck shall be paid to the conductor when the passenger boards a car.

tests far greater speeds have been attained. The gain in speed is due to the use of selenium cells to amplify the signals received, and to the use of means for obtaining, from one or more sources of illumination, a very large number of light beams, concentrated coincidentally upon selenium cells, and deflected by a line galvanometer across the surfaces of the selenium cells, the effect being that a very intense illumination of the selenium cells is obtained. It is found that the practicable speed of operation increases as the intensity of illumination increases. The selenium cells operate a siphon recorder or a relay. There being no physical connection between the recorder or relay and the line galvanometer, the inertia and frictional losses present in the older magnifying and recording apparatus are largely eliminated, the more so as in the new system the amplitude of vibration of the galvanometer coil is, in general, much less than in the case of the older apparatus.

It is stated that Mr. Dixon employed 45 separate light beams, all derived from one 400-c.p. tungsten lamp, and all concentrated on a thin galvanometer mirror 5 in. long and $\frac{3}{8}$ in. wide. These light beams were reflected from the galvanometer mirror, in one case, a distance of $\frac{7}{8}$ ft., and were then re-reflected a further distance of $\frac{7}{8}$ ft. to the selenium cells, the light beams being concentrated coincidentally upon the cells.

With this apparatus, working over one of the trans-Atlantic cables, the normal rate of operation of which is less than 200 letters per minute, speeds of 450 letters per minute and higher were obtained in the regular commercial handling of business, and still higher speeds have been obtained on test, with signals fully readable as to size and character.

An interesting feature of the invention is a new balancing arrangement, which greatly facilitates the obtaining of a balance on the cable for duplex working, and also aids materially in shaping the signals so as to render them readable.—*T. and T. Age.*

Pacific Cable.—The report of the Pacific Cable Board for the year 1915-16 shows that the total revenue was £310,516, and the expenditure £205,896, leaving a surplus after allocating £74,000 to the renewal account, of £104,620; of this sum, £77,545 was paid to interest and sinking fund, and £9,150 to the renewal fund as interest and sinking fund in respect of money borrowed from the renewal fund for the Auckland-Sydney cable, leaving a surplus of £17,925, which goes to reduce the debt. The excess of receipts over expenditure was £25,934 greater than in the previous year, and this is the first occasion on which there has remained a surplus from revenue after payment of the sinking-fund annuities. The net traffic receipts were up by £58,749. The expenditure included special appropriations to the renewal account of £30,000 in respect of depreciation of securities and £14,000 in payment for a new schooner; after deducting these items, there is an increase of £15,537 over the preceding year, due to various causes arising out of the war. The renewal fund on March 31st, 1916, stood at £271,460. The section Norfolk Island-Auckland was interrupted on February 12th, owing to a fault near the island; it was repaired on February 19th, traffic in the meantime being diverted to the Southport-Norfolk cable. All the cables have been worked continuously at high pressure, the long sections carrying far more traffic than was originally expected; they are now occupied day and night throughout the week.

During the year, nearly 8½ million paying words were transmitted over the cable, much more than double the traffic during the last normal year (1913-14). There was also a considerable quantity of non-paying matter. The Board also carried nearly two million paying words between Australia, New Zealand, and the Pacific Isles. The deferred traffic was more than doubled, and the week-end traffic more than trebled, as compared with the previous year, but ordinary traffic decreased 30 per cent., owing to the restricted use of codes. The cheap services had to be suspended on certain occasions owing to interruptions in the Atlantic cables and congestion of traffic, and the outward week-end and deferred Press services are at present in abeyance, but will be reinstated as soon as possible.

The Board has established a public office for international business in Melbourne. A new schooner is being built, in place of the *Seraphina*, to maintain a boat service with Fanning Island. Sir George H. Reid, having retired from the position of High Commissioner for the Commonwealth, has been succeeded on the Board by Mr. Andrew Fisher.

South-Western Railway Electrification.—The electrification of the Claygate Branch has been completed, and a half-hourly service of electric trains between Claygate and Waterloo, covering the journey in 29 minutes, is announced to commence on Monday.

Telephone Charges.—According to the *Times*, the Post Office Telephone Department is abolishing all unremunerative rates, which are the result of telephone competition in the past, and the intention is to have one fixed charge in every place.

The Marconi Co. and Germany.—A letter has been circulated to the Press by Marconi's Wireless Telegraph Co., Ltd., with regard to an attempt which, it is said, is being made to create uneasiness in the minds of the public in respect of the relationship which has existed between the Marconi Co. and the German Telefunken Co.

Mr. Godfrey Isaacs, managing director, states that the Belgian company to which reference has been made was formed in the year 1901, and secured from the Marconi Co. the mercantile marine rights of certain countries in Europe, including those of Germany and Austria. The company was purely Belgian, and the shares were held in Belgium and England. The Belgian company pro-

TELEGRAPH and TELEPHONE NOTES.

Africa.—There is now direct communication across French and British territory in Africa, with posts on the Atlantic and Indian Oceans. The French authorities in the region of Lake Tchad are contemplating the establishment of regular communication between Egypt, the Red Sea, Cameroon and Nigeria.—*The Times.*

Cable Telegraphy.—A new invention, devised by Mr. Thomas B. Dixon, has been in practical operation on certain of the Atlantic cables, and is reported to have given remarkable results, the speed of operation in the commercial handling of cable messages having been increased upwards of 125 per cent., while in

...the... of... operators on all the principal ships... of the... of Germany and Austria but in the year 1910 the German Government made it known that they would no longer permit the installation or operation of any wireless system on board any German ships other than the German system, under German control. In these circumstances, the Belgian company... with a considerable loss, it therefore came to an agreement with the German Telefunken Co. for the formation of a company in Germany, the Belgian company, together with the Marconi Co., retaining a 45 per cent. interest in the German company, while the Germans held 55 per cent. The Belgian company... in Marconi Co. appointed members on the board of the new German company. Subsequently the Austrian Government took a similar action, and the Belgian company thereupon agreed with the German company that the Austrian ship stations should be transferred to the German company. In return, however, it was agreed with the German company that their sphere of action should be strictly limited to ships of Germany and Austria.

The Belgian company was reconstructed and the capital divided, the Belgians holding one-third, the Marconi Co. one-third, and the Germans one-third.

At the outbreak of war, two Germans in the employ of the Belgian company were immediately dismissed. The business of the Belgian company was promptly taken in hand by the English directors and transferred to Marconi House, and has been under the complete control of the English directors ever since.

With regard to Australia, owing to the Australian and New Zealand Governments having placed large contracts in the hands of the Germans for the construction of powerful coastal wireless stations, the Germans were in a position of considerable advantage. The Marconi Co. commenced proceedings for infringements of patents against the German company and the Australian Government, but subsequently a settlement was arrived at with the Germans, under which it was agreed that an Australian company should be formed, which should purchase the interests both of the Marconi Co. and of the German Telefunken Co. This company had a capital of £140,000, of which the Marconi Co. held one-half, the Australians some £62,000, and the Germans about £8,000. Thus a complete control of wireless in Australia passed into Australian and English hands.

With regard to other countries, the nature of the agreement was purely commercial, and was brought about as a result of the strength of the Marconi Co.'s patent position. It served to prevent the German company ousting the Marconi Co. from every country in the world by reason of the ruinous prices which the German company was quoting at no matter what financial loss, no doubt with the German Government behind it, for the purpose of obtaining German wireless stations throughout the world. Under such conditions it was impossible for the Marconi Co. to compete. It is only in consequence of this agreement that British wireless stations now preponderate throughout the world.

Whilst the Marconi Co. was interested in the German company, and had directors on the German company's board, the English Marconi Co. has never had any German director upon its board, nor has the German company at any time held any interest in the English company.

On Wednesday questions were asked in the House of Commons with regard to the agreement, and Mr. Pease undertook to inquire into the matter.

Trans-Pacific Wireless.—Yesterday the Japanese Government and the Marconi Wireless Telegraph Co. of America inaugurated a commercial wireless service between California, Honolulu, and Japan.

CONTRACTS OPEN and CLOSED.

OPEN.

Argentina.—November 30th. Buenos Aires Municipality. Electric carbons required during 1917. Oficina de Licitaciones. Intendencia Municipal de la Capital, Avenida de Mayo, 525, Buenos Aires.

Australia.—SYDNEY.—January 3rd. N.S.W. Railways and Tramways Department. 50-ton electric overhead travelling crane for Yarra Street power-house, Newcastle.*

January 8th. Municipal Council Electric Lighting Department. 33,000-volt switchgear. E.L. Department, Town Hall. Specification 10s. 6d.*

January 22nd. Electrical plant (converter, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.*

MELBOURNE.—December 11th. City Council. Supply and erection of coal transporter plant. See "Official Notices" September 15th.

Cape Town.—January 5th. Electric motors and starting panels for the Corporation Electricity Department. Dock Road, Cape Town.*

Durban.—January 3rd. Corporation. One 3,000-KW. steam turbine, alternator, and condensing plant. Specification No. S. 255, drawing No. P. 107 both at the office of the Borough Electrical Engineer, Municipal Buildings. Deposit £2 2s.

Enniskillen.—December 1st. Sligo, Leitrim & Northern Counties Railway Co. Twelve months' supply of telegraph materials. Mr. J. Duff, Secretary to the Company.

Grenada.—December 31st. Government. Electric supply at St. George's and suburbs. Tenders to Colonial Secretary, Grenada, British West Indies.

Johannesburg.—November 20th. Corporation. 500 or 1,000 trolley wheels for trams (Contract No. 181).*

November 27th. Corporation. 1,000 sets of single-pole, ironclad house-service cut-outs (Contract No. 187); 250 field coils for tram-car motors (Contract No. 192).*

December 9th. Corporation. 1,427 A.C. and D.C. electricity meters and 100 time-switches. Specification (21s. deposit) from Mr. E. T. Price, General Manager's Office, Electricity Supply and Tramways Department, President Street, Johannesburg, W.*

December 20th. Corporation. Automatic pressure regulators for the A.C. turbo-generators at the power station.*

January 3rd. Corporation. Iron axles and bushes.*

London. H.M. OFFICE OF WORKS.—November 27th. Twelve months' supply of electric cable and wire. See "Official Notices" today.

Liverpool.—November 22nd. Cheshire Lines Committee. General stores, including (6) telegraph materials and carbons, during 1917. Stores Superintendent, Warrington.

Newcastle-on-Tyne.—November 23rd. The Tyne Improvement Commissioners. Six and twelve months' supply of incandescent lamps, and arc lamp carbons. Commissioners' Offices, Berwick Street.

New Zealand.—DUNEDIN.—January 24th, 1917. Motor-generator, accessories and spares. City Electrical Engineer, Market Street, Dunedin.*

Rhonda Valley.—November 20th. Electrical installation in screwed tubing for Messrs. David John & Co., brewers, Pentre. See "Official Notices" November 10th.

Sheffield.—November 21st. Cast-iron pipes and forming valve chamber. November 17th.—Reinforced concrete carrying bridge over G.C. railway at Neepsend power station.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Department in London.

CLOSED.

Australia.—P.M.G.'s Department, N.S.W. :—

Telephone equipment in connection with the installation of an automatic private branch exchange at Cockatoo Island, £1,813.—Automatic Telephones (Australia), Ltd.

One accumulator battery, 2,500 amp.-hours capacity, for Sydney City Exchange, £388.—T. K. Steanes.

P.M.G.'s Department, Queensland :—

One power board, £152.—Edison Swan Electric Co., Ltd.
300 accumulators, 80 amp.-hours capacity, £518.—Warburton, Franki, Ltd.

Victoria Railway Department :—

Incandescent electric lamps for 12 months.—Edison Swan Electric Co., Ltd.

Tenders.

Impregnating electrical apparatus with insulating varnishes, spare parts, &c., £2,234.—Gibson, Battle & Co., Ltd.

Aust. Mining Standard.

The Electricity Committee of the Sydney City Council has recommended that, in connection with the contract with Standard Waygood-Hercules, Ltd., for the supply of consumers' meters, a payment of 75 per cent. of the price of the meters in England as they are shipped be agreed to.—Tenders.

Bradford.—The B. of G. has accepted the tender of Messrs. Smith & Croft, at £26, to provide a cable for the lighting of the laundry and garage.

London.—L.C.C.—Asylums and Mental Deficiency Committee. Electric lamps for five months: Pope's Electric Lamp Co., Ltd.*

METROPOLITAN ASYLUMS BOARD.—Accepted tenders :—

Lund Bros. & Co.—Rearranging of electric lighting, Mead Station, £42; wiring Eastern, North-Western, Western, and Brook Stations, £65.

Crypto Electrical Co.—Four electric motors, Eastern, North-Western, Western, and Brook Stations, £49.

MARYLEBONE.—Electricity Committee

Cables (contract extended for a further six months to March 31st, 1917).—B.I. & Helsby Cables, Ltd.

The Committee recommends the acceptance of the offer of the British Westinghouse E. & M. Co., Ltd., to supply a balancing attachment for a rotary converter, at £165.

Sheffield.—Town Council. Electricity Department. Accepted tenders :—

A. Beyrolle & Co., Ltd.—20 panels h.r. two-phase sub-station switchgear, £2,709.

Staveley Coal & Iron Co., Ltd.—10,000 3-in. cast-iron cable pipes, £7 10s. 6d.

Tramways Department :—

Dawson & Jones, Ltd.—Alterations and additions to Town Head Street Depot, to convert it into a motor-bus garage, £3,619.

West Bromwich.—T.C. Coal for the electricity works
T. Boston & Sons, W. H. Bowater, Ltd. Field & Bradley.

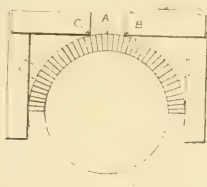
FORTHCOMING EVENTS.

- Institution of Mechanical Engineers.**—Friday, November 17th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Report of the Hardness Tests, Research Committee.
- Association of Mining and Electrical Engineers (Notts and Derbyshire Branch).**—Saturday, November 18th. At 3.30 p.m. At the University College, Nottingham. Paper on "Some Electrical Troubles and their Remedies," by Mr. T. Anderson.
- Electro-Harmonic Society.**—Monday, November 20th. At 8 p.m. At the Holborn Restaurant, King's Hall. Ladies' night.
- Institution of Civil Engineers.**—Tuesday, November 21st. At 5.30 p.m. Paper on "Keady Bridge," by Mr. J. B. Ball.
- Royal Society of Arts.**—Wednesday, November 22nd. At 4.30 p.m. At John Street, Adelphi, W.C. Paper on "The Economic Development of Russia and Britain's Share therein," by Mr. Leslie Urquhart.
- Institution of Electrical Engineers.**—Thursday, November 23rd. At 8 p.m. At Victoria Embankment, W.C. Paper on "The Parallel Operation of Electric Power Stations," by Mr. J. S. Beck.
- Greenock Electrical Society.**—Thursday, November 23rd. Visit to Overton Paper Mills. Members to meet at 7.30 p.m.
- Physical Society of London.**—Friday, November 24th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary meeting.

NOTES.

General Accessories Co., Ltd.—CORRECTION.—The name of the company mentioned in our last issue under "Liquidations" was incorrectly given, owing to the omission of the word "Engineering." The meeting of creditors held at 120, Blackfriars Road, S.E., on November 7th, was of General Engineering Accessories, Ltd., whose winding-up was announced in THE ELECTRICAL REVIEW for November 3rd, page 459. The General Accessories Co., Ltd., of Worship Street, E.C., makers of electrical accessories, are in no way connected with the matter. We regret the error.

Car-motor Defects.—The following experiment with the brush gear of a tramcar motor has proved successful in saving endless trouble:—90 per cent. of switch-blowing on tramcars is due to the brush gear either not being in its proper position, or being spaced out wrongly; this was a great trouble on the cars under the supervision of Mr. E. Mercer, of Castleford, until he adjusted all the brushes to their proper positions. The diagram shows a simple method of finding out the brush positions: Place



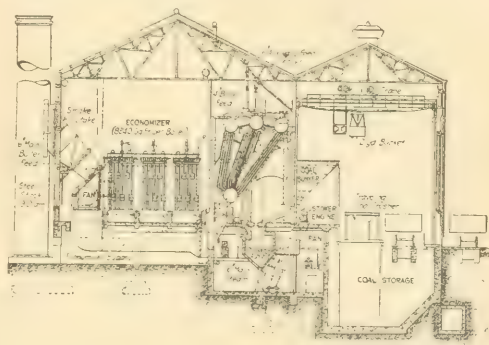
an ordinary steel square in the position shown in the diagram, with a level on top; see that the square is touching both side and top of commutator. Adjust the square until the level is reading correctly, then mark the commutator at the end B of the square; then place the square at the other side of the commutator, and mark the commutator at C. Find the centre A between C and B, and count equal numbers of bars down both sides to set the brushes.

A Fact.—A joiner employed by a northern electricity supply department in fitting-up a cupboard over an electricity meter, &c., in a small shop, had put a small porcelain insulator to act as a door-knob; when the foreman came round to inspect the job he was told by the shopkeeper that he would not have that—y incubator in his shop.

Development of the Turbine.—At a meeting of the Newcastle-on-Tyne Chamber of Commerce, Mr. Gerald Stoney proposed that the Chamber should draw the attention of the Engineering Committee of the Advisory Council of the Privy Council for Scientific and Industrial Research to the importance of a full and complete research into the methods by which the steam turbine could be improved in efficiency and reliability. In view of the success of the steam turbine in the mercantile marine, and its probable larger adoption in the future, this was of the greatest importance to the shipping industry. Mr. Stoney had not been able to get the exact expenditure on coal used on merchant ships, but had received various estimates ranging from £30,000,000 to £60,000,000 a year as the value of the coal. If they took 5 per cent. of that as the saving that might be effected by the development of the turbine, it would amount to from £1,500,000 to £3,000,000. Thus the sum of £10,000 to £15,000 which might be spent on research would be a mere bagatelle. The cost of fuel used on land amounted to about £50,000,000 a year, so that they would see that a saving of 5 per cent. effected there would amount to a very large sum annually. The use of turbine engines was rapidly increasing at sea. Up to the present they had been chiefly used for war vessels and passenger steamers, but now they were coming into use on tramp steamers and in that connection he mentioned that Messrs. Cairns & Noble, Newcastle, had built the first large tramp turbine steamer on the Tyne. The firm was, he understood, very well satisfied with the venture. The motion was carried unanimously.

Novel American Coal-Handling Plant.—A recent issue of *Power* described the plant extension of the West Penn Traction Co., of Connellsville, Penn. Three new independent water-tube boilers, each of 13,710 sq. ft. heating surface, and each equipped with a 14-retort underfeed stoker, and provided with an 8,240-sq. ft. economiser and independent stack, are installed. The boilers are built for a working pressure of 250 lb. per sq. in., and will supply steam, superheated 100-120°, to an 18,000-kw. turbine unit. The boilers are of the Stirling type, with three upper drums and one lower drum; they are set higher than usual to provide a large combustion space, and the baffling is of the four-pass type. The grate gives a ratio of 54.2 sq. ft. of boiler heating surface per sq. ft. of grate area. The coal displaced by each stoker piston movement is 18 lb., and the stoker can handle 16,000 lb. of coal per hour. A forced-draught fan of 60,000 cu. ft. per min. capacity against 6-in. w.g. pressure supplies air to each furnace, and an induced-draught fan discharges the economiser gases into the 100-ft. stack.

The ash-pits are under the combustion-chambers, and discharge



into cars hauled by an electric locomotive, the ashes being dumped into a 320-ton storage pit at the end of the boiler house.

There are no overhead coal bunkers; railway cars are run into the boiler house, on a track passing along the boiler fronts, beneath which is a 2,100-ton coal storage pit extending the full length of the boiler room.

Spanning this portion of the building is an electrical travelling crane with a 2-cb. yd. bucket, which delivers fuel to the stoker-hoppers, either direct from the railway car, or from the pit. Each of the stoker-hoppers has a capacity of 50 tons. If run-of-mine coal is received, it is unloaded by the crane into a travelling crusher (capacity 100 tons an hour, with a 15-ton hopper), and then hoisted to the stoker-hoppers. The crane also travels over the ash storage pit and hoists the ashes into empty railway cars for removal.

The crane (on which, it will be seen, the operation of the plant depends) is equipped with a 25-H.P. lifting motor, a 35-H.P. motor for opening and closing the bucket, a 5-H.P. trolley motor and a 25-H.P. bridge motor, and has a hoisting speed of 150 ft. per min. The crane is equipped with a recording and weighing scale. The design and erection of the plant were carried out by Messrs. Sargent and Lundy, of Chicago.

Electricity on a Duck Farm.—At the Tanglewood Ranch, near New York, 20,000 to 25,000 ducks are raised each year for table use.

Hatching continues from January 1st for eight or nine weeks, and the electric incubator plant in use has a capacity of 9,600 eggs, the incubation period being one month. The incubator lamps are run on a 10-volt circuit operated through a transformer from the 110-volt general lighting circuit. Central station energy at 2,200 volts, 60 cycles, is received and transformed down to 110 or 220 volts at suitable points. Three 30-watt tungsten search-lights are located so as to illuminate the area occupied by the fully-grown ducks, and all can be operated from the owner's house, superintendent's house, or watchman's house; they serve as a burglar alarm and to prevent panic at night.

In addition, 60-watt lamps on brackets are distributed over the farm, and the dwelling and brooder houses are electrically lighted.

The use of electric power has effected a considerable reduction in expense over the ordinary source of energy—a petrol engine. Ten thousand ducks of all ages require a variety of food, and many meals a day. About 20 bushels of green stuff are cut up twice a day and mixed by machinery with other food, such as meal, the mixer being in fairly constant use.

Three pumping plants are installed, one being driven by a windmill.

New Primary Cell.—It is reported in the *Western Morning News* that Mr. W. Skinner, a member of the mechanical staff of that journal, has invented a new primary battery, which is claimed to be cheaper to manufacture and maintain than any other, absolutely immune from polarisation, free from local action, and of very low internal resistance. The cathode consists of carbon impregnated with a substance to which hydrogen cannot adhere, and is somewhat analogous in its action to the platinumised silver cathode of the Smee element. The anode is of zinc, and the electrolyte consists of a strong solution of common salt and water, one pint of which will keep a miniature lamp glowing for 40 hours continuously before the solution needs renewing. The cell has an E.M.F. of 1.2 volts.

Institution and Lecture Notes.—University College, London. In his third lecture on "Long-Distance Telephony," on Friday last, Prof. J. A. Fleming continued the discussion of the phenomena relating to the transmission of electric waves through cables. The expression $\cosh(x + j\beta l) = \cosh x \cdot \cos \beta l + j \sinh x \cdot \sin \beta l$ (which was incorrectly printed in our last issue) can be simplified if βl is greater than π , as then $\cosh \beta l$ is practically equal to $\sinh \beta l$, therefore $\cosh \beta l = \sinh \beta l$, and substituting we get

$$\begin{aligned} V_1 &= V_2 \cosh \beta l \cdot \cosh x + j V_2 \sinh \beta l \cdot \sin x \\ I_1 &= I_2 \cosh \beta l \cdot \cosh x + j I_2 \sinh \beta l \cdot \sin x \\ \text{and } \alpha l &= 2 \cosh \beta l. \end{aligned}$$

In a long cable with voltage V_1 at the sending end, the voltage V_2 at a distance l is $V_1 \cdot e^{-\alpha l} = V_1 \cdot e^{-2 \cosh \beta l \cdot x}$, and with terminal apparatus of impedance Z at l , the voltage at the end V_2 from the foregoing equation (if $\beta l \gg \pi$) is found to be

$$\begin{aligned} V_2 &= \frac{V_1}{1 + 2 \cosh \beta l \cdot \cosh x + 2 \cosh \beta l \cdot \sin x} \\ \text{and } I_2 &= \frac{V_2}{Z + Z_0} \end{aligned}$$

If two values of characteristics Z and Z_0 are joined together, the second may be regarded as a receiving instrument of impedance Z , and we have

$$V_2 = \frac{V_1}{1 + 2 \cosh \beta l \cdot \cosh x + 2 \cosh \beta l \cdot \sin x} \cdot \frac{Z_0}{Z + Z_0} = \frac{V_1}{1 + \frac{Z_0}{Z} (1 + 2 \cosh \beta l \cdot \cosh x + 2 \cosh \beta l \cdot \sin x)}$$

which shows that part of the wave is reflected at the junction represented by the fraction $(Z - Z_0)/(Z + Z_0)$ of the incident wave while the remainder passes on; this ratio is called the coefficient of reflection, while the ratio $2Z_0/(Z + Z_0)$ is known as the coefficient of transmission, the phenomena, as demonstrated by the lecturer, being analogous to those exhibited by light waves passing through a transparent body. Owing to the occurrence of these reflections, the interposition of underground cables in circuit with overhead lines produces a great increase in the attenuation, and is highly detrimental to the transmission; it is of the utmost importance to keep the Z of the line unchanged.

The effect of an impedance coil inserted in a line was shown to be similar to that of a change in the character of the line at a junction, and this fact made Heaviside's proposal to insert inductance appear undesirable; but in 1913 Pupin discovered that if the coils were spaced at short intervals compared with the wave-length, the reflection losses would be negligible. The necessary condition was that βd should not differ sensibly from $\pi/2$, where $d = 2\pi/\lambda$, λ being the wave-length and d the interval between successive coils. The "loading" increases the wave constant β and diminishes the attenuation constant α . In practice the loading coils are double wound on circular cores of very fine iron wire, the coils being inserted in the go-and-return leads in such a way as to assist one another in magnetising the ring; the ratio of effective resistance to inductance is as small as from 50 to 25, and the coils are inserted at intervals of d miles such that $C L d$ does not exceed 25, where C is the capacity of the line in microfarads per mile and L the inductance of the coil in millihenrys. Various examples of such coils were shown, and the methods of installing them on O.H. and U.G. Post Office lines were illustrated, heavy loading requiring, say, 250 M.H. at 14-mile intervals, and light loading, say, 50 M.H. at 24-mile intervals, on an underground cable, while in aerial lines the coils were spaced about 8 to 12 miles apart. The physical aspect of the subject was illustrated with an apparatus devised by Dr. Fleming, showing stationary waves in rotating cords, unloaded and loaded, with beads representing the coils. In calculating the characteristics of loaded lines, as a first approximation, the inductance is assumed to be uniformly distributed. When this method does not give results sufficiently accurate, a special formula is employed. Where it is necessary to change the character of the line, the inductance must be tapered off, to prevent a sudden change of impedance.

Institution of Civil Engineers.—In the course of his inaugural address last week, the president, Sir Maurice Fitzmaurice, touched upon the subject of the training of engineers. He himself had been brought up on compulsory Latin and Greek to the age of 19, both languages being taught in such a way as to develop the minimum amount of interest in his mind; on the other hand, he was taught mathematics and experimental science by a man whose teaching was alive, and who made commonplace things interesting—one could not help learning from him. He wished to draw attention to the fact that, whatever educational programme might be devised, a great deal depended on the teachers. While he was extremely keen on a radical alteration in our teaching, so that scientific education should be kept all the time in the foreground, he insisted on the importance of a good general education, and suggested that a knowledge of one or more modern languages should be made obligatory. In addition to technical training, experience on works was indispensable—preferably on large works—and the capacity of "getting on" with people and still holding one's own was of very great value. After some years' work at home, a young engineer should spend a few years abroad.

Dealing with the necessity of improved relations between employers and workmen after the war, which can only be brought about by increasing our trade, the president remarked that it would be well if the Institution gave more consideration to questions of industrial and commercial policy with which many of the members were well fitted to deal. The speech of the Prime Minister on August 2nd could only mean that the whole power of the Government would be placed at the disposal of our trade, and that the Empire would be united for purposes of peace as well as for war. Still greater weight attached to the spirit which at present animates our commercial leaders. Sir Maurice expressed the hope

that those who were dealing with the development of our foreign trade would not fail to include full consideration of the important question of the adoption of the metric system of weights and measures in this country. This system was obligatory in 34 countries, with a population of 437 millions, and the Government of the United States had issued a report this year, in which it was stated that international business required international weights and measures.

Institution of Electrical Engineers.—On Thursday last week, the opening meeting of the session was held. Premiums awarded for papers were presented, and Dr. A. Russell delivered the Kelvin Lecture, which is abstracted elsewhere in this issue.

The opening meeting of the MANCHESTER LOCAL SECTION was held on Tuesday last, when the Chairman, Mr. A. E. McKenzie, read his inaugural address, dealing with the organisation of engineering industries, the linking-up of power stations, the Summer Time Act, and various other matters.

The first ordinary meeting of the session of the SCOTTISH LOCAL SECTION was held at Glasgow on Tuesday last, when the inaugural address was given by the chairman (Mr. J. K. Stothert), who spoke particularly of the position of the industry after the war in reference to the educational and apprenticeship problems. It was expected that Mr. C. P. Sparks, President I.E.E., would be present, but it was intimated that on the previous morning Mr. Sparks had sustained an accident in London, which had prevented him from travelling North.

The meeting of February 16th will be held at Glasgow, not Edinburgh, as stated in our last issue.

The first meeting of the NEWCASTLE-ON-TYNE LOCAL SECTION was held at Newcastle on the 13th inst., when Mr. H. W. Clothier, the new chairman, delivered his inaugural address. Before commencing his address, he announced that the Section was forming a roll of those members who were serving their King and country either in the Navy or the Army, and it was the Committee's intention to send, with the members' approval, a letter of encouragement to each stating "that the opening meeting of the Session resolved that an expression of goodwill be sent to members on active service at home and abroad, wishing them God-speed and a safe return." This was agreed to, on the motion of Mr. P. V. Hunter.

The Faraday Society.—"Refractory Materials" were discussed at the meeting last week. Sir Robert Hadfield, F.R.S., the president, stated that the subject had not received in this country the attention it should have had. There had been considerable importations from abroad of refractories, when, without doubt, equally good material was available in our own country. Much research was required in addition to that which was carried on at the works of the manufacturers.

The Royal Society.—The Council has awarded the Copley Medal to Sir James Dewar, F.R.S., for his researches on the liquefaction of gases; the Rumford Medal to Prof. W. H. Bragg, F.R.S., for his researches in X-ray radiation; the Davy Medal to Prof. H. L. Chatelier for his researches in chemistry; and the Hughes Medal to Prof. Elith Thomson for his researches in experimental electricity. The Council recommends that Sir J. J. Thomson be elected president at the anniversary meeting on November 30th.

Electrical Association of Australia.—At a meeting held in Melbourne, on September 28th, Mr. F. W. Chambers read a paper on "Scales of Charges in Relation to Electric Supply," and Mr. J. H. Butters one on "A Description of the Tasmanian Government Hydro-electric Scheme."

South African Society of Civil Engineers.—At a meeting held in Cape Town in September, a paper by Prof. H. Bohle, entitled "Small Electric Power Stations; with Special Reference to the Worcester Hydro-Electric Scheme," was read. Prof. Bohle remarked that in that country municipalities were separated by great distances, and a supply in bulk was out of the question, except in a few isolated cases. Wherever electric light was desired, a power station had to be erected, resulting in a somewhat large capital expenditure per kW. installed, and, consequently, a high charge for energy sold. By carefully designing the plant, it was usually possible to keep the working costs within such limits that the cost per unit sold for lighting purposes did not exceed 1s. maximum. The author went on to describe the principal features of the plant erected for the Worcester Municipality, which had cost approximately £15,000. The total annual costs would amount to about £2,400, so that an average income of £200 per month would be required to make ends meet. Of this sum £55 per month would result from street lighting, leaving an amount of £145 per month from private consumers. The system had not been officially opened many weeks, and the income had already reached the required sum. At Stellenbosch, a town somewhat similar to Worcester, the scheme cost only £10,900. The figures for the first year showed working costs amounting to £488, the income being from public lighting £500, and from private consumers £1,688. The whole profit made during the first year had been put to depreciation and sinking fund. The figures showed that, with judicious working, even a small power station might be made a very profitable undertaking.

Copper Prices.—THE WEEK'S CHANGES.—Messrs F. Smith & Co. report, Wednesday, November 15th.—Electrolytic bars rose from £114 10s. to £117 10s.; ditto sheets from £162 10s. to £165 10s.; ditto rods from £153 10s. to £156 10s.; ditto H.C. wire, from 1s. 9½d. to 1s. 6½d.; silicon bronze wire, from 1s. 9½d. to 1s. 10d.

Messrs. James & Shakespear report, Wednesday, November 15th.—No change in prices quoted last week.

The Nobel Prizes.—The Academy of Science has decided to reserve the sums appointed for the physics and chemistry prize for a future occasion.

Manchester Engineering Wages Advance.—According to the Manchester *Daily Dispatch*, time workers in the engineering and allied trades in South-East Lancashire and Manchester are to receive an advance of 3s. per week. The decision was announced by the Committee on Production, which has been investigating the men's application for an advance of 9s. per week. The new concession, which is intended to apply to or to affect piece prices, is to be regarded as war wages, and recognised as being dependent upon the existence of the abnormal conditions now prevailing in consequence of the war. Engineering workers in Manchester, Ashton-under-Lyne, Newton-le-Willows, Stockport and Warrington are affected. The men were given 3s. advance some time ago, so that a large number are now receiving 6s. per week more than in pre-war times.

Dublin Electricity Supply.—Mr. W. M. Murphy, chairman of the Dublin United (Electric) Tramways Co., who has been the keenest critic of the management of the Dublin electricity concern, has, in an interview, denied a statement attributed to Mr. L. Sherlock, ex-Lord Mayor, and ex-chairman of the Electricity Committee, that he opposed the obtaining of the money necessary "for providing what Mr. D'Alton now regards as absolutely necessary."

"What I did oppose, at the inquiry in 1911, when the Corporation were seeking sanction for a large sum to extend the buildings and plant at the Pigeon House, was," said Mr. Murphy, "the spending of money on the Pigeon House site—the mistake of great magnitude," as Mr. D'Alton calls it—and time has fully justified the advice I tendered. I had then absolutely no interest except that of the ratepayers and electric current consumers, being the largest representative ratepayer in Dublin, and I was at the time contributing to the Electric Department one-fortieth of their whole income from private consumers. The Corporation, however, chose to treat me as a hostile witness, and would have none of my advice, as it did not fit in with their pet scheme.

"My intervention did not consist of mere criticism. I brought them an offer from the owners of an ideal site for a generating station on the quays which could be indefinitely extended, and I showed them how the new plant could be erected there, and how such of the Pigeon House plant as was worth retaining could be transferred to the new site."

In Mr. Murphy's opinion, "the excuses for not making the business pay are simply childish." "A monopoly of the electric supply of Dublin could," he declared, "be a magnificent property and a valuable concession; but I do not think that any solvent man or company could be found to-day who would take a present of the undertaking with an obligation to discharge its liabilities."

Educational.—UNIVERSITY OF BRISTOL. "SANDWICH" SCHEME.—Dr. Wertheimer, the Dean of the Faculty of Engineering of the University of Bristol, has proposed a modified "sandwich" system of training for engineering students. A student on leaving school will enter the University, and will spend a session there, passing the intermediate examination for the B.Sc. Degree in Engineering at the end; if his record is good and he is a promising student, he will be recommended to a firm, which will allow him to enter its works for a period of 14 months. This will enable the student to judge to what extent he is fitted for an engineering career, and will also enable the manufacturers to form an impression as to his suitability. He will then return to the University for a further period of two years, in some cases spending the Long Vacation in the works; after that he will return to the same works, if he has given satisfaction, for another period of 14 months. A number of firms have already agreed to take part in the experiment, including the Electric Construction Co., Ltd., Wolverhampton; Messrs. R. A. Lister & Co., Ltd., Dursley; and Messrs. Mather & Platt, Ltd., Manchester.—*The Times*.

The BOARD OF EDUCATION last year announced its intention to discontinue lower general examinations in Science and Technology, but in a circular recently issued states that it hopes to be able to hold the higher general examinations in 1917, in accordance with the regulations and syllabuses which governed the conduct of those examinations in 1915 and 1916. After 1917 no higher general examinations will be held in Pure Mathematics, Theoretical Mechanics, Heat, Magnetism and Electricity, Organic Chemistry, Coal Mining and Metallurgy.

Lundberg "Batch Exams."—As the present war time is not very suitable for embarking on one of their periodical switching competitions, Messrs. Lundberg & Sons have hit upon the idea of "batch exams." This means that anyone applying for particulars of the next competition is given the opportunity of working an examination paper without delay, and that when a certain number of such papers is in hand, the batch is examined, and certificates are awarded to those who acquire themselves well. The results of the first of these batch exams are as follows, the names in each grade appearing in order of merit:—

Advanced.—H. Hanks (Birmingham); T. C. Hodges (London); S. Frankland (E. Merton, Yorks.); L. Thomas (Rugby); T. Doyle (London); H. Cumick (Swansea); J. W. Hunt (London).

Intermediate.—H. Grimshaw (Golborne, Lancs.); W. A. McCall (Blackburn); W. E. Fairchild (Newark); C. R. Gunn (Liverpool); R. Maynard (Leithorpes); J. J. Rogers (Dundalk); K. G. Ferguson (London); A. Holroyd (Port Clarence).

Preliminary.—A. Doyle (Bexhill); J. Moran (Stirling, near Bury); "Winnie" (London); C. G. Owens (Manchester); P. Carroll (Drumcondra); J. C. Gale (Rushbourne); C. H. Bull (Blaina, Mon.). *Extra*.—A. V. Harris (Waltham, India).

Information concerning the above exams can be obtained on writing to the firm at 477-489, Liverpool Road, London, N. Those who are interested in the subject may be reminded that we published a set of simple problems relating thereto in our issue of the 3rd inst.

Dublin Fire Incident.—While engaged in the extinction of a fire which had broken out in a furniture store at Harrington Street, Dublin, a member of the City Fire Brigade got in contact with a live electric wire, and seized hold of a colleague who was near by. Both men received severe shocks, and fell from the first window of the building to the street. They were subsequently attended to in the Meath Hospital.

Signalling with Bare Wires.—The West of Scotland Branch of the Association of Mining Electrical Engineers, which is in January next holding a display of all the various types of bells that comply with the recent report on electric signalling with bare wires, is inviting manufacturers who desire to exhibit, to get into touch with the secretary. An announcement on the subject appears in our advertisement pages to-day.

Heating Appliances.—On October 15th, the licence schedule of prices on heating appliances under the Marsh patent for nickel-chromium resistance elements went into effect in the United States. The Marsh patent is owned jointly by the Hoskins Manufacturing Co. and the General Electric Co., and almost all of the responsible heating-appliance manufacturers have been granted licences under the patent. Under the terms of the licence each appliance carries a minimum list-price and a maximum discount. The manufacturer, however, may charge a price higher than schedule, which is being done on some lines.—*Electrical World*.

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, November 20th.—Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10, Signalling Class. Recruits' Drill, 6.25–8. Lecture, "On Telephones," 7.30.

Tuesday, November 21st. School of Arms, 5.7. Lecture, 7.15. "Squad and Platoon Drill," Company Commander Fleming.

Wednesday, November 22nd. Instructional Class, 6.15. Platoon Drill, Platoon No. 2.

Thursday, November 23rd.—Platoon Drill, Platoon No. 7. Ambulance Class by M.O., 6.

Friday, November 24th.—Technical for Platoon No. 10, Regency Street. Squad and Platoon Drill, No. 9. Signalling Class. Recruits' Drill, 6.25–8.25. Lecture, "On Telephones," 7.30.

Saturday, November 25th.—Parade, 2.20. Uniform, for inspection by the County Commandant, at 3. As a full muster is important, every member should attend.

Sunday, November 26th.—Entrenching at Otford.—Parade Victoria (S.E. & C. Railway Booking-office), 8.45 a.m.

(By order) MACLEOD YEARSLEY, Adjutant.
November 19th, 1916.

Appointments Vacant.—Charge engineers for the Northern Command power station. See our advertisement pages to-day.

Large British-Built Pelton Wheel.—On Wednesday last we were able to inspect a large Pelton wheel which has recently been constructed in this country by Messrs. James Gordon & Co., the well-known water-power engineers, for the extension of the British Aluminium Co.'s hydro-electric plant in Scotland. The wheel will develop a maximum output of 3,300 H.P. at 300 R.P.M., and is, therefore, far larger than anything of the kind previously attempted in the country, and, indeed is, in point of comparative size, a very large wheel. The plant, which we hope to describe in an early issue, is equipped with special governing gear, and is intended to drive a three-phase generator.

Electric Steel Furnaces Worked from Town Supplies.—A writer in a French journal suggests the installation of electric furnaces in towns, in order to utilise the plant lying idle at the power station during slack times. He saw the first installation of this kind about eight years ago in a suburb of Turin. There were two small Stassano furnaces of 100 H.P. each, and two of 1,000 H.P. each, taking their current direct from the town supply. In France the idea is making headway. Outside Limoges, a Keller furnace has just been installed, capable of melting down 30 tons of iron turnings and other cheap scrap per day, and producing 25 tons of high-priced cast metal, in conjunction with dephosphorisation or without it, or turning out ordinary cast-iron of high quality when the current is obtainable at a low rate. The furnace occupies a very small space in the tramway depot, and requires little attendance owing to the provision of ample labour-saving appliances. The current in this case is transmitted from a hydraulic power station to Limoges at 30,000 volts, where it is transformed down to 10,000, and then again to 110 volts to suit the furnace. The consumption of energy is about 700 to 800 KW.-hours per metric ton of metal produced. The first heat would, it is presumed, have to start about midnight, or soon after the peak-load was passed at the power-station.—*Colliery Guardian*.

U.S. Census of Electrical Manufactures.—A preliminary statement on the manufacture of electrical machinery, apparatus, and supplies, for the year 1914, compared with the year 1909, has been issued by the Bureau of the Census. The summary shows that the capital employed in 1914 was \$355,725,000, an increase of 32.8 per cent. as compared with 1909, and the value of the products was \$335,170,000, an increase of 51.1 per cent.—*T. and T. Ages*.

Colliers and Flash Lamps.—A collier at Cwmbran was fined 20s. for having a lamp in his pocket whilst in the pit an electric flash lamp. He had procured the lamp in order to guide him on his way out of the dark moorings, and it was stated that he had not been on his way out of the colliery. The prosecuting solicitor pointed out that it was distinctly provided in the Act that no person should be promoting a lamp should be employed underground except a safety lamp of approved pattern, and the management of the colliery took a serious view of this offence, desiring to stop this sort of thing at the beginning. *Colliery Guardian.*

Accumulator Manufacture in America.—The equipment of the new works of the Willard Storage Battery Co., which are approaching completion near Cleveland, U.S.A., will include apparatus using alternating current at 21,000 volts for the testing of battery jars by means of which the smallest holes or thin spots can be detected. Incorporated in the new factory is also a refrigerating test-room, in which it will be possible to test motor-car engines fitted with electric starting and car-lighting motor-generators, battery, &c., at low temperatures. The engine unit with the starting and lighting equipment will be mounted on a trolley, which runs on a track into the refrigerating room, where a temperature of 20° F. below zero can be maintained. Arrangements are provided for controlling the engine from the outside, and by this means it will be possible to check the behaviour of the batteries used with the engine-starting and car-lighting sets under extremely low temperature conditions.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station Officials.—Mr. G. B. HALLAM, shift engineer at the Hackney electricity works, who met with a severe bus accident in January last, has now resumed his duties after being detained in hospital for ten months. Before returning to work he led to the altar Miss Tuffe, of Sunderland.

The Marylebone B.C. Electricity Committee recommends the Council to grant leave of absence during the period of the war to Mr. H. H. HOLMES, sales manager, who has been offered an appointment in the Army with a commission.

Mr. T. K. RICHARDSON, station superintendent at the Marylebone electricity works, has resigned his position owing to failing health.

General.—Mr. W. H. ALLEN, who relinquished the position of borough electrical engineer at Loughborough in August last, joined Messrs. Chance & Hunt, Ltd., at Oldbury, in an advisory capacity for the whole of their works at Oldbury and in various other parts of the country. The reason for Mr. Allen's appointment was the recognition by the firm of the need, in their particular business, of an engineer to give the whole of his attention in the first instance to the application of current in all possible ways to chemical production, and secondly, to generate power on a high annual load factor at the lowest possible cost, as electrolytic methods of production result in much greater purity.

Mr. CHRISTOPHER YOUNG, formerly of the electrical staff of the Farnham Gas & Electricity Co., who joined the Royal Flying Corps, and who recently obtained his "wings," has been married to Miss Phyllis Lake.

Ald. G. WEEKS, of Messrs. Weeks & Son, electrical engineers, has been re-appointed Deputy-Mayor of Bromley (Kent). *London Gazette* Notice.—Territorial Force. Royal Engineers. Tyne Electrical Engineers: Lieutenant (temporary) Captain C. M. Campbell to be temporary Major.

The undermentioned Second-Lieutenants (temporary Lieutenants) to be temporary Captains:—

H. O. Rogerson; H. Sherlock; C. F. Scott; D. Myles; F. B. C. Sutherland; T. T. Tucker; W. H. James; J. Lawther; R. H. Rocksby.

The undermentioned Second-Lieutenants to be temporary Lieutenants:—

H. G. Campbell; E. V. Baldwin; E. Harrison; O. W. E. Hedley; W. W. Wilson; C. B. S. Micklam; W. Fox; J. B. Murray; C. Graham; J. L. Bates; D. E. Ross; A. S. Burdis; J. R. B. Emerson; F. T. Hamilton.

Mr. W. NEWBERRY, Weston, M.Mech.E., has been appointed a director of Messrs. Herbert Morris, Ltd., of Loughborough. He will continue to hold the position of secretary, which he has occupied for the past nine years.

Roll of Honour.—The West Ham Corporation tramway traffic staff have presented an inscribed silver tea service to Regimental-Sergeant-Major J. R. JONES, Royal Welsh Fusiliers (London Welsh), who enlisted whilst a motorman, in commemoration of his bravery in action by which he gained the Military Cross.

Sapper (Corporal) A. J. TOWLSON (London Field Company) has been presented with the Military Medal for executing a most important survey successfully under heavy fire. Sapper Towlson was a draughtsman in the employ of the India-Rubber Co., Silvertown, and he has been on service in France for two years.

Corporal BASIL O. DAWFREY DAWSON, Canadian Battalion, who was for several years a pupil at the Corporation electric light works at Folkestone, has fallen in action.

Sergeant L. PAYNE, R.E. (Signalling Section), who has been awarded the D.O.M. for gallantry on the field of action, was a Leeds tramcar driver. Gunner H. LONG, R.F.A., who has earned the Military Medal for excellent work as a signaller, was a Leeds tramcar conductor.

Corporal ALAN WALKER, West Yorkshires, who is reported killed in action, was an electrician in the employ of Mr. R. Falshaw, of Harrogate.

Private JOHN SMITH, West Yorkshire Regiment (Machine Gun Section), who has been awarded the Military Medal, was employed at the Leeds Corporation electricity works.

Gunner W. RILEY, R.F.A., employed in the Manchester Corporation tramways department, has been awarded the Military Medal.

Sergeant J. W. WOOD, 4th London Field Ambulance, R.A.M.C. (an employee of the Marylebone electricity department), has been awarded the D.O.M.

Private T. A. JONES, of Runcorn, who has won the V.C., was previous to the war in the employ of the Mersey Power Co., Ltd., as fitter in the power station at Weston Point. Single-handed, he captured 102 Germans. He is 36 years of age. The local Press contains copies of many messages of congratulation, and his native place has naturally duly celebrated his magnificent exploit.

The sudden death at the Wimereux Hospital of Private ROBERT DONALDSON, Royal Irish Rifles, who was assistant electrical engineer to the Corporation of Halifax, is reported.

Second-Lieutenant J. R. IRELAND, Argyll and Sutherland Highlanders, killed in action, was 19 years of age, and was a student in mechanical and electrical engineering at Edinburgh.

Private REID, H.L.I., killed in action at the age of 22 years, was employed as an electrician with Messrs. Allan Arthur and Ure, Glasgow.

Sergeant W. D. BARRON, Canadians, has been missing since October 8th. He was employed with the Winnipeg Electric Car Co., and was 26 years of age.

Private W. E. DUNN, 11th Hants. Regiment, who has fallen in action, was employed in the Burton Corporation electricity department.

Sergeant F. J. BURK, who prior to enlistment was employed at the Accrington electricity works, has won the D.O.M.

The Military Medal has been awarded to Lance-Sergeant BERT MEE, of the West Yorkshire Regiment, who joined the Forces when only 16. Formerly he was in the tramways department at Bradford.

Corporal J. THOMPSON, East Kent Regiment, formerly driller, permanent way section, of the L.C.C. tramways department, has been killed in action.

Private W. HAZELDINE, East Lancashire Regiment, who enlisted whilst with Messrs. Bullers, Ltd., Hanley, has died of wounds.

Private J. GOODWIN, Leicestershire Regiment, killed in action, was an electrical engineer formerly engaged at Belton Park, Grantham.

Second-Lieutenant A. JACKSON, Border Regiment, killed in action on November 3rd, aged 25, was an electrical engineer with the British Westinghouse Co., Ltd.

Gunner J. HENDERSON, R.F.A., who served his apprenticeship with Mr. J. Ellwood, electrician, of Whitehaven, has died of beri-beri whilst on service in Mesopotamia.

Lance-Corporal E. RICHARDSON, East Kent Regiment (The Buffs), who is reported from France to be missing since October 7th last, was for 14 years on the staff of the Maidstone Corporation electricity works.

Company-Sergeant-Major HERBERT SALTER, Rifle Brigade, who was at the outbreak of war an electrician at Manchester, has fallen in action, aged 34 years.

Private LEONARD ROWLEY, Royal Fusiliers, who has been killed in action, was on the staff of the Potteries Electric Traction Co.

Private HARRY THOMPSON, York and Lancaster Regiment, of the Rotherham Corporation tramway staff, has been awarded the Military Medal.

The Military Cross has been awarded to Lieutenant H. B. BARRAN, R.F.A., and Second-Lieutenant S. R. BUTLER, R.F.A., for laying telephone wires under heavy fire, &c., at the end of September. Military Medals have been won, also for specially hazardous telephone work, by Gunner A. DRIVER, R.F.A., Acting Bombardier C. E. BRAYSHAW, R.F.A., and Private C. TWINEHAM, West Yorks.

Obituary.—SIR W. VAUGHAN MORGAN.—We regret to record the death, which occurred on Sunday in his 86th year, of Sir Walter Vaughan Morgan, who many years ago, together with five of his brothers, founded the Morgan Crucible Works, at Battersea, and established two now well-known trade papers—*The Ironmonger* and *The Chemist and Druggist*.

MR. S. W. MADDICK.—We regret to announce the death, which occurred on November 5th, of Mr. S. W. Maddick (retired), late electrical engineer, H.M.O. Works, at the age of 72. Mr. Maddick's name has been identified with electrical engineering since its infancy. He became associated with the Heating, Ventilating and Lighting Department at the House of Parliament as far back as 1869.

NEW COMPANIES REGISTERED.

Traction Development, Ltd. (145,238).—This company was registered on November 9th, with a capital of £20,000 in 40,000 7½ per cent. pref. ord. to carry on the business of road motor vehicles, locomotives, traction engines, motor cars, aeroplanes, and all heavier-than-air flying machines, and fittings for the same, mechanical and electrical engineering, &c., and to adopt in conjunction with R. B. Macdonald, Manager, &c., Ltd. The subscribers (with one pref. ord. share each) are: A. Smeed Pratt, 40, Swanage Road, Wandsworth, S.W., solicitor; H. N. Letts, 106, Fernhead Road, Malda Hill, W., solicitor's clerk. Private company. The number of directors is not to be less than two or more than five; the first are F. Macfar, 40, Talbot Road, W., and H. F. Smalman-Smith, Hampden House, Kingsway, W.C. Qualification, one share. Remuneration as fixed by the company. Solicitors: Corbould, Ellis & Mitchell, 1, Church Court, Clement's Lane, E.C. Registered office: Hampden House, Kingsway, W.C.

Tele-Dis Services (Founders' Company), Ltd. (145,270).—This company was registered on November 9th, with a capital of £1,000 in 1,000 founders' shares of £1 each, to acquire and turn to account any invention for improvements in hygienic appliances relating to telephone apparatus, sound-recording instruments, &c., and to carry on the business of manufacturers of and dealers in hygienic apparatus, lotions, polishes, pastes, patent medicines, and chemicals of all kinds, &c. The subscribers (with one share each) are: Millicent Roberts, 74, Sussex Street, Poplar, E., clerk; V. F. Megham, 197, Peisham Road, Putney, S.W., accountant. Private company. The number of directors is not to be less than two or more than five; the first are not named. Secretary: W. A. Cover, 1, Clement's Lane, Strand, W.C. Secretaries: W. S. Shree, Regent Street, 97, Queen Victoria Street, E.C.

General Engineering & Export Co., Ltd. (145,240).—This company was registered on November 7th, with a capital of £40,000 in 40 shares, to carry on the business of general merchants, engineers, contractors, brokers, commission agents, manufacturers of mechanical and electrical plant, machinery, and hardware, &c. The subscribers (with one share each) are: W. C. Guerner, 112, Chestnut Avenue, Walthamstow, clerk; A. T. Freeman, 20, Marquis Road, Stroud Green, N., publisher's assistant. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Secretary: J. Crockett, 23, Abchurch Lane, Street, S.W. Registered office: 1, St. John's Lane, 1917, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Rangoon Electric Tramway & Supply Co., Ltd.—A memorandum of satisfaction to the extent of £5,750 on February 2nd, 1916, and to the extent of £226 on October 4th, 1916, of deb. stock dated February 1st, 1906, Do. miles, 22nd, 1908, and November 30, 1913, securing £250,000 has been filed.

A. Hirst & Son, Ltd.—A memorandum of satisfaction in full on September 7th, 1916, of deb. dated February 11th, 1910, securing £3,600 has been filed.

CITY NOTES.

Drake & Gorham, Ltd. MR. BERNARD DRAKE presided at the annual meeting, held on November 9th. He said that the net profit of £8,527 compared with £3,817 in the previous year, and considering the proportion of their men who were with the Forces, the shortage of country-house installations, and the allowances they were making to absentees, they had been able to very satisfactorily adjust their organisation to meet the altered conditions. Government contracts included work on a number of camps in all parts of the country, and work for various branches of the Services, as well as at the works of big engineering, shipbuilding, and other companies. The large electric generating station for the United Alkali Co. had been satisfactorily put to work, and he had every hope that when the results were ascertained it would lead to further work of the same character. The speaker gave the names of important works at which power and lighting installations had been carried out, also of eminent private clients. The factory had done well, and very great credit was due to the works manager, who had increased his output by nearly 75 per cent. The wholesale department, the operations of which were naturally curtailed by the lighting restrictions and cessation of building work, had been able to apply its energies to the execution of Government power and lighting orders, &c., with the result that both the turnover and profits had increased considerably during the twelve months. Every effort was being made to organise this and other departments with a view to trade after the war, as they looked forward to receiving export orders in connection with the reconstruction work which would be necessary in Belgium, France, Russia, and elsewhere. Their electric vehicle department had been able to demonstrate on an extended scale the economy and convenience which could be obtained from electric haulage. Vehicles had been supplied to the Chester Corporation, the Manchester Corporation, Broughton Copper Co., Ford Motor Co., Brunner Mond & Co., Deakins, Ltd., J. & J. M. Worrall, Ltd., Ainsworth & Son, and others. They had also repeat orders from Messrs. Richard Johnson and Nephew, Messrs. Greenall, Whitley & Co., and Messrs. Levinstein, Ltd. As Edison batteries were reported to have run

over 60,000 miles in this country without renewals it was clear that battery-propelled vehicles would play an important part in the world's carrying trade. As he was compelled last year to refer to the disappointing results of the branch in Manchester, he was pleased this year to congratulate the staff on the improvement which they had been able to show both in turnover and profit. As regards the future, there might well be hard times ahead, and the Labour problem was very acute, but they had made a good start for the current year, and although it was unfortunate that it had been found necessary by heavy taxation to curtail trade extensions, and consequently earning capacity in the near future, they might rest assured that they would all do their best to meet whatever difficulties might be in store for them.

The Edison Swan Electric Co., Ltd. The report for the year ended June 30th, 1916, states that after providing for interest on both classes of debenture stock, and depreciation upon freehold properties and plant there is a net profit of £24,147, plus £4,879 brought forward. The directors propose to transfer to reserve account £25,000, carrying forward £4,025. The capital expenditure during the year, before providing for depreciation, has amounted approximately to £16,000, the major portion of this having been expended upon additional plant and machinery. The company's trade has shown a further considerable improvement during the year. "In consequence of this expansion all available cash is required in the business, and considerable further sums could have been profitably employed. Under these circumstances, the directors regret that they are not in a position to recommend the payment of a dividend upon the shares. The high cost of labour and materials has again seriously affected the profits derived from the manufacture and sale of drawn-wire lamps, it being impracticable to increase the selling price of these to meet such extra cost. The engineering side of the works has been almost wholly employed upon special work. The export business shows a still further expansion, and this branch of the company's trade being now established upon a firm basis, it is hoped that when normal times come still better results will be obtained. Annual meeting: November 22nd.

Monte Video Telephone Co., Ltd.

After providing for all charges in Monte Video and London, and making provision for income-tax and excess profits duty, the net profit for the year ended July 31st, 1916, was £25,985, as against £25,776 for the previous year. £8,000 is put to depreciation of property and plant, £9,000 is transferred to reserve for renewals, and after paying a final dividend of 2½ per cent. on the preference and one of 3 per cent. on the ordinary, making 5 per cent. on the preference and 6 per cent. on the ordinary for the year, £5,694 is to be carried forward, as against £5,394 brought in. There has been a moderate increase in the number of subscribers. Owing to pressure of business engagements Mr. L. Phillips has retired from the board, and his brother, Lord St. Davids, has been elected to fill the vacancy. Mr. Albert Anns, formerly secretary of the National Telephone Co., Ltd., is recommended as an additional director.

Western Telegraph Co., Ltd.

Sir J. WOLFE BARRY, presiding at the meeting last week, said that although the receipts from messages were less by somewhat over £15,000, the interest from investments, &c., almost balanced this amount, resulting in a net decrease of slightly over £1,000 in revenue. In 1914-15 the message revenue was the highest in the history of the company. Not only were a smaller number of messages transmitted, but a larger proportion of the total were "deferred" at half rates. The net profit to the company was less than for the previous year, but an unusually large balance of nearly £86,000 was brought forward from June 30th, 1915, and in view of the satisfactory condition of the company's financial position the directors felt justified in recommending the payment of a bonus of 2 per cent., instead of the 1 per cent. paid in past years, making a total distribution of 8 per cent. for the year, free of income-tax. With regard to the revenue since June 30th last, the traffic receipts for the three months to the end of September showed scarcely any variation as compared with the corresponding period last year.

Fraser & Chalmers, Ltd.

For the year to June 30th the profit, after providing for all expenses and depreciation on buildings, plant and machinery, was £24,668, as compared with £12,058 for the previous year. This profit has been arrived at after making provision for war taxation. The results show a considerable increase over those of the previous year, notwithstanding the increase in the cost of labour and materials, the difficulty of maintaining a sufficient labour force, and also the large increase in rates of freight and insurance to South Africa and elsewhere. The merchandise business in South Africa has shown substantial improvement during the year, and the prospects for the current year there, as well as at the other branches of the company, are good. The dividend of 7½ per cent. on the preference shares was paid in July last. The directors have decided to carry forward the balance of profit to the current year in order to conserve the resources of the company required to provide for the large increase in values of stocks and work in progress.

British Uralite (1908), Ltd.—For the year ended June, 1916, the profit was 9,208. After paying 5 per cent dividend, and putting £2,000 to reserve, £1,197 is carried forward. The outstanding debentures, which participated in the profits, have now been paid off.

Yates & Thom, Ltd.—The directors announce that, in consequence of an adjustment not having been arrived at with the authorities in respect of the proportion of profits payable to the revenue, it is impossible at the present time to issue a correct balance sheet for the year ended August 31st. The directors, however, feel justified in recommending a 10 per cent dividend on the ordinary shares. *Financial Times.*

Cleveland Trust, Ltd.—At the annual meeting, held at Middlesbrough last week, Mr. W. H. HESTER, who presided, said the Trust had been very severely hit by the holding of land and the electric light undertaking at Saltburn-by-the-Sea. In regard to the latter, he was afraid there was no possibility of any improvement so long as the lighting restrictions and the greatly increased cost of oil had lasted, but, so far, the directors had not thought it advisable to meet the position by increasing the price of current to consumers in the special circumstances obtaining at Saltburn. They had confidence, though, that the undertaking would give them a fair return as soon as the restrictions were removed.

Cape Electric Tramways, Ltd.—A dividend of 3½ per cent, less tax, is announced.

R. Hornsby & Sons, Ltd.—Dividends, 6½ per cent, and a bonus of 3½ per cent on the ordinary shares are recommended, carrying forward £43,734.

Castner Kellner Alkali Co., Ltd.—A dividend of 13 per cent for the past six months makes a total of 22 per cent for the year.

STOCKS AND SHARES.

TUESDAY EVENING.

Markets round the Stock Exchange exhibit a very fair amount of steadiness, and the firm manner in which Consols and other gilt-edged issues are maintained is a useful buttress to other investment securities. Here and there some slight yielding is taking place, though this does not become noticeable until a would-be seller tries to realise his stock, when both he and his stockbroker may be surprised to find that the transaction is less facile than they expected to find it. This is more particularly the case with stocks in such markets as those touched upon here, because in a large majority of the stocks and shares the market is at the best of times somewhat limited. To-day, the position is that in many cases dealing has become a matter of negotiation.

The reasons are several-fold, and have been alluded to on various occasions here. Summed up, they embrace the advent of a new Loan, the disappointment over Roumania, and the modification of the undue optimism which saw, last July, a termination to the war by the end of the present year. But the fine news of this week has helped to cheer-up things generally.

Amongst electricity supply shares, a dullish tone prevails. It is not that there is much stock on offer, but rather the absence of inquiring buyers, that gives the market a heavy tendency. City Lights have been lowered ½, and so have Metropolitan and London Electric preference, the last-named looking reasonably-priced on a basis of 6½ per cent. return. But with Exchequer Bonds paying 6, an industrial preference—even allowing for its being irredeemable—fails to attract at less than 7 per cent., unless it boasts special reasons to make it tempting.

The re-election of President Wilson, after such a lot of fuss, is read for the moment as a bear-point in regard to Mexican affairs. The argument is that Mr. Wilson's policy in Mexico has been a weak and vacillating one, fomenting disorders in the country instead of restraining them. Mexico Tramways 5 per cent. bonds are ½ down, at 38½, and the Sixes, at 29½, have lost 4 points. Mexican Light and Power issues remain unchanged. Some say in the Stock Exchange that Mexico cannot possibly get into any worse a situation than prevails now, and that any change must therefore be for the better. But all the same, these people do not buy Mexican stocks.

Marconi has gone back to 2 13/16. The vigorous defence of Mr. Godfrey Isaacs in regard to the Marconi Co.'s connection with the German Telefunken has had no effect in helping the price of the shares, but it has been studied with keen interest. American Marconis and Canadians have scarcely moved; interest is very spasmodic, but there are many who hold that Marconi at the present price will one of these days provide the holders with substantial profits and dividends.

The Anglo-American group of cable stocks is dullish, Anglo-American preferred slipping back to 95; but there has been a slightly better inquiry for the deferred stock on the basis of 2½. Great Northern, at 37½, have receded a further 10s. Eastern Extensions show ½ rise, and a fall similar in extent has occurred in Globe preference. West India and Panama Telegraph ordinary shares are unaltered on the dividend

announcement of 6d. per share, free of tax, for the half-year to June 30th last. Last November the dividend was 9d. per share.

Underground Electric Income bonds show especial strength, having regard to the prevailing depression of other stocks in the Home Railway market. The price has advanced to 90, and the buying this time has come from the North. The strength of these bonds communicated itself to Metropolitan, which went up to 23, but reverted to 22½. A slight improvement has occurred in Metropolitan deferred stock, which has hardened to 18½. It may be recalled that this stock was given to holders of the Great Northern & City Railway in exchange for their shares, and ranks level for dividend purposes with Metropolitan ordinary from the first half of 1920. Districts are lower at 15½, while the £10 shares of the Underground Electric Co. are steady, although there has been free buying of the 1s. shares, raising the price to 6s. 6d.

Brazilian Tractions weakened to 54, and Anglo-Argentine Tramways 5 per cent. debenture stock dropped to 69. The slump in British Columbia Electric Railway stocks shows no signs of abatement, and further falls have taken place ranging from 2 to 4½ points, the 4½ per cent. debenture stock being the chief sufferer.

Callenders are 6s. better at 122. India-Rubbers rose 15s. to 132. Electric Constructors rose to 1 3/32, and the preference are better at 1 1/16. The Edison & Swan shares are unchanged on the issue of the report, and industrials as a whole steady, with the exception of a few cases in which preference shares have given way a little for the reasons mentioned above. The rubber share market keeps good, and several excellent dividend declarations have played their part in stiffening confidence and prices.

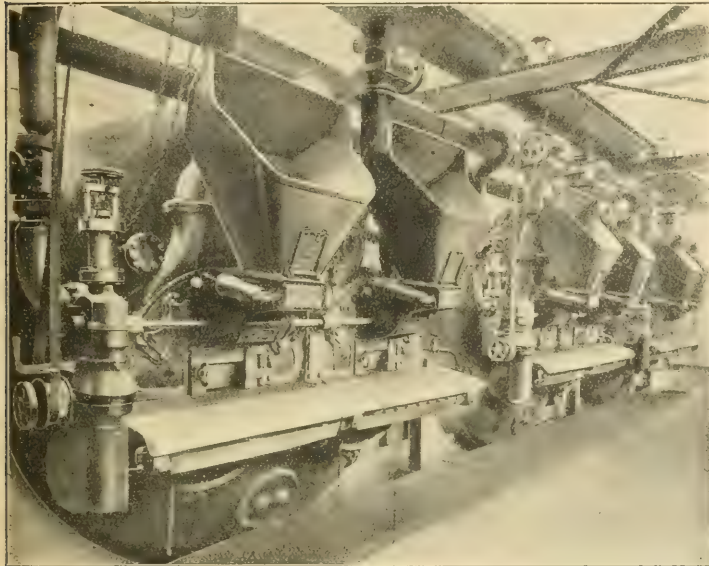
SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend		Price Nov. 14, 1916.	Rise or fall this week.	Yield p.c.	
	1914.	1915.				
Brompton Ordinary	10	10	88	—	—	£7 11 0
Charing Cross Ordinary ..	5	5	98	—	—	7 10 8
do. do. do. 4½ Pref. ..	4½	4½	90	—	—	6 14 4
Chelsea	5	4	112	—	—	6 18 4
City of London	9	8	112	—	—	6 16 2
do. do. 6 per cent. Pref. ..	6	6	100	—	—	6 17 1
County of London	7	7	107	—	—	6 10 3
do. do. 6 per cent. Pref. ..	6	6	102	—	—	6 18 6
Kensington Ordinary	9	7	68	—	—	6 4 6
London Electric	4	4	112	—	—	6 10 6
do. do. 6 per cent. Pref. ..	6	6	4½	—	—	6 15 4
Metropolitan	3½	3	22	—	—	6 6 4
do. do. 4½ per cent. Pref. ..	4½	4½	34	—	—	7 4 0
St. James' and Pall Mall ..	10	10	64	—	—	6 8 0
South London	5	5	2½	—	—	6 16 1
South Metropolitan Pref. ..	7	7	14½	—	—	6 7 2
Westminster Ordinary	9	7	67½	—	—	6 13 0
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	6	6	95 ½	—1	—	6 6 4
do. Def.	50½	50	22½	—	—	7 10 8
Chile Telephone	8	8	7	—	—	6 14 6
Cuba Sub. Ord.	6	6	82	—	—	8 8 6
Eastern Extension	7	8	13½	—	—	6 15 6
Eastern Tel. Ord.	7	7	12½	—	—	6 17 1
Globe Tel. and T. Ord. ..	6	7	122	—	—	6 13 0
do. Pref.	6	6	108	—	—	5 15 8
Great Northern Tel.	22	22	37½	—	—	5 17 4
Great European	13	13	51	—	—	6 14 6
Marconi	10	10	21½	—	—	6 11 2
New York Tel. 4½	4½	4½	98	—	—	4 10 0
Oriental Telephone Ord. ..	10	10	2½	—	—	4 6 6
United R. Plate Tel.	8	8	62 ½	—	—	5 18 6
West India and Pan.	1	—	1	—	—	—
Western Telegraph	7	8	142	—	—	5 8 4
HOME RAILWAYS.						
Central London, Ord. Assented	4	4	65½	—	—	6 2 2
Metropolitan	1½	1½	22½	—	—	4 9 0
do. District	Nil	Nil	16½	—	—	Nil
Underground Electric Ordinary	Nil	Nil	11½	—	—	Nil
do. do. "A"	Nil	Nil	6½	—	—	Nil
do. do. Income	6	6	80	—	—	6 18 4
FOREIGN RAILWAYS, &c.						
Adelaide Sup. 6 per cent. Pref.	6	6	41½	—	—	6 1 6
Anglo-Arg. Trams, 1st Pref.	5½	5½	37½	—	—	8 9 2
do. do. 2nd Pref.	5½	5½	26	—	—	—
do. do. 5 Deb.	6	6	9	—1	—	7 5 0
Brazil Tractions	4	4	64	—1	—	7 8 2
Bombay Electric Pref.	6	6	102	—	—	6 17 3
British Columbia Elec. Ry. Pica.	6	6	59	—2½	—	7 3 0
do. do. Preferred	Nil	Nil	51	—2	—	Nil
do. do. Deferred	Nil	Nil	82	—2	—	Nil
do. do. Deb.	4½	4½	82	—4½	—	6 17 1
Mexico Trams 5 per cent. Bonds	Nil	Nil	38½	—	—	Nil
do. do. 6 per cent. Bonds ..	Nil	Nil	29½	—	—	Nil
Mexican Light Common ..	Nil	Nil	17	—	—	Nil
do. Pref.	Nil	Nil	81	—	—	Nil
do. 1st Bonds	Nil	Nil	40	—	—	—
MANUFACTURING COMPANIES.						
Babcock & Wilcox	14	15	25	—	—	5 4 4
British Aluminium Ord. ..	6	7	23	+83.	—	6 14 4
British Insulated Ord. ..	15	17½	13	—	—	7 6 10
British Westinghouse Pref. ..	7½	7½	27½	—	—	6 3 0
Callenders	15	20	12½	—	—	7 15 0
do. 5 Pref.	5	6	4½	—	—	5 17 8
Castner-Kellner	20	—	4½	—	—	5 6 8
Edison & Swan, 43 paid ..	Nil	Nil	8/3	—	—	Nil
do. do. fully paid	Nil	Nil	13	—	—	Nil
do. do. 4 per cent. Deb. ..	5	6	62½	—	—	8 0 0
Electric Construction	6	7½	13	+ ½	—	6 16 4
Gen. Elec. Pref.	6	6	6	—	—	6 0 0
do. do. Ord.	10	10	14½	—	—	6 15 0
Henry	20	25	16	—	—	7 16 3
do. 4½ Pref.	4½	4½	4	—	—	6 13 6
India-Rubber	10	10	122	—	—	47 17 6
Telegraph Con.	30	30	88½	—	—	46 4 7

* Dividends paid free of income-tax.

A DUAL METHOD OF MACHINE-FIRING BY COAL AND GAS.

An interesting example of boiler furnaces which are machine-fired by the dual application of gas and coal is found in the installation carried out by Messrs. E. Bennis & Co., Ltd., at the South Staffordshire Mond Gas (Power and Heating) Co.'s works



BOILER PLANT WITH DUAL COAL AND GAS FIRING.

at Dudley Port, Tipton. The plant comprises eight producers, each capable of gasifying 20 tons of fuel per day of 24 hours, and generating sufficient gas to drive gas engines of 2,000 H.P. continuously. The total capacity of the present section is thus equal to 16,000 H.P.

The fuel, brought by boat or by rail, is loaded into bunkers, which automatically feed two conveyors, each having a capacity of 10 tons per hour, which convey and distribute the fuel into the storage bunkers over each set of producers. The bunker over each producer will hold 40 tons, i.e., sufficient to keep the producer working for two days.

The gas, after leaving the producers, is thoroughly washed in mechanical washers, and after passing through the ammonia recovery and gas-cooling towers, is further purified by large centrifugal fans and then passed through the scrubbers and the meters before being compressed and sent through the mains for distribution.

Some time ago it was decided to substitute mechanical firing for hand-firing and machine stokers arranged to burn either coal or gas were installed. These are of the well-known "Bennis" sprinkler type, of which an integral feature is the self-cleaning compressed-air furnace. The boiler plant of the South Staffordshire Mond Gas Co. consists of three Lancashire boilers, each 9 ft. x 30 ft., with extended flues, working at 120 lb. pressure. They are fitted with superheaters, and the gases discharge through an economiser.

A definite guarantee was given by the stoker makers that the evaporation of each boiler should not be less than 12,000 lb. of water per hour, with an overload evaporation of 15,000 lb. per hour, when desired, for short periods, and an efficiency of 72 per cent. was also conceded.

The qualified staff of practical chemists employed by the South Staffordshire Mond Gas Co. were entrusted with the task of taking tests which should establish the results of the work actually done by the boilers. The tests showed not only that the guarantees were maintained, but that an appreciable increase on the figures had been achieved. For instance, an overload evaporation of 17,000 lb. of water per hour from each boiler, instead of 15,000 lb. per hour, was obtained.

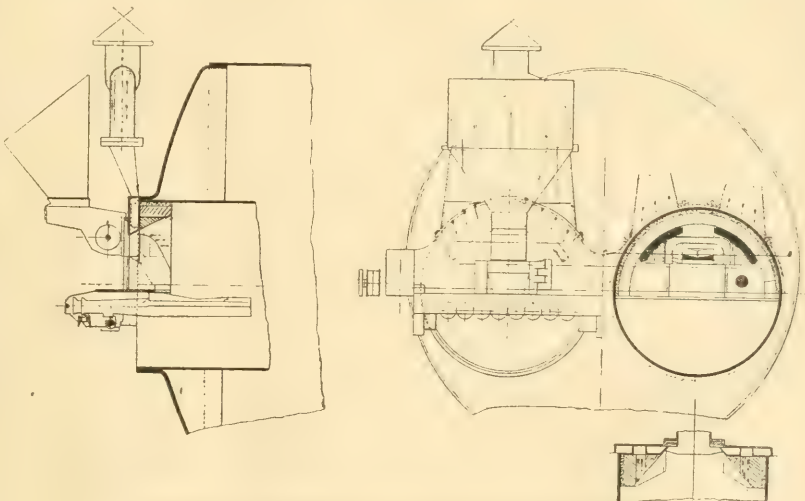
The South Staffordshire Mond Gas Co., prior to the installation, had found no little inconvenience owing to the fact that steam was required both during the night and from mid-day Saturday until Monday morning, when it was desirable that labour duties should stand at a minimum.

To meet this condition the mechanical stoker plant was arranged so that it could be coal-fired in the ordinary manner at ordinary times, and the boilers gas-fired during the hours of night and at the week-ends.

A reference to our views will show the gas ducts let into the top flange of the stoker front, and secured by means of a gas-tight joint. The baffle plates, which are situated behind the front, are arranged with a passage, the outlet being over the grate: the gas thus passes from the ducts to the furnace. There are two ducts to each flue: that is, of course, four to each boiler, each pair containing a breeches pipe placed immediately behind the hopper, and passing thence to the gas supply, constituting an extremely simple and satisfactory arrangement. It is, of course, essential that air should

have access to the gas; a valve is, therefore, placed on the furnace front with an adjustable cover to regulate the amount of air supply. The air is conveyed into the furnace through a separate air duct, and does not mix with the gas until it reaches the inside of the flue, where ignition takes place.

The results have been such as to justify the firm in applying the



SECTIONAL VIEWS SHOWING DUAL BOILER FIRING ARRANGEMENTS.

idea to all their extensions of boiler plant since the method was first adopted. The fact that repeat orders have been placed for machines of the same pattern to those already supplied for their new installation of boilers, is in itself sufficient evidence of the efficiency of the method and its satisfactory solution of the problem it was designed to meet.

A letter received from the South Staffordshire Mond Gas (Power and Heat) Co. the secretary states that the thermal efficiency obtained during a six months' run under all conditions and variations of load, including times when parts of the plant were off for constant inspection was 75 per cent. The average quantity of water evaporated per boiler per hour for a month's run was 14,880 lb. During this period the boilers were fired with slack during the day and gas-fired during nights and week-ends.

REVIEWS.

Localisation of Faults in Electric Light and Power Mains. By F. OGDEN WHITFIELD and WILLIAM WHITTINGHAM. Bradford: Wm. Ryles & Sons. Price 10s. 6d.

There is room for a work on the dry-as-dust and unlevelling subject of income-tax, which is, perhaps, as imperfectly comprehended by some of those who profess to discourse on it as it is by the general public, who seemingly have some of the professional classes such as the lawyer-politician, the lawyer, the accountant, that singular atom known as the "official mind," and other generally self-seeking and nebulous entities to thank for much of the difficulty and mystery that pervades it, and the anomalies in which it abounds.

The book before us is one that presents to the reader much useful information in an admirably concise form, and should be read by those who are interested in the general working and finance of Municipal Corporations.

There are twelve chapters dealing with income-tax generally within the limits of the title of the book in relation to local authorities. Chapter XIII treats briefly of the excess profits duty, and the book contains by way of an appendix a memorandum which was issued by the Institute of Municipal Treasurers and Accountants explaining the application of the provisions relating to excess profits duty in connection with the trading undertakings of local bodies, and sets forth statements illustrating the methods to be adopted in computing the liability.

The sections and matter which concern us in particular, however (in addition to excess profits), are those covering the ground of the assessable profits of tramway undertakings and electricity undertakings, as well as those discussing the important subjects of wear and tear and obsolescence. These appear to have received due consideration, are presented in succinct expression, as the following example shows, and, on the whole, we are glad to recommend the work.

Statement showing Allowance for Wear and Tear for the Year ending April 5th 1917.

(Based on accounts for 1915-16.)

Permanent Way

Miles run	6,250,000	= 55,803 miles per track mile
Track mileage	112	

(i.e., length of single track)

therefore the allowance for renewal of permanent way is based on an estimated life of 14 years.

Revenals

£ 1,400	{ cost of renewals of one mile of single track	× 112 miles (as above) ...	£35,200
74 years			

Traffic

	Track mileage.	Cost of repair.
Year ended March 31st, 1912	102	£9,374
Year ended March 31st, 1913	105	10,637
Year ended March 31st, 1914	107	9,832
	314	£29,843

Average for the three years, £95 per mile.

£95 × 112 track-miles (as above) ...

£10,640

Instead of three years, the average cost of repairs may be based on five years, but if five years is taken, this period must be adhered to in the future. In the present case, the average of £95 per mile was first adopted in respect of the assessment for the year 1914-15, and the same average will be applied for each year to April 5th, 1919

£45,840

Cables

(In this undertaking the power is supplied by the electricity undertaking, and the cables are the property of that undertaking. In those districts where the cost of the cables for tramway power has been borne by the tramway undertaking an allowance should be claimed of 3 per cent. on the written-down value.)

Workshop, Tools and Plant

Written-down value last year...	£5,800
Expended during the year 1915-16	350
	£6,150

At 5 per cent.

£307

(The written-down value to be carried forward to next year will be £6,150, less £307 or £5,843.)

Standards and Brackets

Written-down value last year	£38,000
Expended during the year 1915-16	2,500
	£40,500
At 5 per cent.	£2,025
Trolley wiring and connections	
Cars and other rolling stock	
No allowance for wear and tear is made in respect of either of these items, the expenditure upon renewals being charged in the working expenses, and when, it is incurred. Where, however, the profits of the undertaking are so small as not to cover the cost of renewals, the authority may make a claim to be allowed for wear and tear, and the Commissioners may allow 7 per cent. on the written-down value.	
Power station	
Where the power station is part of the tramway undertaking, allowances for wear and tear should be claimed in respect of the various items of expenditure, in accordance with the scheme applicable to electric lighting undertakings.	
Total allowance for wear and tear in respect of the year ending April 5th, 1917	£48,172

Localisation of Faults in Electric Light and Power Mains. with chapters on Insulation Testing. By F. CHARLES RYHMEY. London: Electrical Printing and Publishing Co. Price 8s. 6d. net. Third edition.

This well-known work has been out of print for some time, and we are glad to welcome its reappearance in a new edition.

The author points out in the preface that, although improvements have taken place in the manufacture of cables, and changes have occurred in the methods of laying and protecting feeders and distribution networks, faults still develop and have to be tested for and localised. Whereas the main principles of the testing of cables *in situ* and of the localisation of faults remain the same, the particular methods in which they have to be applied under modern conditions have altered, and it has accordingly been necessary to rewrite the descriptions of the methods to be employed in carrying out the tests in almost every case.

Beyond the rewriting of much of the matter of the earlier editions, a considerable amount of new material appears in the present edition. Thus, in Chapter VIII, which deals with "Discontinuities and Short Circuits," a good many instructions for localising the results of burn-outs are introduced for the first time. A short chapter has been added on faults in tramway feeders, and in this some interesting methods are given for employing the trolley wires to form part of the loop or to replace the slide wire in the localisation test.

Another fresh chapter is devoted to the means which have been so largely introduced in recent years for providing duplicate feeders with automatic devices for the protection of the mains, such as the Merz-Price system, the core-balancing and split conductor systems, and the Ferranti-Walters and Callender-Walters protective systems.

The main part of the book is taken up with careful and detailed instructions for carrying out localisation tests for faults under various conditions and by the various known methods. The author has drawn extensively on his own experience in describing the methods to be employed, the special precautions to be observed, and the limitations in the application of each. It is for the actual user of the tests that he writes, and not for the more general reader, who might desire to gain a more comprehensive insight into the principles of cable testing. It is the method of conducting the test, rather than the principles on which it is based, that the author sets out to explain, and he does it very well. The underlying principles are given also, but their interest is secondary, and many special precautions or devices of a practical nature are introduced with little or no explanation of the theory underlying them. In saying this, the reviewer intends no adverse criticism; the author has a particular object in view, and he quite legitimately pursues that object, and omits what he considers to be not essential to its attainment. Thus, on page 51, he is satisfied to state that "a well-insulated concentric system has its outer main at a comparatively low potential, owing to the effect of capacity," without stopping to explain why the capacity produces this result.

In connection with the diagrams Nos. 68 and 69, which show transformers connected in series for breaking down a fault, it might have been desirable to explain the simplification in the connections which would result from the use of a single transformer capable of giving the required pressure.

One piece of advice we are glad to see emphasised by Mr. Raphael in more than one connection, namely, that it is wrong to wait for the development of a fault before making preparations for localising it. As far as possible, the best method to be adopted on the particular system in question, any special apparatus which may be required and calculations of "equivalent sections," &c., for the circuits, should be carefully decided upon and prepared beforehand. It is not

the least of the good points of Mr. Raphael's book that it will be of material help in making such preparations for the day of trial.

Readers of the earlier editions of this book will probably need no fresh assurance of its utility; to any others who have charge of installations where fault localisations may have to be made we can cordially recommend it.

In concluding his notice of this useful and practical work, the reviewer ventures to make one criticism of a general character. He would like to suggest that if the printed matter had been more frequently divided into paragraphs, with fairly numerous sub-headings, and if the diagrams had been provided with titles, the book would have been rendered more convenient for purposes of ready reference. Such a subdivision would also have made it easier to give greater prominence to matters which are common to a series of tests, and which are at present in some danger of being buried amongst the details of the description of some particular measurement. It is only fair to add that by the provision of a good index the author has deprived this criticism of some of the force which it might otherwise have had.

MINISTRY OF MUNITIONS OF WAR.

PROCEDURE AFFECTING SUPPLIES OF MATERIALS.

THE Ministry of Munitions is desirous of informing manufacturers, merchants, and exporters that the arrangements that have been in force for controlling supplies of steel, tinplates, &c., are to be extended to other materials, and for the convenience of the public an explanation of the above-mentioned arrangements and their extended application is set forth below.

To obtain, whether for home use or export, supplies of copper wire, cable containing copper, bessemer and open hearth steel, corrugated sheets, tinplates, tinned sheets, terne plates, blackplates and lead-coated sheets, it will be necessary either to quote a Government contract reference and number if the materials are required to execute a Government contract, or to procure a permit reference number and priority classification from the Ministry of Munitions, Priority Branch, 28, Northumberland Avenue, W.C. In applying for such a permit, full particulars of the requirements and purpose should be given. This Government contract reference and number, or permit reference and number and priority classification, as the case may be, must be quoted to the suppliers, who are forbidden to deliver any of the aforesaid materials without being furnished with a Government contract number or reference number and priority classification covering the material ordered.

Where one of the following can be quoted to the suppliers no permit reference number and priority classification from the Ministry of Munitions are needed:—

1. Admiralty contract reference and number or Admiralty Priority Section permit reference and number.
2. War Office contract reference and number.
3. Ministry of Munitions contract reference and number.
4. Commission Internationale de Ravitaillement or Commission Française sanction reference and number, with Ministry of Munitions priority classification.
5. Board of Trade (Marine Department) (in the case of mild steel only) permit reference and number declaring merchant shipping to be munition work.
6. Post Office contract reference and number (in the case of copper or copper alloys only).

In the above cases (1)–(6) suppliers on receipt of the contract or permit reference number and a declaration by the customer that the materials ordered are required solely to fulfil the orders covered by the reference number quoted are entitled to deliver on the basis of priority classification A/4 (war work). If a higher grade of priority is required, application must be made to the Priority Branch of the Ministry of Munitions, stating the ground of special urgency.

The reference, date, and grade of contract permit or priority classification should be passed on to sub-contractors, if any, so that they, like the main contractor, can quote the necessary particulars referred to above on any orders that may be placed with the merchant, stockholder, or the manufacturer of the materials. This means that once a permit has been granted for a certain plant, such permit covers all parts and materials necessary for completing the plant unless instructions to the contrary are entered on the original permit.

As a general rule, the customer should make the application for permit and priority classification, and not the stockholder or manufacturer of the materials.

References need not be insisted upon in the case of urgent Admiralty telegraphic instructions for immediate repairs to ships.

In case of machine tool firms and electrical firms, the order can be covered by quotation of the reference and date of permit accorded by the Machine Tool Department or the Electrical Branch of the Ministry of Munitions respectively, for the machinery or parts for which the material is ordered.

None of the aforesaid materials can be supplied, except for orders or contracts coming within Class "A" or Class "B";

only shell discard quality steel and iron are allowed to be supplied in Class "C" or Class "C" Priority Instruction 6. If required for use within the United Kingdom, shell discard quality steel can be obtained without any permit. If for export, shell discard quality steel can be obtained only where the orders have been classified by the Priority Branch, and the reference number of the classification certificate and specific particulars of destination must be quoted to suppliers and the War Trade Department.

In all applications full particulars should be given under the following headings:—

1. A precise description of the articles or materials required.
2. The exact quantities thereof. If required for different orders or purposes the quantities required for each order or purpose respectively. If required for stock, or "running account," the minimum quantities needed for a period of three months and the respective quantities in hand at present.
3. The name of the firm or firms with whom the order or orders are or are to be placed, respectively.
4. The respective war, national, or other object to be served, and proof of urgency and importance.

A priority certificate is required even though the goods are merely to be transferred from one branch of a firm in the United Kingdom to another branch of the same firm in a foreign country or British possession.

Merchants, manufacturers, and the general public are earnestly requested to assist the Ministry of Munitions in particular and the nation in general by refraining from applying for permission to obtain the materials mentioned herein unless the same are required for war or other urgent national objects. It is essential that supplies should be conserved for direct war work and work of urgent national importance.

NOTICE IN REGARD TO THE EXPORT OF COPPER WIRE AND CABLE CONTAINING COPPER, BESSEMER AND OPEN HEARTH STEEL, OR CORRUGATED SHEETS, TINPLATES, TERNEPLATES, BLACKPLATES, TINNED SHEETS, AND LEAD-COATED SHEETS.

1. With a view to conserving supplies of copper wire or cable, Bessemer and open hearth steel, corrugated sheets, tinplates, terneplates, blackplates, tinned sheets, and lead-coated sheets, the Director of the War Trade Department announces that it has been arranged with the Ministry of Munitions that export licences will not be granted unless a Ministry of Munitions priority certificate (Class "A" or Class "B") permitting manufacture or sale from stock has been obtained, or unless the reference and number of an Admiralty contract or permit or War Office contract for the completion of which the copper wire or cable, steel, tinplates, &c., are required can be quoted. Export licences will not as a general rule be issued in respect of copper wire or cable, steel, tinplates, &c., for which a Class "C" certificate is quoted.

2. In the case of allied countries (France, Russia, Italy, Serbia, Portugal, Roumania, Belgium, Japan) priority certificates are only given in very exceptional cases by the Ministry of Munitions, unless the application is supported by the Commission Internationale de Ravitaillement, whether the consignment is intended for a Government contract or not. Application should, therefore, be made direct to the Commission Internationale de Ravitaillement, India House, Kingsway, London, W.C., which, if prepared to support the case, will communicate with the Ministry of Munitions, and arrange for the issue of a priority certificate. If the copper wire or cable, steel, tinplates, &c., are for Government work and export is allowed, the permits for export will be issued by the Commission Internationale de Ravitaillement. If the goods are not for Government work, and the applicant is in a position to quote a priority certificate ("A" or "B") or contract reference and number, he should make an application to the War Trade Department for the grant of an export licence, and if the export is allowed a licence will be granted by that Department.

3. In the case of Sweden, Norway, Denmark, Holland, and Switzerland, application should be made in the first instance to the War Trade Department, which, if there is no immediate reason for refusal, will arrange direct with the Ministry of Munitions for the issue of a priority certificate. The applicant should not communicate direct with the Ministry of Munitions, and the priority certificate will be forwarded to the applicant by the War Trade Department with the export licence. This exception does not apply to bessemer and open hearth steel nor to corrugated sheets.

4. In the case of all other destinations, including British possessions, application for a priority certificate should be made direct to the Ministry of Munitions, Priority Branch, 28, Northumberland Avenue, S.W. No application for an export licence can be considered by the War Trade Department, unless the number of a Ministry of Munitions priority certificate under Class "A" or "B" (or, alternatively, an Admiralty or War Office contract number) is quoted.

5. A priority certificate is required, even though the goods are already manufactured, and even though the goods are merely to be transferred from one branch of a firm in the United Kingdom to another branch of the same firm in a foreign country or British possession.

6. Applicants are warned that the issue of a priority certificate by the Ministry of Munitions is not a guarantee that an export licence will be issued by the War Trade Department.

7. If exporters have any doubt as to the reliability of the proposed consignee, they are recommended before proceeding

to manufacture to consult the War Trade Intelligence Department, Broadway House, Tothill Street, S.W. (as regards foreign countries in Europe), and the Foreign Trade Department, Lancaster House, The Mall, S.W. (as regards foreign countries outside Europe).

AMERICAN EXPORTS OF ELECTRICAL GOODS.

THE following figures, showing the exports of electrical goods from the United States during the year ended June, 1915, are taken from the recently-issued trade statistics; figures for 1913-14 have been added for purposes of comparison, and notes of any increases or decreases given:—

	Dollars. 1913-14.	Dollars. 1914-15.	Dollars. Inc. or dec.
<i>Telegraph instruments.—</i>			
To Denmark	—	11,000	+ 11,000
" Canada	16,000	14,000	— 2,000
" Central America	14,000	8,000	— 6,000
" Mexico	9,000	17,000	+ 8,000
" Colombia	6,000	1,000	— 5,000
" Argentina	1,000	—	— 1,000
" Cuba	1,000	1,000	—
" Brazil	29,000	1,000	— 28,000
" Other countries	61,000	23,000	— 38,000
Total	137,000	76,000	— 61,000

<i>Telephone instruments.—</i>			
To United Kingdom	55,000	132,000	+ 77,000
" Canada	432,000	205,000	— 227,000
" Central America	38,000	56,000	+ 18,000
" Mexico	23,000	8,000	— 15,000
" Cuba	82,000	76,000	— 6,000
" Brazil	336,000	51,000	— 285,000
" other S. America	140,000	38,000	— 102,000
" Japan	14,000	6,000	— 8,000
" Australia	277,000	405,000	+ 128,000
" Other countries	156,000	172,000	+ 16,000
Total	1,553,000	1,149,000	— 404,000

<i>Other electrical instruments and appliances.—</i>			
To Canada	3,760,000	2,253,000	— 1,507,000
" Mexico	326,000	244,000	— 82,000
" Panama	566,000	300,000	— 266,000
" Cuba	374,000	211,000	— 163,000
" Argentina	358,000	191,000	— 167,000
" Brazil	947,000	255,000	— 692,000
" Japan	483,000	306,000	— 177,000
" Philippine Islands	244,000	159,000	— 85,000
" Australia	516,000	623,000	+ 107,000
" United Kingdom	574,000	1,950,000	+ 1,376,000
" Other countries	2,292,000	1,660,000	— 632,000
Total	10,440,000	8,152,000	— 2,288,000

<i>Gas engines, stationary.—</i>			
To Canada	144,000	83,000	— 61,000
" Argentina	26,000	3,000	— 23,000
" Australia	13,000	21,000	+ 8,000
" Europe	111,000	51,000	— 60,000
" Other countries	89,000	262,000*	+ 173,000
Total	383,000	420,000	+ 37,000

* Russia-in-Asia, \$197,000.

<i>Electric motors.—</i>			
To United Kingdom	461,000	292,000	— 169,000
" Canada	833,000	514,000	— 319,000
" Panama	221,000	40,000	— 181,000
" Mexico	264,000	81,000	— 183,000
" Cuba	131,000	136,000	+ 5,000
" Argentina	109,000	30,000	— 79,000
" Brazil	179,000	55,000	— 124,000
" Chile	93,000	87,000	— 6,000
" British India	99,000	83,000	— 16,000
" Japan	829,000	303,000	— 526,000
" Australia	268,000	634,000	+ 366,000
" Other countries	1,055,000	564,000	— 491,000
Total	4,542,000	2,819,000	— 1,723,000

<i>Petrol engines, stationary.—</i>			
To Canada	1,009,000	608,000	— 401,000
" Argentina	200,000	19,000	— 181,000
" Australia	290,000	180,000	— 110,000
" Mexico	34,000	18,000	— 16,000
" United Kingdom	89,000	125,000	+ 36,000
" Other countries	709,000	250,000	— 459,000
Total	2,331,000	1,200,000	— 1,131,000

<i>Steam engines, stationary.—</i>	Dollars. 1913-14.	Dollars. 1914-15.	Dollars. Inc. or dec.
To Canada	190,000	103,000	— 87,000
" Cuba	38,000	60,000	+ 22,000
" Mexico	40,000	8,000	— 32,000
" Brazil	4,000	6,000	+ 2,000
" Philippine Islands	29,000	—	— 29,000
" Other countries	437,000	121,000	— 316,000
Total	738,000	298,000	— 440,000

<i>Electric locomotives.—</i>			
To Canada	28,000	110,000	+ 82,000
" Panama	354,000	158,000	— 196,000
" Mexico	—	10,000	+ 10,000
" Bolivia	5,000	14,000	+ 9,000
" Chile	4,000	15,000	+ 11,000
" China	34,000	—	— 34,000
" Other countries	12,000	17,000	+ 5,000
Total	437,000	324,000	— 113,000

<i>Dynamos and generators.—</i>			
To Canada	397,000	246,000	— 151,000
" United Kingdom	333,000	832,000	+ 499,000
" Panama	43,000	52,000	+ 9,000
" Mexico	26,000	36,000	+ 10,000
" Cuba	235,000	35,000	— 200,000
" Brazil	136,000	3,000	— 133,000
" Peru	12,000	35,000	+ 23,000
" Japan	869,000	301,000	— 568,000
" Australia	92,000	76,000	— 16,000
" Spain	182,000	—	— 182,000
" Other countries	309,000	397,000	+ 88,000
Total	2,634,000	2,013,000	— 621,000

<i>Fans.—</i>			
To Canada	70,000	17,000	— 53,000
" Argentina	87,000	18,000	— 69,000
" Brazil	26,000	7,000	— 19,000
" China	27,000	49,000	+ 22,000
" British India	47,000	44,000	— 3,000
" Japan	25,000	19,000	— 6,000
" Australia	10,000	12,000	+ 2,000
" Uruguay	17,000	—	— 17,000
" Other countries	124,000	92,000	— 32,000
Total	433,000	258,000	— 175,000

<i>Arc lamps.—</i>			
To Canada	35,000	10,000	— 25,000
" Brazil	14,000	2,000	— 12,000
" Other countries	28,000	19,000*	— 9,000
Total	77,000	31,000	— 46,000

* United Kingdom, \$10,000.

<i>Carbon filament lamps.—</i>			
To Argentina	4,000	8,000	+ 4,000
" Canada	7,000	11,000	+ 4,000
" Mexico	98,000	25,000	— 73,000
" Brazil	10,000	5,000	— 5,000
" Other countries	53,000	55,000*	+ 2,000
Total	172,000	102,000	— 70,000

* United Kingdom, \$10,000.

<i>Metal filament lamps.—</i>			
To Russia	—	26,000	+ 26,000
" United Kingdom	—	35,000	+ 35,000
" Canada	26,000	62,000	+ 36,000
" Mexico	31,000	20,000	— 11,000
" Cuba	18,000	74,000	+ 56,000
" Argentina	13,000	31,000	+ 18,000
" Brazil	25,000	39,000	+ 14,000
" Australia	13,000	25,000	+ 12,000
" Other countries	93,000	161,000*	+ 68,000
Total	219,000	473,000	+ 254,000

* Italy, France, and Spain, \$10,000 each.

<i>Static transformers.—</i>			
To United Kingdom	35,000	37,000	+ 2,000
" Spain	422,000	1,000	— 421,000
" Canada	106,000	73,000	— 33,000
" Panama	137,000	19,000	— 118,000
" Mexico	99,000	32,000	— 67,000
" Cuba	55,000	46,000	— 9,000
" Brazil	148,000	36,000	— 112,000
" Chile	38,000	10,000	— 28,000
" Japan	23,000	1,000	— 22,000
" Australia	47,000	54,000	+ 7,000
" Other countries	345,000	315,000*	— 30,000
Total	1,455,000	624,000	— 831,000

* Italy, \$37,000; India, \$99,000.

Insulated wire and cables.—	Dollars.	Dollars.	Dollars.
	1913-14.	1914-15.	Inc. or dec.
To United Kingdom	133,000	272,000	+ 139,000
.. Spain	112,000	36,000	- 76,000
.. Canada	267,000	137,000	- 130,000
.. Panama	273,000	195,000	- 78,000
.. Mexico	100,000	42,000	- 58,000
.. Cuba	215,000	166,000	- 49,000
.. Brazil	323,000	143,000	- 180,000
.. Australia	121,000	64,000	- 57,000
.. Other countries	448,000	857,000	+ 409,000
Total	1,992,000	1,912,000	80,000

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Substituting Paraffin for Petrol.

A device has been recently invented by MR. F. A. WILKINSON, of Hatfield, Herts, whereby motor-cars, and internal-combustion engines used for driving electric lighting plants and other purposes designed for running on petrol, can be run entirely on paraffin without alteration to the engine or carburetter. At the existing prices of petrol and paraffin, a saving of about two-thirds the cost of running can be effected.

The chief attractions of Mr. Wilkinson's invention, which is known as the "By-pass" paraffin attachment, are that it is by no means expensive to purchase, and can be fitted up in a very short time, and that the engine can be instantly converted to run on paraffin or petrol by simply opening or closing a valve. In order to vaporise the paraffin to enable a start to be made from cold, an electrical heater is provided which is wound for a suitable voltage, the power consumption being 196 watts for 2½ minutes. After the engine has started, the paraffin and air passing from the carburetter are heated by the somewhat revolutionary method of introducing a small percentage of the exhaust gases direct into the inlet pipe, which, mingling with the paraffin and air, enters the cylinders for a second time.

The attachment has been fitted to stationary engines and to many motor-cars, including Mr. Wilkinson's own car, a four-cylinder Overland, which has now been running entirely on paraffin for the last seven months and continues to give him great satisfaction.

Fig. 1 shows the attachment, in which the electrical heater A is mounted alongside of the carburetter, being held in position by means of a pipe connecting the float chamber with the bottom

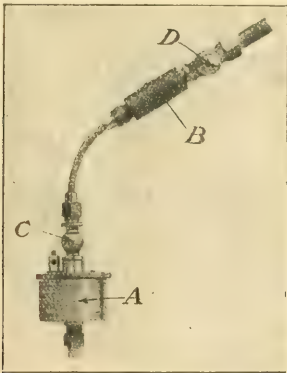


FIG. 1.—"BY-PASS" PARAFFIN ATTACHMENT.

outlet of the heater; this connection ensures that the level of the paraffin in the heating receptacle is always kept the same as that in the float chamber of the carburetter. Above the heater A is a valve C, connected by means of a small copper pipe to the T-piece B, which is connected to the induction pipe of the engine. The two openings of the valve D are connected respectively to the T-piece and the exhaust pipe; the function of this valve is to by-pass a small portion of the exhaust gases direct into the inlet pipe of the engine in order to heat the incoming charge of paraffin and air from the carburetter. When the attachment is fitted to a motor-car, these two valves are controlled from the dashboard by means of steel wires run in brass tubes, but in the case of a stationary engine the dashboard controls can be dispensed with. For controlling the electrical heater a switch and pilot lamp are provided, the second terminal being usually earthed when applied to a motor-car.

A great advantage of the "By-pass" paraffin attachment is that no petrol whatever is required for its operation, as the electric heater, which is only used for starting purposes, enables the engine to start from cold on paraffin.

Klaxon Factory Signals.

The displacement of steam power in so many of our factories by electricity has led to a demand for a powerful electric alarm operated from the existing supply, and the KLAXON CO. LTD., of 1, King Street, St. James's, S.W., has introduced a high-voltage type of the Klaxon horn, which can be employed on either D.C. or A.C. circuits at usual voltages. The sound can be heard at a distance of two to four miles, and overpowers the noise made by machinery, while it is so distinctive that it cannot be confused with any other sound. For factory signals, fire alarms, time and danger signals, engine-room signals, burglar alarms, and code signals for calling particular employes to the telephone, &c., the Klaxon is said to be particularly useful.

Reyrolle Combined Switch and Wall-Plug.

Figs. 2 and 3 show the combination of a watertight-pattern switch with a corresponding wall-plug. The switch is of box form, and is made to operate by a rotary action of the lid; it is of a design due to MESSRS FOOTE & MILNE. The watertightness of a



FIG. 2. FIG. 3.
COMBINED WATERTIGHT SWITCH AND WALL-PLUG.

metal-clad type as made by MESSRS. A. REYROLLE & CO., LTD., of Hebburn-on-Tyne, and an interlock between the two is provided so that the plug cannot be withdrawn when the switch is "on."

Fig. 2 shows the switch in the "on" position, and fig. 3 in the "off" position.

THE RÖNTGEN SOCIETY.

THE presidential address from the chair of the Röntgen Society was delivered on November 7th by the new President, Captain THURSTAN HOLLAND, M.R.C.S., of Liverpool. He devoted himself to discussing the status of the radiologist and the need for organised teaching of X-ray work and electrotherapeutics in the universities and medical schools. As showing the progress which had been made in apparatus, he mentioned that his first radiograph of the hand, taken nearly 20 years ago, required an exposure of 1½ hours, and now he was able to obtain pictures of the internal structure even of the deeper parts of the human body in a single flash. In the early days the chief desideratum was to obtain a good X-ray negative, but to-day a good negative could be obtained by anybody with modern apparatus, and it was not the photographic technique which was so important now, as the interpretation based on the photographic result. This interpretation could only be carried out by a medical man of exceptional professional attainments, and here Captain Holland made a protest against the placing of lay persons in control of X-ray departments, and against the practice, which he said was a growing one, of surgeons and physicians sending their X-ray work to unqualified people. To his certain knowledge this was done by eminent and even titled members of the medical profession. He claimed for the X-ray department that it was the most important single department in a hospital, and that the cessation of its work would paralyse the hospital's activities. The man who had charge of it must have a thorough knowledge of physics, chemistry, and electricity; he must be to a certain extent an electrical engineer, and he must be well up in medical and surgical diseases, and have more than a little knowledge of certain special diseases as well. While there could be no objection to lay assistants helping in the work of the department, he insisted that no opinion on matters of diagnosis or interpretation should be given by such assistants, no treatment carried out by them on their own initiative, and that the medical head of the department should hold the strings very firmly. He was of opinion that many of the smaller hospital X-ray installations up and down the country, in the hands of untrained medical men or equally untrained non-medical persons, were a constant source of danger to the community, and that the good they did in some cases was far more than counterbalanced by the mistakes they made in others. The time had come to enter a strong protest against the continuance of methods which allowed such anomalies to exist. As to electrotherapeutics, he said that this was becoming more and more important in every direction, and he urged the proper recognition of radiology and electrotherapeutics and the teaching

of these subjects at the hospitals and universities. In many countries this teaching had been organised already, and was being carried on in proper lines. We must not lag behind. America in particular was moving strongly from the X-ray point of view. There we ought to have a regular system of instruction in X-rays and electricity, both for medical students and post-graduates. He hoped to live to see the time when these subjects would be taught at all the universities and medical schools, their teachers having a recognised status.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

MEXICO.—The translation, recently published by the Board of Trade, of the revised Customs Tariff of Mexico—noted in the *ELECTRICAL REVIEW* of October 29th—gives the following as the rates of import duty now payable on the under-mentioned goods:—

	Rate of import duty.
Pesos. Cts.	
Bronze, brass, and white metal, in ingots or granulated	kilog. gross 0 06
Copper in ingots or granulated	Free.
Wire of common metal, insulated, of any diameter	" 0 15
Wire of copper or copper alloys, not covered, up to 2 mm. in diameter ..	" 0 15
Wire of copper or copper alloys, of more than 2 and up to 10 mm. in diameter ..	" 0 12
Articles of copper or its alloys, not specially mentioned—	
Weighing more than 10 kilogs. per article	kilog. legal 0 30
Weighing not more than 10 kilogs. per article	" 0 60
Bars of copper or its alloys	kilog. gross 0 15
Armoured and insulated cables and wire	" 0 05
Cables of insulated common metal, not armoured, and uncovered cable of copper or its alloys	" 0 10
Pipes and tubes, sheets and plates, of copper, bronze, brass or white metal ..	" 0 20
Lead in bars, pigs, or ingots	" 0 05
Zinc in ingots, flings, or grains, and wire	Free.
Lead in sheets, in tubes, or piping, and glaziers' lead	" 0 08
Zinc in sheets, not specially mentioned ..	" 0 10
Zinc in perforated sheets, for treating ores	Free
Iron or steel wire covered with cotton, linen, wool, silk, or paper	kilog. legal 0 30
Iron or steel wire more than 1 and up to 10 mm. in diameter	kilog. gross 0 09
Iron or steel wire 1 mm. in diameter or less	" 0 12
Iron or steel wire cables	" 0 02
Tale and mica	" 0 05
Insulators of glass, china, and porcelain, not specially mentioned	" 0 02
Bulbs for the manufacture of incandescent electric lamps, commutators, switches, contacts and their keys, fuses, circuit closers, rings, and detents	" 0 15
Automatic toys operated by spring, steam or electricity	kilog. legal 1 50
Electric arc lamps and separate parts thereof	kilog. gross 0 10
Incandescent electric lamps	" 0 25
Machinery of all kinds for industrial purposes, and parts thereof	" 0 02
Belts for machinery, of rubber, and of tarred cotton or hemp	" 0 20
Rubber footwear	kilog. legal 1 00
Rubber in sheets of all kinds	" 0 12

Gross weight is the weight of the goods with all receptacles and wrappings, both interior and exterior. Legal weight is the weight of the goods, together with the receptacles, wrappings, bottles, and boxes of cardboard, wood, or tin in which they are packed inside the exterior cover containing them all. 100 centavos = 1 peso = 2s. (par value).

PHILIPPINE ISLANDS.—Regulations in regard to the administrative procedure to be followed in dealing with articles imported into the Philippine Islands through the mails, are contained in a recent Customs Administrative Circular (No. 737), the text of which can be seen at the Department of Commercial Intelligence, 73, Basinghall Street, E.C.

ARGENTINE REPUBLIC.—By a recent decision of the Customs Authorities, cardboard tubes for posting catalogues, &c., are dutiable on importation at the rate of 27 per cent. of the declared value.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled, according to this journal by MESSRS. W. P. THOMSON & Co., London, Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Belfast.

- 15,434 "Electricity in W. Jones." F. DOWNS & W. G. YOUNG, October 30th.
- 15,435 "Electricity in W. L. WATER, October 30th (U.S.A., March 17th, 1915).
- 15,436 "Improvements in electrically-propelled rail and road vehicles, applicable also to stationary driving purposes." J. S. WILSON & J. M. WILSON, October 30th.
- 15,437 "Sprocket key mechanism." W. FRACHELLE, October 30th.
- 15,438 "Igniters for internal-combustion engines." L. F. ALFORD & W. B. THOMSON, October 30th. (U.S.A., October 28th, 1915.)
- 15,439 "Wireless telephone systems." THE BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.), October 30th.
- 15,440 "Dynamo-electric machines." R. L. CHAMBER & H. F. POLLS, AND S. S. SWEET, Ltd., October 31st.
- 15,441 "Portable telephones." H. W. SCOTT, October 31st.
- 15,442 "Electric heat radiators." A. F. BERRY, October 31st.
- 15,443 "Electrographic methods and devices." J. SHEARER, October 31st.
- 15,444 "Electric circuit controlling devices." SOC. FRANCAISE RADIO-ELECTRIQUE, October 31st. (France, November 11th, 1915.)
- 15,445 "Dry batteries." BRITISH LACE-READY CO. & A. H. SHEPARD, October 31st.
- 15,446 "Radiotelegraphy and radiotelephony." SOC. FRANCAISE RADIO-ELECTRIQUE, October 31st. (France, December 8th, 1915.)
- 15,447 "Morse signalling apparatus." H. S. DICKSON, November 1st.
- 15,448 "Electric arc lamps." A. E. ANSON & A. H. RAINE, November 1st.
- 15,449 "Fuses for electric circuits." F. B. HOLT & H. SMITH, November 1st.
- 15,450 "Commutators for dynamo-electric machines." A. M. ALLEN, November 1st.
- 15,451 "Processes of making laminated articles." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. (Westinghouse Electric & Manufacturing Co., U.S.A.), November 1st.
- 15,452 "Terminal attachment to counterbalance sparking-plug electrode against centrifugal force on rotary aeroplane engines." H. HUMPHREYS, November 2nd.
- 15,453 "Electrolytic manufacture of metals and/or alloys." E. A. ASH-CROFT, November 2nd.
- 15,454 "Magneto separators." O. C. JONES, November 2nd.
- 15,455 "Electrolysis of fused electrolytes." E. ASHCROFT, November 2nd.
- 15,456 "Wireless telephone systems." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.), November 2nd.
- 15,457 "Locking device for magneto-electric machines." G. W. BARNES, H. KIRK & G. WESTON, November 2nd.
- 15,458 "Sparking plugs." C. WILCOX, November 3rd.
- 15,459 "Production of electric light." J. F. SPURLOCK, November 3rd.
- 15,460 "Electrostatic induction machine." W. S. FROST, November 3rd.
- 15,461 "Electric heating and tempering." SNEAD & CO. IRONWORKS, November 3rd. (U.S.A., June 14th.)
- 15,462 "Electric welding." S. Z. de FERRAZ, November 3rd.
- 15,463 "Dynamo-electric machines." A. H. MIDDLEY & C. A. VANDERVELL & Co., November 3rd.
- 15,464 "Electrical device for giving warning when gas pressure is reduced." T. G. MOORE, November 4th.
- 15,465 "Switchboards, and manufacture thereof." W. N. RINGROSE, November 4th.
- 15,466 "Protective devices for electric circuits." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.), November 4th.
- 15,467 "Telegraph key." C. N. de HOEDT, November 4th.
- 15,468 "Magnets." SOC. ANON. APPAREILLAGE ELECTRIQUE GRIVOLAS, November 4th. (France, December 27th, 1915.)
- 15,469 "Inexpensive electric batteries." P. D. HOLLINGS & ACCUMULATORS, Ltd., November 4th.
- 15,470 "Insulators for sparking plugs." J. F. BOTTOMLEY & L. SAMPLE, November 4th.

PUBLISHED SPECIFICATIONS.

1914.

- 15,361. SIGNALING ON RAILWAYS BY DETONATORS. Compagnie de Signaux Electriques Pour Chemins de Fer, June 9th. (France, June 27th, 1913.)
- 16,340. SYSTEM OF CONNECTIONS FOR TELEPHONE INSTALLATIONS IN WHICH THE WORK OF THE OPERATORS IS SUPERVISED FROM SPECIAL OBSERVATION PLACES. E. C. R. Marks (Siemens & Halske), July 8th.

1915.

103. DYNAMO-ELECTRIC MACHINES FOR TRANSFORMING ALTERNATING CURRENTS INTO CONTINUOUS CURRENT OR VICE VERSA, AND APPLICABLE ALSO AS DOUBLE CURRENT GENERATORS. J. la Cour, January 4th. (January 2nd, 1914, Sweden.)
- 14,482. PROTECTIVE DEVICES FOR ELECTRIC DISTRIBUTION SYSTEMS. British Thomson-Houston Co. (General Electric Co., U.S.A.), October 13th.
- 14,490. PROCESS FOR THE MANUFACTURE OF HOLLOW SHAPES FROM PHENOL AND FORMALDEHYDE. F. Pollak, October 13th. (Convention date not granted.)
- 14,498. TIME-LIMIT ELECTRIC CIRCUIT BREAKERS. Akt. Ges. Brown, Boveri & Cie., October 13th. (November 30th, 1914, Germany.)
- 14,503. INTERRUPTERS FOR INDUCTIVE ELECTRIC CIRCUITS. Harry W. Cox and Co., J. P. T. Bruggekatte, October 13th.
- 14,553. GALVANOMETERS. H. W. Sullivan, October 14th.
- 14,633. DYNAMO-ELECTRIC MACHINES. F. A. Heys (Neuland Patents, Ltd., U.S.A.), October 16th.
- 14,643. DYNAMO-ELECTRIC MACHINES. F. A. Heys (Neuland Patents, Ltd., U.S.A.), October 16th.
- 14,729. ARRANGEMENT OF CIRCUITS FOR THE TRANSMISSION OF AETHER WAVES, e.g. THOSE USED IN WIRELESS TELEGRAPHY. A. W. Long, October 19th.
- 14,851. MAGNETO-ELECTRIC MACHINES. British Thomson-Houston Co. & G. J. Ralph, October 20th.
- 14,885. DYNAMOMETERS. Heenan & Froude, Ltd., H. Heenan & G. H. Walker, October 21st.
- 15,112. PROCESS FOR MANUFACTURING TELEPHONE INSULATORS AND SIMILAR OBJECTS. P. SIMONIN, October 26th. (November 13th, 1914, Denmark.)
- 15,633. PROTECTIVE DEVICES FOR ELECTRIC CIRCUITS. British Thomson-Houston Co. (General Electric Co., U.S.A.), November 3th.

THE

ELECTRICAL REVIEW.

Vol. LXXIX.

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ELECTRICAL REVIEW.

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's)

1916 EDITION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE inaugural address of Mr. A. E. McKenzie, Chairman of the Manchester Local Section of the Institution of Electrical Engineers, deals with a number of the topics with which the electrical industry is at present preoccupied, and contains some information of exceptional interest. The rapid development of the Manchester electrical undertaking, which is unable under present conditions to keep pace with the demand, presents a remarkable record, and it is interesting to observe that the 3,750-kw. generating sets—the finest in the country when they were installed—are giving place to 15,000-kw. turbo-alternators. Such is the march of progress. Mr. McKenzie recalls the opinion of a well-known central-station engineer at that time, that the 3,750-kw. sets were more than twice too big; we did not think so, however, and in describing the great extensions which were then taking place at Manchester (July, 1903), we expressed our confident belief that, although the huge scheme of public lighting by electricity had fallen through, and the new plant was therefore for the moment superfluous, the industrial area served presented such magnificent possibilities that the output would "very soon increase to an enormous amount, sufficient to tax the resources of the whole of the plant"—a prediction which has been abundantly justified by the event. Since then the capacity of the plant has been further increased, from 30,000 kw. to 73,500 kw. now, shortly to be raised to 93,000 kw., and while the output during the past twelve months was 196 million units, an output of no less than 300 million units is expected within the next five years. The results already attained are excellent, and Mr. Pearce and his staff are entitled to our congratulations.

The proposal to install electrochemical works in conjunction with public supply systems is so obviously a desirable policy that it has often been advocated, but, unfortunately, rarely carried out. There are some instances where it has been adopted, as on the Tyne, for example. The first requisite is a cheap supply of electrical energy; the second, enterprise and the will to collaborate on both sides; and the third, the necessary capital. While the last two items are not restricted as to locality, the first can be realised only where electricity is generated on a vast scale, and thus progress in this direction has taken place at few British centres up to the present. The fact that a consumer whose demand for electrochemical purposes will exceed that of any other consumer, not excluding the tramways, has just been connected to the Manchester Corporation's mains is highly significant; it will require no extension of plant, the demand being kept off the peaks, and therefore the capital charges per unit will be minimised, to the great advantage of the undertaking and its ordinary consumers. The example is one worthy of imitation wherever circumstances render it possible, and in the increased attention which is now, and still more in the future will be, devoted to the production at home of chemical compounds for which we have hitherto been dependent mainly upon Continental sources we see the opportunity to develop this type of load on a large scale.

We are glad to see that Mr. McKenzie recognises the great importance of economy in the boiler-house, which he rightly regards as the department

of a power station where, at present, there is the widest scope for improvement. The boiler-house is usually a dirty, gloomy place, from which the engineer is glad to escape to the palatial engine-room; out of sight, out of mind—it is the old story, with the inevitable consequences. We do not accuse station engineers of deliberately neglecting their duties with regard to the plant which constitutes the very *fons et origo* of the energy which they distribute; but we do hold that as it is a more congenial occupation to study every possibility of increasing the efficiency of the handsome plant which adorns the engine-room, where an engineer feels that he is in his own element, rather than to potter about hot and dusty boilers seeking for air-leaks, criticising coal, examining ashes, and analysing smoke, the former has naturally had the preference. It is in the boiler-house that great changes may be looked for in the near future, and elsewhere in this issue we have endeavoured to focus attention upon certain features of design which appear to us to cry out for amendment. Cleanliness and light are amongst the foremost requirements, but there are several other particulars in which the modern boiler-house is far from ideal. As in other walks of life, "fashion" here plays a great part in moulding design and hindering progress; nowadays, however, new ideas are more readily taken up, as in the case of the rotary pump and the geared turbine, and we see in the Walsall power station the evidence of enlightened ideas on coal storage and boiler-house construction. Further comments on this subject will be found in the article above-mentioned, which we commend to the notice of our readers; but, returning to Mr. McKenzie's paper, we welcome his reference to the future adoption of gas-firing for boilers and the installation of by-product recovery plant, which will not only reduce the waste of valuable materials, but will also go a long way towards the evolution of the bright, clean, and efficient boiler-house that we have in our mind's eye. We have not forgotten that gas-firing implies producers, but the conditions under which the latter operate are so widely different from those of steam boilers that they stand upon another footing altogether.

The Edinburgh Tramway Report.

It is somewhat of a novelty at the present day to find an important city in our midst discussing what system of tramway traction it shall adopt, and under the circumstances considerable interest attaches to the up-to-date review of the situation contained in the expert report, prepared jointly by Messrs. Brodie, Hamilton, and Horsburgh-Campbell on the instructions of the Edinburgh Corporation, on the future of the tramways in that city.

To be sure, Edinburgh has been wrestling, circumspectly, in Scottish fashion, with this question for many years, so much so, in fact, that one has a feeling that Edinburgh without a tramway problem would be equivalent to Edinburgh without a Princes Street, which is probably an accurate statement of the case. For to the jealous eye of the City Father Princes Street is, to all intents and purposes, Edinburgh, and to secure the amenities of this admittedly charming thoroughfare against the real or imagined depredations of those who had overlooked this fact, the city has been condemned to an obsolete tramway system long after it had outgrown its possibilities for passenger transport.

It is, therefore, to be hoped that the latest report will assist the city authorities to a final decision; the expiration of the lease of the present cable system in June, 1919, barely leaves them time, judging by past experience. As might be expected, the report views

unfavourably any system of street traction other than the overhead trolley; it even discusses the possibilities of the motor 'bus, although this was not specifically asked for by the Corporation and, in deference to the already mentioned sentimental prejudices of the latter, considerable pains are taken to explain that the overhead trolley system is in operation in, dare we say, equally charming localities, without, so far as we know, suicidal results.

It is unfortunate for Edinburgh that the Princes Street line forms a sort of wasp-waist for the whole tramway system; had there been alternative connecting routes across the centre of the city, it is probable that the exaggerated views as to the importance of this one-sided shopping thoroughfare—from the utilitarian standpoint—would for economic reasons have been dispelled. The idea that a motor 'bus service could be constituted to provide the whole of the public street transit requirements of a large city has not, we believe, found acceptance in any responsible quarter as yet, though, doubtless, irresponsible admirers of such a project exist, and it is therefore well that this hypothetical alternative has been considered in the report. Admirers of the motor 'bus appear to forget that its nimbleness is mainly due to its restricted carrying capacity, which latter is precisely the cause of its rejection for the situations where rush-hour traffic has to be dealt with.

Of course, we do not know what the future may bring in the way of more efficient propelling machinery, but it is at least certain that the bulk of the average passenger will remain fairly constant, and that, therefore, any attempt to increase the carrying capacity of an individual 'bus must result in a vehicle as unwieldy as the 'bus enthusiast alleges the tramway car to be, and in the sacrifice, to a large extent, of the mobility and nimbleness which are claimed as its attractive features. Nevertheless, a self-contained vehicle, such as the 'bus, whether driven by petrol, steam, or electricity, can perform valuable functions as an auxiliary traffic carrier, and this is duly recognised in the report.

Of course, it may be that the "amenities" of the city—the name "Auld Reekie" comes to mind though, no doubt, this was before the days of electricity supply—coupled with recent developments in aviation, will be sufficient to influence a further postponement of the question, which during, say, the next 25 years, should offer endless possibilities in the way of expert reports, discussions by City Fathers, and last, though probably by no means least, municipal by-elections.

Trouble with A.E.G. Turbines.

THE report of Mr. T. H. U. Aldridge, engineer-in-chief to the Shanghai Electricity Department, on the breakdown of a 5,000-kw. A.E.G. turbo-alternator in the Riverside station, which we abstracted in our issue of July 21st, has called forth a reply from the local agents of the makers, who advance various possible reasons for the disaster; all their excuses, however, are easily refuted by Mr. Aldridge. Referring to this and other A.E.G. turbines, he remarks that "the turbine plant is most unsatisfactory," whereas the six British machines, although from five to nine years in service, are in excellent condition. For want of space we must defer detailed reference to the subject to a later issue, but may add here that at Melbourne and Sydney also A.E.G. 5,000-kw. turbo-alternators have revealed similar defects which have led to serious trouble. Numerous other cases of failure of German turbo-alternators, transformers, and switchgear were recently reported in the *South African Mining Journal*, and it would appear that German plant is rapidly earning a very evil reputation, not owing to the war, but to its own bad qualities.

THE WALSALL EXTENSIONS.

On October 31st the new Birchills generating station of the Walsall Corporation was formally opened by Mr. D. Hayward, chairman of the Electricity Committee; the extension scheme as a whole, including the above plant, has cost some £75,000.

The first public supply of electricity in Walsall was commenced in 1893, the "Oxford" system being adopted, with

example of modern power-station design, incorporating certain novel features of great interest. The present buildings are intended to accommodate 12,000 kw. of generating plant in three sets, and this is equivalent to 10 kw. per sq. yd. occupied, which, it is interesting to note, as indicating the progress being made, compares with 5 kw. per sq. yd. in the case of the Radcliffe station of the Lanca-

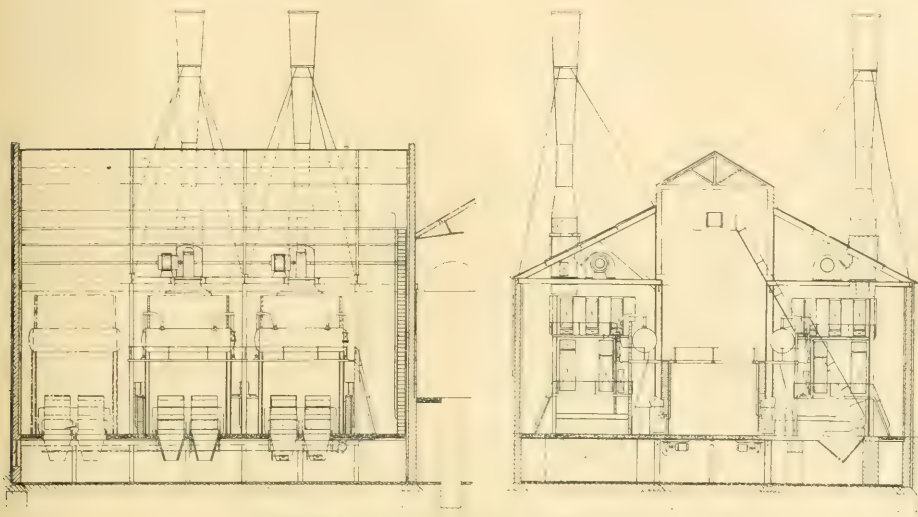


FIG. 1.—VIEWS SHOWING ARRANGEMENT OF SELF-CONTAINED BOILER UNITS.

H.T. direct-current generation at 2,000 volts and motor-generator sub-stations supplying a 105-volt, two-wire distribution.

Five years later, a 210-volt distribution was commenced to outlying portions of the borough, and plant was installed for supplying the Corporation tramways. In 1910 and 1911 the first move in the direction of modern industrial supply was made, two 500-kw. turbo-alternators being installed in the old Wolverhampton Street station, for the supply of three-phase energy at 3,300 volts, 50 cycles, in the Bloxwich district, a central rotary converter sub-station being also installed in Darwall Street.

Apparently it was then appreciated that the old station and system of supply handicapped the progress of the undertaking, being quite unsuited for the production of cheap electric power, and, in view of the necessity of further extensions, expert advice was obtained, and the present scheme put in hand.

The complete scheme, which includes the generating station; a three-phase transmission system at 6,600 volts to various sub-stations; rotary transforming plant at the latter to supply the direct-current areas, and the changing-over of the latter from the original two-wire to a three-wire system, with double the pressure across the outer conductors; also the laying of a H.T. network for the supply of large power users, was recommended to the Council in 1913 by Mr. E. M. Lacey, who had been called in to investigate the situation, and that gentleman has acted as consulting engineer in connection with the work.

The Birchills station, comprising boiler and engine houses, with switch annexe, tank room, &c., is constructed in steel and brickwork, and may be regarded as a typical

shire Power Co., which was designed for 6,000 kw capacity, and, going further back still, only 1.6 kw. per sq. yd. in the case of the original reciprocating engine and Lancashire boilered station of the Salford Corporation, which was also designed for 6,000 kw. plant capacity.

The boiler house is designed to accommodate six boiler

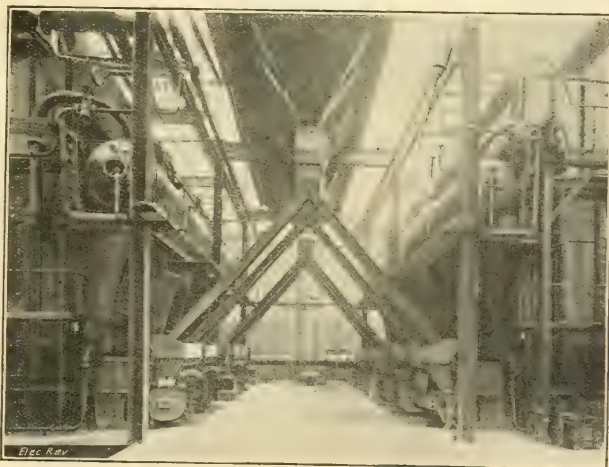


FIG. 2.—INTERIOR OF BOILER HOUSE, SHOWING SMALL OVERHEAD BUNKERS.

units, three on either side of the central aisle; four boiler units have been installed, each comprising a marine type Babcock boiler with integral superheater, a superimposed economiser, induced-draught plant driven by a 30-H.P. motor, and steel chimney of the Venturi type, also a chain-grate stoker. Each of these steam units is designed for a normal evaporation of 26,000 lb. of water per hour from a

feed temperature of 100 F. entering the economiser, to steam at 185 lb. pressure, with a total temperature of 630 F.; on high duty 30,000 lb. of steam per hour can be raised.

The arrangements for coal handling are also somewhat

hopper and measuring apparatus in the chutes leading from the bunkers to the stoker hoppers.



FIG. 3.—ARRANGEMENT OF COAL-HANDLING PLANT.

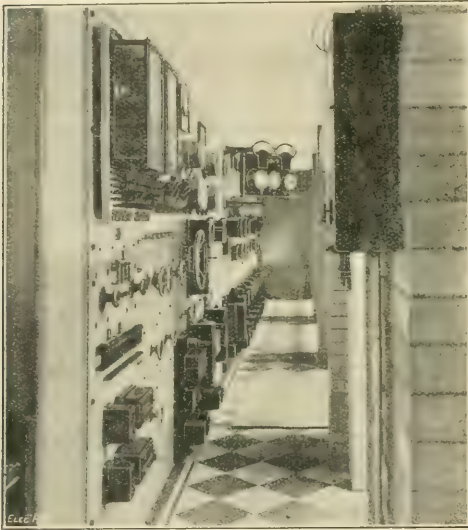


FIG. 4.—E.H.T. SWITCH CONTROL PANELS.

novel, and, in addition to being much less costly than the usual larger capacity overhead bunker construction, they enable plenty of daylight to penetrate into the boiler house, a feature which, in the past, has not always received the attention it deserved; it may also be here mentioned that at the Birchills station the whole of the boiler house is glazed with wired glass. Coal is delivered in barges on the neighbouring canal, being transferred by an electric jib crane having a 40 cb. ft. capacity grab, to the hopper of a bucket conveyor, which runs for a considerable distance on an elevated structure over a coal-storage yard, then passes along the roof of the boiler house, and returns over miniature steel bunkers holding some 10 hours' supply, finally being led down the end wall of the boiler house and under the storage yard.

The yard, which will accommodate some 3,000 tons of coal, is suitably formed with concrete flooring sloping to chutes, under which a travelling filler can be placed to feed the conveyor, thus providing for the alternative handling of the coal either direct or from storage to the boiler house. The capacity of the conveyor is 30 tons per hour, and it is driven by a 10-H.P. motor. An Avery weigher is provided at the receiving

The coal is South Staffordshire unwashed slack, of 11,000 B.T.H.U. cal. value.

Two Weir 8,000 gallons per hour, steam turbine-driven centrifugal boiler feed pumps are installed, these exhausting into a boiler feed heater.

The engine house is designed to accommodate three 1,000-kw. Belliss-Siemens turbo-alternators; two such sets have been ordered, but only one has been erected. The turbines are of the compound horizontal impulse type, ex-

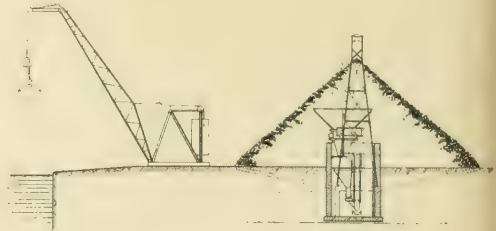


FIG. 5A.—GRAB CRANE AND CONVEYOR HOPPER.

hausting direct into the contraflow surface condensers in the basement; a rotary air pump, ejector and centrifugal circulating pump set driven by a 95-B.H.P. three-phase motor is provided to each condenser. It may be added that the canal will supply the necessary circulating water for up to 8,000 kw. maximum demand. The turbines, which operate at 3,000 R.P.M., are coupled to three-phase 6,600-volt, 50-cycle alternators, the rotor fans of which draw cooling air from outside through a dry filter and connecting ducts.



FIG. 5.—VIEW OF E.H.T. SWITCHGEAR.

and discharge it into the engine room. The alternators have a normal full-load rating of 5,000 K.V.A. and an overload rating of 6,250 K.V.A. for two hours, and are direct coupled to their exciters.

The E.H.T. switchgear, of the Reyrolle ironclad type, situated on a gallery, consists of three generators and seven 1,500-kw. feeder panels; duplicate bus-bars are provided with a non-automatic interconnecting switch for coupling them. The Merz-Price system is employed for generator protection. The system is earthed through an earthing transformer direct connected to the bus-bars, and duplicate batteries are available for operating the E.H.T. trip gear. A new system of E.H.T. cables, designed for Callender-Waters earth leakage protection, has been laid down by Messrs. Callender, linking up several sub-stations in various parts of Walsall.

The rotary-converter plant, consisting of two 500-kw. and three 250-kw. machines, was supplied by Messrs. Siemens Dynamo Works.

Five 500-kw. static transformers, and the whole of the

Not only has considerable space economy been effected in the new station, but its initial cost (£7 12s. per kw., which will fall to under £7 when 12,000 kw. are installed) is low—a feature of particular importance in an industrial area, where cheap electricity is essential to prosperity.

In conclusion, we are indebted to Mr. H. A. Howie, the borough electrical engineer and manager, and to Mr. E. M. Lacey, in accordance with whose designs and specifications the scheme has been carried out, for the particulars here given; also to Messrs. Babcock & Wilcox for drawings of the boiler and conveyor arrangements.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

ON Tuesday last week, Mr. A. E. MCKENZIE, Chairman of the MANCHESTER LOCAL STATION, read his inaugural address, dealing with several general topics, the more or less direct outcome of the present war. His remarks are abstracted below:—

Organisation of Engineering Industries.—Much has been written in the daily Press, and in every technical journal, regarding the re-organisation of British industries. One association alone which has been recently formed represents firms having an aggregate capital of over 150 millions sterling. Such a powerful association cannot fail to bring considerable influence to bear in many directions upon the trading conditions of the Empire. We know that



FIG. 6.—GENERAL VIEW OF SWITCH GALLERY.

E.H.T. and L.T. switchgear for nine sub-stations, have been supplied by the British Westinghouse Co.

Two transformers installed in the Birchills power station convert three-phase current from 6,600 to 375 volts for use in motors driving the station auxiliaries; two others are used to step up a 3,300-volt supply from the 500-kw. turbo-alternator sets in the old power station to 6,600-volt supply for use on the new extra-high-tension distribution system, while a fifth similar transformer is installed to convert from 6,600 to 3,300 volts to feed an existing switchboard and distribution network. All the transformers are of the oil-insulated type, designed with ample overload capacity.

The E.H.T. sub-station switchgear is of the sheet-iron cubicle type; the panels are fitted with red and green indicating lamps, amperemeters, contacts for voltmeter and synchronising plugs, and suitable relays affording automatic protection to rotaries and feeders, and in the event of a feeder being cut out through excessive overload, preventing interruption of supply to other feeders; the oil-break switches are of large breaking capacity.

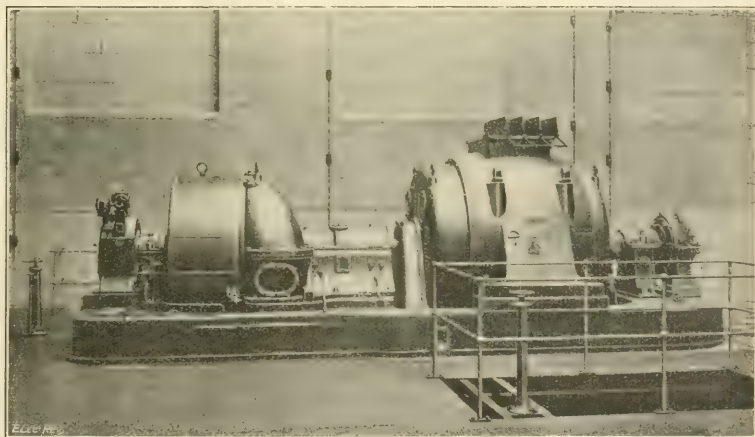


FIG. 7.—4,000-KW. BELLISS-SIEMENS TURBO-ALTERNATOR SET.

the six leading Engineering Societies of the German Empire have amalgamated expressly for the purpose of recapturing their foreign trade which, through the invincible British Navy, has been cut off from them as it were by the stroke of a knife. It is the duty of each and every one of us to see to it that no effort is spared to prevent them recapturing this trade. It has been abundantly proved that the engineering firms of this country can supply all our requirements of equal, if not better, quality than our Continental neighbours could supply, from a turbo-alternator to a lamp. If the purchasing engineers of this Empire, as distinct from those engaged in manufacturing, remember after the war the sentiments that most of us now feel, there is no doubt that the British engineering industry will soon attain that position to which it is justly entitled.

This is not said to imply that British manufacturers have

in the past done all that they should to cater for the requirements of, say, the electrical engineering industry. To cite one case only, that of turbine rotor disks. Practically all these came from abroad before the war, mainly because the steel makers of this country would not adapt themselves, or lay their works out, for this class of business. The particular case cited is an important one, for if the British steel makers after the war will not take up this line it is bound to have a marked effect in determining the type of turbine to be employed in the future, especially for large units.

Linking-up of Power Stations.—It seems to be the general opinion of the members of this Section that the interconnecting of most of the existing stations should precede the building of a few large super-stations, from which bulk supplies would be furnished.

The personal factor is very important in cases of this kind, where negotiations have to be carried out. Some engineers are more easily converted than others, who may be afraid of loss of prestige, and even of position, through the association of their undertakings with larger ones. The latter view is not really a sound one. Whilst the distribution of electricity remains in the hands of each existing undertaking, there will still remain scope for the services of an engineer-manager. The advantages of any linking-up scheme are by no means confined to the larger undertakings.

It is to be hoped that the Government will assist to some extent in the raising of the capital necessary for the carrying out of the work, seeing that the estimated annual saving therefrom is approximately 30 per cent.

The Summer-Time Act.—Although as a result of the operation of the Summer-Time Act the output from many supply stations has been considerably reduced, there can be no doubt whatever that, from the national financial standpoint, it has been an unqualified success. In Manchester the Act has led to marked benefits to domestic users. An examination of four residential districts reveals a saving of some 15 per cent. On the other hand, in certain industrial and shopping districts a similar examination reveals an increase of some 8 per cent. In the latter case the increases are due to war-work and revival of retail trading.

It is estimated that the reduction in lighting output from the Stuart Street station for the period covered by the Act was equivalent to 1 per cent. of the total output, while the consequent saving in coal was about 600 tons. At the other Manchester Corporation stations the reduction was approximately 1½ per cent. of the output, with a saving in coal of about 400 tons.

Supplies of Electricity for War Purposes.—The past year has been a strenuous period with all supply undertakings. The output from the various stations situated in all the large manufacturing centres of the country has gone up by leaps and bounds.

The following figures relating to the Manchester electrical undertaking are doubtless typical of what other large undertakings are experiencing. The total plant capacity installed at the three stations to date is 73,500 k.w., and when the plant now under construction is completed will be 93,000 k.w. Included in the latter is another 15,000-k.w. turbo-alternator for Stuart Street station, and a 10,000-k.w. ditto for Bloom Street station. These sets will displace reciprocating units of 3,750 k.w. and 1,800 k.w. respectively.

I remember a well-known central station engineer remarking to me about 12 years ago, when the 3,750-k.w. sets were being installed, that it was a mistake to put down such large units, and that additional 1,500-k.w. sets would have been far better.

During the year ending March last the present 15,000-k.w. set at Stuart Street station generated some 90 million Kelvins. The total number of Kelvins generated during the year ending September last was 196 millions. This was an increase of 27 millions, or 16 per cent., over the quantity generated during the previous year. This increase, however, will be greatly exceeded during the current year, as the increase of power demands has already exceeded all previous records.

It can safely be predicted that the annual output from the Manchester stations will within the next five years reach 300 million Kelvins.

Electrochemical Demands.—The establishment of electrochemical plants in this country is essential, and steps are already being taken to secure the independence of the country in these essentials. Many of these plants can be adapted to take a restricted-hour supply during the winter months of the year, thus furnishing an ideal load for central stations. One such consumer has just been connected to the Manchester undertaking whose demand will far exceed that of any other on the system, not excluding the entire tramway demand. This supply will be given by the Corporation without the latter having incurred any capital outlay on plant to supply it, because over the peak of the winter load, viz., from 3.30 p.m. to 5.30 p.m., and at any other times of severe atmospheric conditions, the consumer has arranged to reduce his load to zero if required. Otherwise the demand will be continuous night and day. There are several other large consumers on the system taking a restricted-hour supply. Such desirable consumers are, of course, rightly entitled to the lowest possible rate per Kelvin.

Fuel.—Great difficulty has been experienced by both gas and electricity supply undertakings during the past year in obtaining their necessary supplies of fuel, even where it could be proved that practically the whole output was for war work.

There is no doubt that additional legislation is required to enable our electricity stations to obtain coal in sufficient quantities for their needs and at reasonable prices.

The fuel that is procurable to-day is inferior to that obtained before the war from the same pits, because of the greater percentage of the dirt content. A large proportion of the total fuel now offered was until recent years unsaleable. During the late coal strike more than one large electricity undertaking was only enabled to keep running by burning fuel which had been thrown on the rubbish tip in preceding years. To burn such inferior fuel called for conditions different from those previously obtaining in most stations, but higher draught and modern grates suggest that frequently the lower grades of fuel can be used economically.

The high prices now obtaining for all classes of fuel undoubtedly call for the more efficient management of our boiler houses, where more can be done to improve the economical working of a supply undertaking than in any other department. The man in charge of the working of a large boiler-house should be an engineer of exceptional ability and should be well paid. The salary of such a man is a very small fraction of the saving he will effect. To him should fall the duties of seeing that combustion is obtained as perfectly as circumstances will allow; also that correct gas, water, and steam temperature are maintained.

The indispensability of the analytical chemist in electricity undertakings of any magnitude is not yet sufficiently recognised. Only by regular testing can one ensure getting fuel of anything approaching constant quality from most collieries, and the knowledge that such tests are made is usually sufficient to make contractors careful in sending supplies to works where this practice is followed. Nor should the chemist's efforts be confined to raw fuel tests. He should be responsible for the correct treatment of the feed water, and for seeing that scale and corrosion in the boilers are prevented, and the like.

Power Stations of the Future.—The large station of the future will, I believe, have a proportion of boilers gas-fired, the proportion being based upon the load factor in such manner that the extra capital incurred by the installation of by-product recovery plants will be remunerative, and the by-products of the bulk of the fuel used recovered.

Skilled analysis and extensive experience tend to show that with improved forms of producers the aggregate value of by-products recoverable from coal by conversion to gas equals or exceeds the original coal value, and when extra capital and labour charges are taken into account, the procedure leads to a substantial rebate on fuel costs.

There were isolated cases on record, in the days when slack could be bought at 6s. or 7s. per ton, where large boiler installations were fired throughout the year substantially for nothing, and as the value of the various by-products fluctuates largely in sympathy with coal values, one might expect a net saving by the system of between 4s. and 7s. per ton of coal consumed.

Gas firing has not yet had its fair chance, in that practically every trial has been conducted with Lancashire or water-tube boilers converted. There is a fine field open for the invention of the large and highly efficient gas-fired unit. The researches of the late Prof. Nicholson might be pursued in this connection.

Obvious advantages incidental to gas firing will be the utilisation of poorer grades of coal, and clean, comfortably controlled, smokeless boiler-houses, involving low maintenance charges.

It seems not improbable that British engineers will aim at increasing the size of individual boiler units in the future, whilst decreasing the number to be installed. It is, however, a moot point whether American engineers have not gone too far in the direction of the size of unit employed, and the duty expected from it. The higher efficiency of American boiler plant is by no means established. A compromise between the two somewhat conflicting views would appear to be the correct line on which to develop the new stations that are planned in this country. The proposed use of large gas-engine-driven generators is now clearly a thing of the past. Their manufacture was never taken up very seriously in this country. Turbine plants undoubtedly hold the field, and in the near future one may confidently anticipate seeing units of 20,000–25,000 k.w. installed in some of our large British stations.

Electrification of Railways.—During the last year or two most of the large railways have converted portions of their suburban traffic from steam to electric operation, and there is no doubt that many similar conversions will be tried before electric traction is generally adopted for the main-line traffic.

I believe that no two of the recent schemes are identical, and I cannot help feeling that in the light of our present knowledge it is perhaps just as well that it is so.

Without doubt standardisation is desirable, but to standardise an article or system whilst almost daily radical improvements are being made would seem to be a great mistake. If each system is developed and given a fair trial, the best will soon demonstrate its superiority over the others; then let the Government legislate to enforce the adoption of this particular system in the future, to ensure through running on all railways.

Rate Relief.—The war has served to bring into prominence again the vexed question of rate relief from the trading departments of municipalities. In these days of a 5s. income-

tax, and with the possibility of an increase even on this figure, surely the time has come for a drastic revision of the methods followed by many municipalities of exacting large sums of money by way of rate relief from the trading departments. So staunch a supporter in the past of the principle of rate aid as the *Accountant*, in a recent issue wrote as follows:—

"Our own view is that ratepayers are entitled to be remunerated for their financial guarantee; but we would put such remuneration on a basis of a sum not exceeding $\frac{1}{2}$ per cent. upon the outstanding loans for the time being. We think that any municipality applying profits in excess of that amount towards the relief of rates is abusing its position."

This extract is, I submit, significant of the change in public opinion. Most engineers are agreed that the nearer electricity supplies are furnished to cost price the better for the community at large.

As an alternative, it would not be unreasonable for the ratepayers at large to stipulate that the supply undertaking should, in addition to providing for debt redemption, at the same time make some provision over an extended period of years for a renewal of the assets of the undertaking when worn out, so as to avoid recourse to borrowing. To place a figure on this "extended period of years" is a question that requires very close consideration, as obviously it would not be fair to burden present consumers for the benefit of posterity.

In the course of his inaugural address as Chairman of the NEWCASTLE LOCAL SECTION, Mr. H. W. CLOTHIER paid a tribute to those men who had nobly answered the first calls from the Army and Navy at the commencement of the war, and said that the way in which the majority of the manufacturing industry had to fight at the present was to multiply their output and to develop for the future. The stigma of a selfish motive which in pre-war days seemed to hover round the manufacturer who spoke of his productions was, or should be, now removed. The increase of output from every place was now the common national cause. The perfection of British productions, both now and in the future, affected the life of the nation, and so he thought he need make no excuse for selecting as the subject of his address the Development of Armour-clad Switchgear of the "Draw-out" Type. He suggested that this type of gear was not only of British origin, but an embodiment of British characteristics, and that the demands of those who set the standard had as much claim upon what credit there was in the development as the manufacturers themselves.

The leading features in the development had been:—

1. The oil-break switch.
2. The ironclad enclosure of conductors.
3. The "draw-out" principle.

Each of these three features was of very early British origin. With the aid of lantern slides he illustrated an oil switch attributed to Mr. Partridge, which was used on cable mains in 1892. Another was used by Mr. Ferranti on power-station switchboards in 1894-5. The use of ironclad pillars for generators was introduced by Mr. Raworth about the same time, and shortly afterwards the "draw-out" principle, or the easy detachment of complete working parts, was initiated on the Ferranti slate-cell gear. Ten years afterwards these main features were assembled on the gear then known as the "ironclad" type, and at the same time a further feature, viz., the enclosure of bus-bars run in solid with compound, first published by Highfield, made possible a more complete enclosure, each conductor or limb of the apparatus being screened by armour.

He indicated the progress that had been made in the last decade, showing designs prepared in this country by several manufacturers, including Westinghouse, Siemens, B.T.I.L., Holmes, Switchgear & Covans, Epstein Heap, Electrical Apparatus, and Reynolds.

All the designs might be said to have one common purpose, viz., to meet the demand for apparatus solid and substantial in its construction, and reliable in operation; and, though perhaps more expensive than some other types of switchgear, it had the humane feature of affording the maximum protection to life. As there was a similarity of purpose, so there was a similarity in designs, and though standardisation might be too ideal to consider at the moment, he thought it was not an impossibility, particularly for 3-phase 440- to 3,000-volt use.

It had been said in a recently-published book that ironclad "draw-out" gear was "suitable for mining and sub-stations, but with control-board requirements of a central station the arrangement no longer possesses the advantage of simplicity." He did not agree with this statement as, in cases where a control board was requisite, the design of the control board presented no more difficulties with armour-clad gear than with any other form of gear; in fact, in some instances the control board had been considerably simplified on account of the use of armoured gear.

Dealing with larger switchgear, Mr. Clothier said he thought the near future would decide in favour of the use of the armoured principle for all sizes of plant and power stations. He illustrated examples of large power-station switchgear, and said that the chief problems were:—

The necessary strength of the enclosure of actual circuit-breaking parts under the heaviest stresses which may occur due to the breaking of short-circuit currents

The prevention of static discharge and arcing across conductors.

The perfection of all contacts and their surroundings to enable every one to carry the enormous currents which might occur in practice in the event of short-circuits between phases.

The elimination of all conductors which were of insufficient size to bear the stresses and currents which they might be called upon to carry under short-circuit conditions.

He saw no limitation to the use of armour-clad gear in these problems for any size of plant or for any voltage, and there were no difficulties which experience to date had brought to light which were not equally applicable to other forms of switchgear construction.

DELIVERING his inaugural address at the opening of the session of the SCOTCH LOCAL SECTION, at Glasgow, Mr. J. K. STOTHERT, the new chairman, said that in the extraordinarily quick construction of munition factories too much credit could not be given to the great work that central-station engineers had achieved in meeting the requirements. Touching upon "after-war" problems which would present themselves, the first thing that naturally occurred to one's mind on hearing the words "trade after the war" was the protection of our industries from competition with enemy and neutral nations, but this was not going to the root of the matter. This subject of so-called Tariff Reform, or Trade Protection, should not be made a political football for the sake of catching votes, but should be treated in all seriousness, as free from political bias as the Army or the Navy.

What interested them most of all as an engineering society was, perhaps, the question of technical education and apprenticeship. There was hardly any subject which had been more discussed. At one time the Trade Unions endeavoured to limit the number of apprentices that a firm could bind in proportion to the number of journeymen employed, which was part and parcel of the general scheme before the war which they had in mind, that the restriction of output meant additional wealth in the form of wages to them. The employer, on the other hand, wanted to employ as many apprentices as suited him.

The masters, as a rule, did not give sufficient attention to the education and technical training of the apprentices under their care, and this must be improved. The results of the war would see to that; for, not taking into account the effect which the dilution of labour was bound to have on the old methods of training skilled labour, the trade unions would see, with so many casualties in their ranks to fill up, that the restriction of the number of apprentices would be a fatal policy; and the masters must see that a little more care and a little more training for the apprentices would make them into skilled workmen all the more quickly, and make producers for the nation in the shortest possible time, and that was what was wanted.

In one works in the Glasgow district, salaried men were employed whose sole duty it was to teach the apprentices and bring them on, and it had been found that this was very beneficial, not only to the apprentices, but also to the employers. They had provided facilities for cheap and wholesome food, recognising that young and growing youths, working hard and long hours, required perhaps better sustenance than they would otherwise get. They had also thought out a system whereby the better educated and brighter boys could get a technical education as part of the apprenticeship system, but up to the present the success had not been altogether what they expected, due to the want of receptivity and sympathy on the part of the lads, and other causes; but they were sure that they were on the right lines, and that in the end they would succeed. It was possible that technical training throughout the country, and the apprentice system, would have to be taken in charge by a central authority.

They had seen the difficulties that the Allies got into when they were wanting in co-ordination, which enabled the enemy to shuttlecock his armies from one front to another, and either nearly defeat us or, at least, hold us in check. When we were able to organise and co-ordinate all our forces and to act with one mind, a different state of affairs soon manifested itself, and what had been true of the fighting on the Continent would be true in our trade fight after the war. No longer must each firm fight entirely for itself. No longer must they keep their own experiments and researches secret for their own individual benefits, but there must be a freer interchange of views, a freer disclosure of results, and associations in the various trades, so that their research could be combined and the results of this research shared. In fact, any business which refused to act in this co-operative way would be avoiding a public duty, with possibly dangerous results to its continued existence. Here, indeed, was a duty for learned societies, to help more than ever they had done in the past with research work, to do something practical and useful, rather than shrivel up into societies, debating only those subjects which practical firms did not desire to keep to themselves. The Institution was fully alive to this; it had a Research Committee of its own. It was working in conjunction with the Committee of the Privy Council and other bodies, and he took it that what they were doing was being done by others.

Dealing with the question of population and labour, Mr. Stothert remarked that with a million men gone in the war, and possibly two millions crippled, our power of production

The central idea of the labour was finished, and we should need all the brains and labour—skilled, semi-skilled, or unskilled—that were available. They must recuperate, and recuperate quickly, if they were to keep their place in the world, and to be able to compete with neutral nations. It is a great pity that the minds of the workers that tell us this theory that the restriction of output increased the value of the nation by creating a scarcity in commodities, and therefore restricting the markets. They must do it by using brains and inventive faculties for every possible labour-saving appliance which would tend to cheapen manufacture. Capital and Labour must work hand in hand; there must be no more avaricious employers, no idle or unreasonable workers. There was a better understanding between employer and employed to be got at? How were strikes and lock-outs to be prevented? These were problems which no one man could solve, but about which they must all think, and every individual effort to attain these objects would be something done to build up the bulwarks of our Empire, and to show our enemies that even in trade matters, as in military matters, we were not indeed a decadent nation.

Possibly, for the want of research, for the want in the past of Government support, our industry, which had made such wonderful progress even during the lifetime of younger men than himself, had been outstripped by Germany and America. Of course, a great deal of this lagging behind other countries had been the result of Government legislation. Part of the present Government's programme was to facilitate finance for trade purposes, but unless they proceeded on more courageous lines than he understood they proposed to do, no amount of re-awakened energy, no amount of organisation, would be of much use. He did not think any of these results, however, would be attained until a Ministry of Commerce, or some such body, was established. A new Ministry of Commerce, in his opinion, was a necessity. Connected with the new Ministry there should be a new Consular system, more active, more informative, and with more power. He knew from agents in foreign countries that the routine necessary to get information from the Foreign Office sometimes took at least two years, while foreigners could get the same information, which would enable them to grab the order against ourselves, in two days. That was what they had been up against, and that was what they would be up against; and, therefore, it was obviously necessary that one of the bricks of their new fabric must be a re-organised Consular service.

In conclusion, Mr. Stothert said he was convinced that much of the industrial unrest and discontent was due to bad housing and miserable environment. Those employers of labour who would, in conjunction with the Government and local authorities, look after the housing of their workpeople, would attract a better class of workmen, who would permanently stay with them, to the advantage of all.

LEGAL.

TELUX CO. v. EFANDEM CO., LTD., AND
EFANDEM CO., LTD., v. TELUX CO.

In the King's Bench Division, on November 16th, the Lord Chief Justice, sitting without a jury, had before him these combined actions. The plaintiffs, of Hammersmith, alleged that their firm was formed by the defendant company, the EfanDEM Co., Ltd., of Fallings Park, Wolverhampton, for the purpose of getting rid of their goods. The defendants are manufacturers of electric batteries and cases, and the claim was for £852 15s. 5d. as damages for loss on the re-sale of goods not delivered. The defendant company counter-claimed for an account of all goods supplied and re-sold.

At the outset, Mr. ABINGER, appearing for Mr. T. M. Gordon, claimed that his client was the sole partner of the plaintiff company, and that the action had been instituted without his consent or authority. Various litigation had followed the institution of the action. Mr. Gordon refused to make an affidavit, and no order was made in an application to commit him. Mr. Gordon took out a summons asking to be indemnified in costs on the ground that he was not a party to the action, which had been brought without his authority, and the Master made no order, costs to be dealt with by the judge at the trial.

His LORDSHIP: It seems to me that everybody referred the tangle to the judge at the trial.

Mr. ABINGER said he intervened because if it was found that Mr. Gordon was the sole partner the time of the Court would only be wasted by hearing the case.

Mr. HUGO YOUNG, K.C., on behalf of the Wolverhampton Co., said, of course, if Mr. Gordon was the sole partner, as he was not bringing the action, the defendants had no case to answer. If the other parties were partners, then he had an answer to the case.

Mr. DISTURNEL, K.C., opening the case for the plaintiffs, said the defendants were in a large way of business, and had their works at Wolverhampton, with a London office. The plaintiff firm consisted of P. A. Cooper, S. Gerald, and T. M. Gordon, the active manager being, no doubt, Gordon, and he had the main control of the business. Cooper was the sales manager of the defendant company at their London office,

and Brown was the order clerk. The Telux Co. was formed in May, 1915, for the purpose of selling the defendants' goods to the retail trade, and, in fact, they had no other business. It had a short life, and was in fact dissolved in December, 1915. The claim was for breach of contract in failing to deliver goods. The defendant company was formed in March, 1911, to take over the business formerly conducted by one Fahn and another, who had brought their appliances from America for the purpose of commencing this business. Mr. Fahn was the vendor to the company; he was the managing director of the company, and the active moving spirit from the very beginning. A Mr. Varley joined the board in 1913, and this matter arose out of a conflict between the Varley and Fahn groups. Messrs. Cooper and Brown were in the employ of the vendors. Up to this time the defendants had made a practice of supplying the very smallest retailers. This entailed a large amount of work, and a change in the method was started by Mr. Fahn in 1914-15. Just before May, 1915, Messrs. Cooper, Brown and Gordon had a small shop in the Harrow Road, where they did a retail business as "The C.M.G. Electrical Co." This was not very successful, and as a result of a discussion with Mr. Fahn, they started a wholesale business, Mr. Fahn providing the money with which to open the account at his bank, the London County and Westminster Bank. Matters went on until the present difficulties arose, when the defendants said the plaintiffs were acting in competition with them.

The hearing was resumed on Friday.

Mr. P. A. COOPER stated that he formerly acted as London export sales manager. The business of the defendant company was the manufacture of electric hand-lamps and dynamos. The defendant company were anxious to devote their attention to the wholesale trade, and to eliminate dealings with retailers. The Telux Co. was started at Hammersmith to deal with the retail side, and witness became a partner in that business. After the starting of this business witness was informed by a representative of the defendant company that he must resign his position either in the Telux Co. or in the EfanDEM Co. Witness was given a month's salary in lieu of notice by the defendant company. He, together with Mr. Gordon and Mr. Brown, were the partners in the Telux Co., which was formed with the approval of Mr. Fahn, who was formerly managing director of the defendant company.

On the point raised by Mr. Abinger that Mr. Gordon was a partner of the plaintiff company, and was not a party to the action, his lordship ruled that Mr. Gordon should be added as a defendant.

Mr. R. VAUGHAN, of Messrs. Vaughan & Williams, solicitors to the plaintiffs, said this action was concurred in by the three parties.

Mr. HUGO YOUNG, K.C., said the orders were accepted in ignorance by Fahn, and the defendants denied the authority of Fahn, and no sanction he gave could have any authority behind the back of the company.

Mr. KENDRICK, one of the directors and chairman of the defendant company, was called, and gave evidence to the effect that the defendant company knew nothing about the members of the plaintiff firm being employees of their company.

Cross-examined: Mr. Fahn was joint managing director of the defendant company, and had general management. Mr. Varley had been brought up as an accountant in Wolverhampton, and knew nothing special about this class of business. It was common knowledge that in 1915 the orders were heavy in this trade, and really the trade were unable to cope with them.

Re-examined: Witness said he guaranteed an overdraft at the bank for £20,000 on behalf of the company.

The hearing was resumed on Tuesday, when Mr. T. VARLEY, an accountant, of Wolverhampton, and Mr. PETER SMITH, secretary to the EfanDEM Co., gave evidence. The hearing was adjourned.

RATING OF ELECTRIC TRAMWAYS.

APPEAL BY THE LONDON COUNTY COUNCIL.

At the County of London Quarter Sessions, at Clerkenwell, Mr. A. P. Lawrie (Deputy-Chairman) and other magistrates began the hearing of an appeal by the London County Council against the quinquennial assessment by the Assessment Committee of the Holborn Union of tramways in Clerkenwell Road, City Road, Gray's Inn Road, Rosebery Avenue, Old Street, Goswell Road, Theobald's Road, and St. John's Road. The Surveyor of Taxes was also named as a respondent.

Mr. Walter Ryde, K.C., and Mr. E. M. Konstam appeared for the County Council, while Mr. Clavell Salter, K.C., M.P., and Mr. W. J. Jeeves represented the Assessment Committee.

Proceeding to open the appeal for the County Council, Mr. RYDE explained that the rateable value fixed by the overseers was £16,923, which was reduced by the Assessment Committee on appeal to £13,818, and the County Council now claimed that it should be further reduced to £6,960. This sum included £810 which had been agreed by the parties as the value of the Holborn electrical sub-station. The gross value had been fixed at £32,055, and the County Council claimed that it should be reduced to £25,197. The County Council tramways were no doubt a going concern, but they had been seriously affected by the competition of motor buses

and tube railways, and, as a consequence, in one year there was a fall of something like a quarter of a million in the net proceeds. In the year following there was a minus quantity of £88,000, so it was quite obvious that at that stage the motor 'buses had made themselves felt as a most powerful rival to the tramway undertaking. The year following, however, there was a slight recovery, or a less adverse balance. The respondents' case simply stated that in view of the earning capacity of the tramways the tenant of such hereditaments might be reasonably expected to give a rental which would justify the gross value appealed against. It had been decided in the High Court—and the decision was vital in this case—that in arriving at the value the separate earnings of each distinct route should be divided between the parishes in proportion to the lineal mileage of each route in each parish.

The first witness was Mr. FRANK HUNT, chief of the Estates and Valuation Department of the County Council, who said it was not true that the city termini ends of a tramway were more remunerative than the others. On a tramway route there were two thin ends, and what was called "a fat middle," and the two ends were always less valuable, if they had to discriminate from a traffic-earning point of view, than the average of the route as a whole. In the day-time they got their "fat middle" in the shopping centres. The value of the generating station had been agreed at £207,000, which was equal to 8.91 per cent. of the gross receipts. The aggregate capital expenditure to March 31st, 1915, was as follows:—Permanent-way tracks £4,681,718, overhead equipment £42,179, cables £540,568, ducts £351,838—£5,616,303. The witness submitted a mass of figures in support of the assessment now claimed by the County Council. In the parishes in question he found a total car mileage of 3,444,331, and the passenger receipts amounted to £131,712. He deducted £36,284 for expenses assignable in proportion to car mileage at 6½d. per car mile, and £32,928 assignable in proportion to passenger receipts at 25 per cent. There remained a rateable value, plus rates, of £5,500, from which he deducted £1,528 for rates leaving a rateable value of £3,972. To that sum he added £810 for the Holborn sub-station, not in dispute, making a total rateable value of £4,782, against the £13,818 fixed by the Assessment Committee. He arrived at a gross value of £23,019, compared with the £32,055 appealed against.

Mr. JOHN WELLING, permanent-way engineer of the tramways, said his summarisation of the annual cost of repairs for the ensuing quinquennial period on 279.42 miles of tramway was as follows:—Permanent way, at £385 per mile, £107,577; electrical equipment, at £42 per mile, £11,736; cables and ducts, at £13 per mile, £3,632; total, £122,945. He added £11,893 for increase in mileage of repairable lines, and £26,955 for increased cost of labour and materials, making £161,733. Dealing with renewals, he said that a 25-years' life in place of a 60-years' life would increase the annual provision for renewals of concrete yokes, &c., from £7,666 to £34,285, or by £26,619. He estimated that the total annual provision required for renewals amounted to £186,357, of which £26,619 were added the amount would be £212,976. Increased acceleration of the running of the cars and the rapid retardation now rendered possible by magnetic brakes not only caused a great increase in repairs and the shortening of the life of the rails, but must cause a greatly increased strain on the cars themselves. The amount that should be put aside annually by the Council, spread over the capital loan period, by way of repayment of the cost of reconstruction was £224,652, apart from any provision for the renewals of short-lived works. The provision for renewals should exceed the original cost, since in the first place it was cheaper to construct works simultaneously than to renew any parts; secondly, it was more costly to do work under running conditions and subject to continual interruptions; and, thirdly, the cost of labour and materials had greatly increased. The stores of materials for repairs and renewals were valued on March 31st, 1915, at about £100,000, and he estimated there should be an allowance of £5,000 a year in respect of the stores in stock. It was necessary to keep those stores in hand. Junctions, cross-overs, and all parts required had to be designed and ordered in ample time before they were wanted, and the cost was reduced by ordering in fairly large quantities. He estimated the average life of the whole of the Council's tramway system as 11½ years, while the lines in the parishes comprising the Holborn Union had only a life of 10.6 years, owing to the greater frequency of tram and general vehicular traffic above the average of the whole system. The costs and estimates for repairs and renewals that he had given were averaged over the whole system.

Mr. Wigner, technical electrical assistant of the County Council, and Mr. H. S. May, assistant superintendent of rolling stock, also gave evidence.

After sitting for three days the Court adjourned the hearing of the appeal till November 29th.

ELECTRICAL ENGINEER'S LIBEL ACTION: APPEAL.

In the Court of Appeal, on Thursday and Friday last week, Lords Justices Swinfen Eady and Bankes and Mr. Justice A. T. Lawrence had before them an appeal by Mr. Charles Joseph Weld-Blundell, of Ince Blundell Hall, and Lydiat Hall, Lancashire, and Ludworth Castle, Dorsetshire. He was the defendant in an action brought by Captain William Her-

bert Lowe, an electrical engineer, for alleged libel. The defendant did not personally appear at the trial, which took place before Mr. Justice Ridley, and upon the verdict of the special jury, the judge entered judgment for the plaintiff for £1,000 damages, with costs. The defendant now appealed, contending that the damages were excessive.

Mr. PARFITT, for the appellant, in arguing that the damages were excessive, contended that the letter in the case ought not to be regarded seriously, as it was written by a man who, the evidence showed, would say one thing in the morning and another thing in the evening about the same matter. It was not a commercial case, but a case of mere tort, and the damages were quite at large and out of all proportion to any harm that might have been done.

In reply to the Court, Mr. PARFITT stated that in an action tried later, brought by Mr. Comins on the same letter, £500 damages were awarded against the defendant.

Mr. COTES FREEDY, supporting the verdict and judgment, argued that, having regard to the position the plaintiff held as an electrical engineer, and also as an officer in His Majesty's Army, at the date when the letter was written, the damages could not be considered excessive. It must be remembered that the jury was a special jury, composed of men in the same position in life as the plaintiff, and with respect to the defendant, probably in the same position in life as he, although not so wealthy.

On Friday, when the hearing was resumed, Lord Justice SWINFEN EADY said that one must feel sympathy with a man like Captain Lowe, who had brought an action to clear his character, but, as at present advised, the amount of the damages struck him as excessive for what was, well, an extravagant letter from an eccentric and irascible old gentleman. Was it not a case in which the parties could agree to reduce the damages to a reasonable figure, and so put an end to the litigation?

Counsel asked for time to consider the matter, and his lordship ordered the case to stand over for 10 days.

APPRENTICES' WAGES IN WAR-TIME.

An apprentice electrician who had been discharged from the Army appeared before Sheriff Effe at a Munitions Tribunal in the County Buildings, Glasgow, last week, and applied for a clearance certificate in order to go to more remunerative employment. He stated that he earned only 12s. 6d. per week. His father received 32s. per week, and as there were three children younger than the appellant, the combined earnings were insufficient to keep the home together.

His LORDSHIP (according to a Glasgow paper) said he was perfectly well aware of the hardship of the position of certain apprentices, but the Munition Appeal Judge had decided that it was in the national interest that apprentices should remain at their trade. 11s. 6d. was a low wage for a three-year apprentice, and his lordship inquired if the firm could not give a little more money. The firm's representative said that any change would require to apply to all the apprentices.

The application was refused, whereupon the appellant remarked that his house was better off when he was in the Army. The home could not be kept together, and no matter what happened he must earn more wages.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., v. BRITISH AND FOREIGN AGENCIES CO.

Mr. JUSTICE MCCARDIE, sitting with a common jury in the King's Bench Division, on Tuesday, heard an action in which plaintiffs sought to recover damages from defendants for non-delivery of 3½ tons of copper wire. The defendants pleaded that there was no contract, but only negotiations.

Mr. J. B. Matthews, K.C., and Mr. Tyrrell were for the plaintiff company, and Mr. Ralph Bankes, K.C., and Mr. Douglas Hogg were for the defendants.

In opening the case, Mr. MATTHEWS said that the defence was that there was no actual contract in writing, and that being so there never was any contract at all. The question was really rather one of law than of fact, and turned to a great extent upon correspondence between the parties. The plaintiffs, he said, hold very large quantities of copper wire. The defendant firm was comprised, so far as the plaintiffs knew, of two partners—Messrs. Dennis and Pollock. The plaintiffs had known those gentlemen for quite a number of years in connection with the copper trade. Being a young firm, the defendants were anxious to do business with such a company as the plaintiffs, and approached them with that object in view. From time to time they had invited the plaintiffs to give them orders, and three or four contracts had been satisfactorily carried out. The contract in question was entered into in December, 1915, when the plaintiffs gave the defendants an order for 3½ tons of .028 plain copper at 12 and 13/16ths of a penny a lb., to be shipped from New York at the end of January, c.i.f. in London. The defendants were to obtain the wire in America, but plaintiffs were unable to obtain shipment, although they were ready to postpone delivery for a time, and ultimately the defendants asked to be released from their contract.

Evidence was given on both sides, and Mr. EDWIN JAMES HAWKINS, London manager of Messrs. Richard Johnson and Nephew, Ltd., said that the price of wire might be computed from the price of electrolytic wire bars. The price of these

In the result the jury found in favour of the plaintiffs, for whom his lordship gave judgment for £147, with costs.

A.L.G. Electrical Co. of South Africa.—The Supervisors and Controllers appointed by the Treasury to wind up the affairs of the A.L.G. Co. are asking for tenders for the purchase of the plant and stock in the Union.

To be Wound Up.—The Board of Trade has ordered the following companies to be wound up:—

Meyer & Co., 47, St. Paul's Square, Birmingham, export hardware merchants. Controller: J. W. G. Hill, 9, Bennett's Hill, Birmingham.

"I am directed by the Secretary of State to say that the use of electric pocket lamps of low power by pedestrians to enable them to find their way in the streets is not prohibited by the general lights order. There may be local military orders prohibiting their use in some places."

"The metal and engineering trades have suffered the worst of all. The great Cockerill Works at Seraing were taken over immediately after the fall of Liège. Since then all the iron, steel, and electrical works in the Valley of the Meuse have fallen into German hands. M. Renson, director of the important Angleur Steel Works, who refused to conduct operations for the invader, was made prisoner and sent to Germany. The machinery of the International Electric Co. and of several similar concerns has been carried across the Rhine. All stocks of copper and brass and enormous quantities of tools have also been commandeered. Thousands of skilled artisans were thrown out of work in consequence. Many factories which Belgians were trying to keep going have since been closed, because it is impossible to obtain lubricating oils for the engines and machines; and the latest requisitions of the German tyrant are for all the leather belting in the country. Idleness has, therefore, been forced on the people. The German statement that the workmen prefer to be maintained by public charity is not true. The conditions of work in their own country are made impossible for them, and then they are told that there is plenty of employment for them in Germany."

The following headings are added:—
Electrical apparatus and plant for the generation, distribution, and utilisation of electric power, not otherwise prohibited.

Zinc barium pigments made from zinc salts and barium sulphate

Varnishes not otherwise prohibited

to all destinations in foreign countries in Europe and on the Mediterranean and Black Seas, other than France and French possessions, Russia, Italy, and Italian possessions, Spain, and Portugal, and to all ports in any such foreign countries, and to all Russian Baltic ports."

At Oswestry, Mr. A. Cartledge (35), who had filed an appeal, wrote stating that he was now an electrician at a munitions works, and would shortly be badged. The Tribunal dismissed the appeal.

At Bradford Tribunal, last Friday, Mr. C. J. Spencer, city tramways manager, who had applied for three young tram drivers, asked for argument at once following the appeals, but has, had a date with Lord Derby for the general question of the position of men under 30 in the tramway service, and his lordship had agreed with his (Mr. Spencer's) suggestion that certain exchanges should be made. In the Army there were a number of tramwaymen who were failures from the military point of view, but were good for tramway service, and it was proposed to fetch these back to release Class A men at present employed. He hoped a substitution scheme would be fixed up very shortly. Of the three cases in question only one was in Class A, and he was married. The cases were adjourned.

At Chipping Norton, the Military Representative asked for a review of a certificate of conditional exemption allowed to Mr. W. H. Hellyer, manager of the Electric Light Co. The Tribunal reserved its decision pending a report by the Army Medical Board.

Before St. Thomas (Exeter) Tribunal, the Committee of Visitors of the Devon County Asylum appealed for Mr. W. W. Symons (27), acting chief electrical engineer, passed in Class A. Exemption was allowed until April 1st, and the Committee was advised to get a substitute.

The Aldershot & District Traction Co. appealed for a number of drivers, fitters, and conductors. One driver was given two months' exemption, and two others one month each. The others were directed to be medically examined. The company also appealed to the County Tribunal for a driver, given one month only by the Local Tribunal, but further exemption was refused.

Before the Essex Appeal Court, the Ilford U.D.C. appealed for W. G. Galley (28), armature winder and storekeeper at the electric light works. The Military Representative, at the same time, opposed exemption allowed to J. C. Richards (38), chief tramway inspector, and R. Tension (26), overhead linesman. Mr. Harvey said that he would try to dispense with Tension in three months' time if he was allowed to retain Richards. Conditional exemption was granted to Galley and Richards, and a final three months was allowed to Tension.

Before the Margate Tribunal, on November 15th, a local firm of electrical engineers applied for conditional exemption for an indispensable employé, aged 38. A month was allowed for the man to be replaced.

At Chelmsford, on November 14th, Messrs. Christy Bros. and Co., Ltd., appealed for Mr. A. B. Wrightman (31), now engaged on electrical work at Street (Somerset) in connection with the Mid-Somerset Electric Supply Co., who was the only man available for looking after the system and distributing mains. Originally rejected, he is now passed for general service. Final exemption until March was conceded.

At Nuneaton, an appeal was made by Mr. F. A. Newdegate, M.P., for the exemption of W. Mitchell (25), electrician at Arbury Hall and hospital. The Advisory Committee recommended final delay until January 1st. It was stated that Mitchell supplied all the light and heating for the hall and hospital, and was doing the work executed before the war by three men. Efforts to find a man over military age had failed. The recommendation of the Advisory Committee was adopted.

At Wrexham, the Motor & Electrical Engineering Co. appealed for the exemption of Mr. W. M. Wynn (23), secretary and assistant manager, claimed to be indispensable to the business. He had been passed for home sedentary work. The appeal was rejected.

Hertford Tribunal has granted a certificate of conditional exemption to Mr. A. H. R. Sharratt (41), electrical engineer.

The West Dean Tribunal has granted conditional exemption to a foreman (34), applied for by a firm of electrical cable makers at Lyndbrook, but allowed a month only to another foreman, aged 26.

At Weymouth, exemption was sought by Mr. R. S. Smith (29), electrician, who was stated to be electrician to several local hotels and the Weymouth Royal Hospital. He is passed in Class B.1, and claimed as owner of a one-man business. The appeal was refused as from December 31st.

Worcestershire Appeal Court has refused exemption to E. Taylor (35), appealed for by the Worcester Tramway Co. as the only coach painter left.

An appeal was made to the County Tribunal by Mr. H. R. Harwood (38), electrician, of Worcester, refused exemption locally, but the appeal was rejected.

At Bexhill-on-Sea, Mr. H. T. Squirrel, electrician, appealed for the retention of J. F. Gibbs (38), electrician. Three months were granted.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electricity in Agriculture.

I shall be obliged if you will allow me to offer a few comments on the articles by Mr. Jorgensen on the use of ionised air in agriculture, which appeared in your issues of October 27th and November 3rd.

Mr. Jorgensen does me too much honour in saying that, in conjunction with Sir Oliver Lodge, I developed a new system of generating H.T.C. current. What I did was to suggest to Sir Oliver that his method of generating H.T.C. current (known before 1905, when my experiments began) was eminently suitable for use in electro-culture, and to secure his co-operation in the series of experiments which began in 1906 and continued uninterruptedly till 1914, since then, owing to my "joining up," they have been suspended.

Sir Oliver Lodge's account in the Kelvin Lecture of these experiments Mr. Jorgensen calls "fairly complete." I should say it was decidedly brief, and Sir Oliver himself, writing to me before he delivered it, said he would only be able to touch on the subject.

The Lodge valves can be arranged to carry considerably more than the current required. Mr. Jorgensen's disparaging statements appear to be made without sufficient foundation; possibly his only experience is from the very small experimental apparatus described. The Lodge valves for X-ray work will carry the heaviest currents used, and they are certainly most efficient in stopping the reverse current.

Mr. Jorgensen is somewhat scornful as to the accuracy of some measurements of Dr. Breslau, whom he describes, not quite accurately, as the German agent of the A.E.D. Co. I am not anxious to defend a German from the assaults of a neutral, but I would like to suggest to Mr. Jorgensen that Dr. Breslau's measurements and reasoning are accurate, and that he has confused his own measurements of the actual air currents with Dr. Breslau's measurements of the total current delivered to the aerial network, which includes the leakage over the insulators. The number of insulators for a network covering 30,000 sq. metres, and therefore the current flowing into the 30,000-metre network would be more than half that flowing into the 60,000-metre network. My own measurements of currents flowing into networks of sizes from 90,000 sq. yd. closely agree with Dr. Breslau's.

With reference to the prices given in the article, it may be as well to point out, as the figures are likely to be quoted in agricultural papers, that they are very misleading. An induction coil, a mercury break and five Lodge valves handed to an agriculturist would be useless to him, and their bare cost is by no means the total cost of a workable installation. If Mr. Jorgensen were to go to the Triumph Cycle Co., and say to them, "The price of a 44-H.P. engine is £10; frame, £2; tires, £3; rims and spokes, negligible—supply me with a motor-bicycle for £15," they would possibly tell him that his mathematics were correct, but his business and engineering ideas curious.

May I also venture on a grumble of my own. When, some four years back, Prof. Priestley secured a grant from the Board of

Agriculture for the research work which Mr. Jorgensen has described, I hoped he would be able to discover how the effect was produced on the plants; how the growth processes of the plant were altered. (Prof. Priestley is one of the "red-hatted" now, and has been in France since mobilisation, so this criticism does not apply to him.) Until we know that, even if we know the current to the exact ion per hectare, we are unscientific empiricists, all of us, Sir Oliver Lodge and Mr. Jorgensen included.

Possibly Prof. Blackman is working in the direction indicated, but there is nothing in the article to show it.

In conclusion, I should like to take this opportunity of expressing my appreciation of Mr. Jorgensen's painstaking interest and enthusiasm in these experiments, and, on behalf of my company, to say that we should be pleased to co-operate with him, as we have done with Prof. Priestley, and no doubt the result would be equally satisfactory to us both.

J. E. Newman,

General Manager, the Agricultural Electric Discharge Co., Ltd.

Gloucester, November 16th, 1916.

Final-Grade Classes in "Electrical Installation Work."

In your comments under our letter on the above subject in last week's issue, your reference to "Technical Colleges," "Trade Schools," and handicrafts rather minimises the force of our arguments by raising side issues.

We think it will be found that most of the London Polytechnics teach what are generally termed handicrafts, so that in their case the Technical College and the trade school are combined. The same is, doubtless, the case at most provincial institutes.

The term "handicraft" is a somewhat indefinite one, for there are few kinds of work mostly done with the hands that do not necessitate more or less use of the brains as well. In spite of that fact, many people would consider the term as applying to subjects which did not require much other training besides that of a purely manual sort.

That being so, we venture to think that it does not help the cause of electrical installation work to leave it to be inferred that it is merely a "handicraft." It obviously is very much more than that, as a glance through past examination papers will fully testify.

A. P. Lundberg & Sons.

London, N., November 20th, 1916.

I quite agree with your editorial note on Messrs. Lundberg and Sons' letter. Technical colleges should not concern themselves with handicrafts. My address dealt with trade classes.

I disagree with the writers about demand and supply. Principals of Polytechnics tell me that they are quite ready to provide the classes if the students are forthcoming. The ball is now with the employers.

A. P. Trotter.

London, November 19th, 1916.

"Summation Watt" Capacity of Field Rheostats and the Like.

I think Mr. Boothman and I are really talking about two different things. I do not deny that his formula give accurate results of the summation watts as defined by him in his letter of the 13th inst. Such figures, however, are chiefly of academic interest. I do not think that the summation watts, so found, will be a safe guide as a basis of comparison of rheostats, which is the practical use to which I would put them. For example, Mr. Boothman points out that the greater the resistance in a potentiometer the less are the actual summation watts (based upon his definition). But beyond a certain value the more resistance used the greater becomes the size (*i.e.*, bulk) of the rheostat; therefore I think it somewhat illogical to say that the capacity of the regulator does not materially increase. My point is that, as a guide in designing, Mr. Boothman's method will, if precautions are not taken, lead one astray. As an example, I would point out that Mr. Boothman has recommended for potentiometer regulators to allow 2 to 4 ohms per volt of supply. According to Mr. Boothman's way of looking at it this would be correct, as the higher the ohms the less are the summation watts, as defined by him.

I am of opinion, however, that this value of rheostat ohms is too high, and would result in a needlessly expensive design. In support of this view, I can refer to Mr. T. Carter (ELECTRICAL REVIEW, Vol. LXXVI, May 21st, 1915, page 716), who recommends that a potentiometer regulator should have from two to four times the resistance of the field coil. Such a rule results in much lower values of rheostat ohms than recommended by Mr. Boothman, and confirms the method of calculation which I originally recommended.

Charles C. Garrard.

Birmingham, November 20th, 1916.

Stolen Goods.

During the last week or so there have been several burglaries from electrical engineers' premises in this district, and during Sunday night one of the show-cases on our premises was emptied of its contents, and the following articles were stolen:

A small motor-generator by the Electrical Co., 200 volts, D.C. input, and 8 volts 6 watts output, mounted on combined base-plate, with starting switch in the base, and flexible coupling and V pulley.

A portable lamp stand with two 10-ampere standard incandescent lamps with leather handle.

Also numerous other sundries which cannot be identified. The goods are at present in the hands of the Government.

As yet the Government are not offering these in the Manchester market, and we can only assume that they are sending them to the Government. Perhaps the publication of this letter in your paper will help to find them. There must be more than one of the set as one must not carry what was taken away from here, and a friend who had a similar experience a week ago took the set and four men to carry away what was taken from his place.

E. O. Walker & Co.

Manchester, Nov. 20th, 1916.

Between Two Stools.

I have read with great interest the letters of "Victimus" and "Australia" in the last two issues of your journal, having been in a similar cart myself. In all matters of this nature there are always two sides, and it is possible that there are other facts which may alter the complexion which "Victimus" places upon the case he outlines. Certainly, it is inconceivable that "gentlemen" holding positions of responsibility can be found to act in this extraordinary way; and, if the facts are as stated, I imagine the English dictionary contains expressions of far greater force and appropriateness than "irresponsibility" to apply to the actions of such persons. Probably "Victimus" would be well advised to look for the source of the trouble nearer home, and perhaps he could persuade the Editors to publish the correspondence.

Back Pressure.

The New Copper Restrictions.

The text of the recent order relating to the supply of copper wire and cable, which appears in the REVIEW for November 17th, raises some questions of importance to the electric wire and cable maker. The order is so comprehensive as to leave no loophole for the manufacturer, and no orders can be executed, either for home use or export, unless the goods are required for war work by one or other of the parties definitely set forth in the text. No mention is made, however, of imports of copper wire or cable, and it would be interesting to know whether the order applies, for instance, to cable and wire coming from the United States. We notice that the United States' exports of insulated wire to the United Kingdom for 1914-15 were over double the figures for 1913-14. We know that the figures include a quantity of wire for Government purposes, in which copper is not used, but probably only a portion of the total is made up of such material, and it will be only fair to the British wire-drawers to bar imports on the same lines as the home product.

For those who use electric cables in the ordinary way of private business, it will be a hardship to have their supply cut off. Whether in business in a small way or not, people do not stock electric cables very largely, with copper at 1s. 6d. per lb., and for ordinary work it would seem to be a case of shutting up shop willy nilly. For the cable maker, the most serious aspect of the matter is the stoppage of export orders. Since the advent of the war, British cable makers have seen an influx of orders from quarters which were practically terra incognita in times of peace for C.M.A. goods. Orders rolled in from Norway, Sweden, Denmark, Holland, and Spain, among others, some of which have been supplied, and others of which, for very good reasons, have been held over indefinitely, on the principle of prevention being better than cure. Up to the present it has been, at the best, extremely difficult to procure licences for exporting electric wire and cables, and long delays have occurred even where goods have been destined for places and people little suspect. In addition, the calls made by Government requirements upon the average wireworks have pushed export orders somewhat into the background, with the result that Colonial and foreign customers of long standing have had to submit to vexatious delays, high prices, and the ultimate chance of being let down altogether.

A man just over from India was heard last week discussing the new order, and he said that as soon as our exports ceased the Japanese would take the Indian trade. "They are always on our doorsteps," said he, "and this restriction will throw the Indian buyer into their hands." That is the opinion of the man on the spot, which may later be borne out by events. What applies to one market may apply to others. If the Japanese get the trade of the Far East, the United States will take our trade in South America, South Africa, and Australasia. The circumstance and stress of war may render this unavoidable; none the less, the possibility should be counted on, and the task of our manufacturers in the much-discussed after-the-war trade war will not be any easier in consequence.

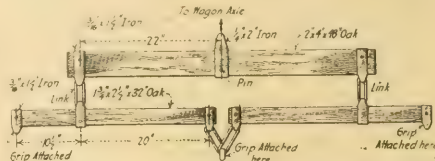
Further, if the requirements of the countries named are thus met, the demand for copper in the world's markets will be just as before, so that at least the effect of the new order will not be to reduce prices. Steel is a product made entirely from the resources of the home industries. The output is limited while the demand is increasing, and therefore its uses should be limited to allow a maximum for war purposes. For electrolytic copper, however, we are dependent upon outside sources, and so long as they are willing to pay the price our old export customers can, and will, buy elsewhere. They can no longer buy British steel when we stop the export, and falling an efficient substitute, must do without; but electrolytic copper has no special merit over British wire or

American wire one over the other, and if we do not sell it other people will. We hope the desired end may be attained by the Government—namely, to conserve supplies for war work; yet we may be permitted a grumble at the means employed in the new order.

Commercial.

STRETCHING THREE LINE WIRES AT ONCE.

MR. H. H. FENTON, in the *Electrical World*, says that when constructing three-phase transmission lines a great waste of time is often caused in stretching conductors by the awkwardness of the block and tackle method. To eliminate this waste of time the writer employs a scheme which enables a small force of men to stretch all three conductors of a three-phase line in one operation. In other words, the three conductors are strung, stretched and tied in with one trip over the ground and by climbing up each pole once. A special whiffle-tree constructed as shown in the accompanying illustration is used. With this device a crew consisting of a foreman, four climbers, a team with driver and a helper on the wagon to watch the reels and fasten the wire grips, can handle line construction rapidly and without difficulty. The special device is



SPECIAL WHIFFLE-TREE FOR STRETCHING THREE LINE WIRES AT ONCE.

attached to the axle of the wagon by a chain, so that it drags about 2 ft. behind the rear wheels. Three reels are mounted upon the wagon platform and carry the wire.

When stringing the conductors for a particular line, each conductor is dead-ended at the starting point, and the team driven six spans for the first pull. Each climber takes his assigned place, one at a pole, the foreman making the fifth, and each carries the wires up the pole, the helper meanwhile at the wagon making fast the wire grips on the conductors, thus attaching the special whiffle-tree to them. The driver then starts the team and draws the wires taut. The brake is then applied on the wheels of the wagon to aid the team in holding the strain. After the four climbers have tied-in the line, the grips on the special whiffle-tree are released and the team is driven up four spans, thus unreeing wire for another pull, and the cycle of operations is repeated. Four spans have been found about the maximum pull on an up grade that can be made with one team of horses; however, on a down grade as many as seven spans have been stretched without any difficulty at one pull.

This method of construction makes possible a very taut line, does not produce twisting upon any pole, makes all wires hang alike, and is considerably faster than the block-and-tackle method. An average of 3 miles of three-phase line has been strung, stretched, and tied-in in one day.

BUSINESS NOTES.

For Sale.—The Sheffield Corporation Electricity Supply Department is offering a number of generating sets for sale; the Woolwich B.C. Electricity Department is offering a 110-kw. continuous-current set for sale. Particulars appear among our advertisements to-day.

Publicity Poster.—We understand that the design for an electric fire poster got up by the COUNTY OF LONDON ELECTRIC SUPPLY Co. has quickly achieved a wide popularity. A large number of supply undertakings throughout the country have purchased copies of the poster, and by arrangement with the company MESSRS. BELLING & Co. have used the design on the cover of their catalogues, of which about 100,000 have been issued.

Bankruptcy Proceedings.—JAMES BROCKIE, mechanical engineer, Forest Hill, Kent.—Second and final dividend, 1s. 10½d. in the £, payable December 4th, at the office of the Official Receiver, 132, York Road, Westminster Bridge Road, S.E.

Book Notices.—MESSRS. E. BENNIS & CO., LTD., of Little Hulton, have issued No. 2 of their house organ, *Cheap Steam*. The principal contributions are:—"An Interesting Textile Installation," "Coal Crushers," "The Commercial Testing of Solid Fuel," "The Care of Mechanical Stokers," and "Steam Production and Machine-Firing."

Catalogues and Lists.—**BRITISH THOMSON-HOUSTON CO., LTD.,** 77, Upper Thames Street, London, E.C.—List No. 10,480 (44 pages), has been issued, says the company's optimist, "in anticipation of the coming demand for improved outdoor lighting schemes," when the removal of the temporary lighting restrictions becomes advisable. The catalogue is devoted exclusively to the subject of weatherproof lanterns, street lighting fittings and accessories, ironclad ship and mill fittings, and so on, for use with standard and half-watt type lamps. Illustrations and details are given of a number of fittings of new design. Among the new weatherproof models listed are the "Strela" cast-iron lantern, with vitreous enamelled reflector; the "Globa," the "Alabas," the "Istva" street lighting unit, and the "Radial Wave," all of which are suitable for Mazda half-watts. These provide in every case for adjustment of the total length, so that lamps of different size may be employed in the correct position relative to the reflector. The B.T.H. series incandescent street lighting system provides for the replacement of arc lamps on series circuits without altering the existing circuits, (1) a substitutional resistance with automatic cut-out for each lamp, (2) a constant-current transformer for each circuit, with an automatic film cut-out for each lamp, or (3) an automatic film cut-out for each lamp only, to prevent the extinction of a number of neighbouring lamps. Many ornamental designs of British-made cast-iron and ferro-concrete pillars for incandescent street lighting are listed, as well as watertight lanterns, fittings and holders for standard Mazda lamps, used in mills, factories, shop windows and steamships. Copies of this exhaustive catalogue will be sent to readers interested in street and industrial lighting.

OVERSEAS ENGINEERING CO., LTD., 75, Curtain Road, London, E.C.—Leaflet giving an illustrated description, with prices, of their "Overseas" automatic lighting sets.

Trade Announcements.—**THE MIDLAND ELECTRIC MANUFACTURING CO., LTD.,** announce that Messrs. Higgin, Ltd., of Manchester, have ceased to represent them in the Lancashire and West Riding of Yorkshire district. Until other arrangements are made all communications should be addressed to the company direct at Barford Street, Birmingham.

THE PATERSON ENGINEERING CO., LTD., have taken temporary premises at Windsor House, Kingsway, for the duration of the war, consequent upon the Military Authorities having taken over India House, Kingsway. Their new telephone number is: "Gerrard, 6560." The firm have just published the new edition of their Red Book, which was preparing when war broke out.

The London office address of **MESSRS. FRASER & CHALMERS, LTD.,** has just been changed to Moorgate Hall, Finsbury Pavement, E.C.

MESSRS. WELLMAN, SEAVER & HEAD, LTD., state that as the Government has taken possession of India House, Kingsway, and the two adjoining buildings, for war purposes, their address is now King's House, Kingsway, W.C. Telegraphic address and telephone number unaltered.

MESSRS. TOZER, KEMSLEY & FISHER, LTD., of 84, Fenchurch Street, E.C., have changed the style of the company to Tozer, Kemsley & Millbourn, Ltd. Mr. Millbourn, whose name is thus incorporated, joined the firm in 1889, and he has been a director of the company for many years.

THE FULLER ELECTRICAL AND MANUFACTURING CO. announce that the Government having taken over Canada House, Kingsway, W.C., they have temporarily removed to Old Sergeants' Inn Chambers, 5, Chancery Lane, W.C., where all communications should be sent.

Safety Lamps Approved.—The Home Secretary made an order on November 16th, approving the following safety lamps for use in all mines to which the Coal Mines Act, 1911, applies:—

Kingsway miners' electric safety lamp.
Davis-Edison accumulator miners' electric safety lamp.
Cambrian officials' lamp, No. 7.
Pearson's officials' pocket lamp.

Western Electric Co. (U.S.A.).—The *Electrical World* states that the Western Electric Co.'s gross for the year to December 31st will reach \$100,000,000. The previous biggest year gross was \$77,000,000. This refers to actual shipment of goods to customers. The incoming orders booked will be very much greater than this amount. While the Western Electric Co. has no war orders, it has felt the effect of the war by limitation of raw material supplies on the one hand, and abnormal demand for its products on the other. The directors recognise the fact that the present conditions are entirely abnormal; at the same time, the pressure is here, and cannot be entirely ignored. As a result, they have authorised further plant additions, which will call for the expenditure of nearly \$1,000,000. The Western Electric Co. is employing 23,000 people.

U.S. and the Russian Electrical Market.—The *Electrical World* contains the following:—"Much has been written by writers in this country concerning the opportunity of the American manufacturer in the Russian market. An article, however, full of significance to the American manufacturer of electrical products appeared recently in the Russian electrical journal, the *Elektrichesky*, in which it was pointed out that imports of German electrical goods into Russia increased from a value in 1909 of \$3,500,000 to a value in 1913 of \$8,500,000. The war, however, forced Russia to seek other suppliers. As her ally, Russia turned to Great Britain, but found that country unwilling and unable to develop the great Russian market. Russia now, the journal states, is looking to the United States to furnish the Russian nation with electrical machinery and electrical products. Already the United States, it is pointed out, has profited by securing orders for considerable quantities of telegraph and telephone apparatus and many tons of copper wire. There is a strong demand for small motors of

from $\frac{1}{2}$ to 4 H.P., for educational electric appliances, for X-ray apparatus, and for every kind of electrical material. A few weeks ago, it was impossible to purchase a single battery cell in the whole of Petrograd, and there is a feeling that the Russian market can absorb huge quantities of supplies in the future. Russia, according to the journal, wants Americans to take the place formerly held by the 150,000 German merchants. Three-fifths of Russian capital has been offered American firms if they will contribute the other two-fifths in order to establish factories in Russia. Continuing, the journal points out that the large field which Russia offers for hydro-electric engineers and factories is shown by the fact that in the European Russia, including Finland, and in the Ural and the Caucasus, the utilisable hydraulic power is estimated at about 10,000,000 kw., while the amount utilised is less than in any other country in Europe. In round figures, around 200,000 kw. is developed, of which 1·8 per cent. consists of small installations."

The Supply of Railway Wagons.—The *Financial Times* states that the railway companies are again calling the attention of traders to the necessity of making every effort to avoid the wastage of rolling stock. It is pointed out that the demand for railway wagons and sheets is extremely heavy, owing to the large amount of urgent Government traffic and material for the manufacture of munitions which the railway companies are being called upon to handle specially. The companies, therefore, hope that they can rely upon the local co-operation of the traders in the country in assisting them to cope with the heavy traffic which is being worked under exceptionally difficult conditions. Two means are suggested by which material assistance can be rendered:—

1. Traffic should not be loaded in railway trucks until senders have ascertained that consignees are able to take immediate delivery, and have obtained confirmation from the railway company.
2. Wagons received with inward traffic should be unloaded and handed back to the railway company with all possible dispatch. It should not be overlooked that when wagons are kept under load after the day of arrival, it is a serious loss to the country, and, in a sense, is playing into the hands of the enemy.

LIGHTING AND POWER NOTES.

Australia.—As a result of the coal strike, the N.S.W. Government, acting under the powers conferred by the Emergency Bill, is assuming control of the electric and gas supplies in Sydney, with a view to conserving the resources for necessary industries in case the strike continues. It is stated that under Government control the supplies will last for a fortnight, otherwise the electrical supplies would have ceased last week. The use of electricity for lighting purposes is prohibited, except for public institutions and street lighting. Electric power is also prohibited, excepting for works connected with water supply, sewerage, and the manufacture of food-stuffs.

Bangor.—**FREE-WIRE INSTALLATIONS.**—The Electric Lighting Committee has had under consideration the question of purchasing the free-wired electric light installations owned by the National Electric Construction Co., and recommends that the company be offered an annual payment of £110, payable over a period of 27 years from April 1st, 1916. This arrangement will result in the installations becoming the property of the Corporation immediately, thus enabling the Corporation to deal with the property in such manner as it considers best in the interests of the electricity undertaking. A resolution to this effect was carried.

Barnsley.—The R.D.C. has given its consent to the Yorkshire Electric Power Co.'s using overhead wires from Beamshaw Wood Colliery to Woolley Colliery, and from Woolley Colliery to Wheatley Wood Colliery.

Bath.—**PRICE INCREASE.**—The E.L. Committee of the T.C. has decided to increase the price of energy by 10 per cent., as from January 1st next, making an advance of 20 per cent. since the war commenced.

Canada.—The annual report of the Canadian Commission of Water Conservation states that, although there has not been a large increase in new water-power enterprise during the year, the following additions are to be noted:—Winnipeg has added some 13,000 H.P. to its municipal plant at Point-du-Bois. The Laurentide Power Co. has inaugurated its new hydro-electric development at Grandmere on the St. Maurice River, the ultimate capacity of which is to be 125,000 H.P. The Eugenia Falls plant on the Beaver River has commenced operations with an initial capacity of 4,500 H.P. The Hawkesbury Electric Light and Power Co. has completed and put in operation its new hydro-electric plant at Bells Falls, on the Rouge River, of 5,000 H.P. Among the new projects proposed during the year may be mentioned that of developing 600,000 H.P. at the Grande Décharge of the Saguenay River, with the object of manufacturing chemical fertilisers.

The St. Maurice River, with a drainage area of about 16,000 sq. miles, possesses many important water-power sites, three of the largest being already utilised at Shawingan Falls, Grandmere and La Turque.

The Quebec Streams Commission, realising the great benefits which accrue from conservation storage of the upper waters of the St. Maurice, has decided to construct a main reservoir at La Loutre Rapids, 38 miles north of the National Trans-Continental Railway, at the lower end of a long chain of lakes; the reservoir will be

the third largest in the world, being exceeded by the Assuan Dam in Egypt, the Niagara Falls, and the Gatun Lock in Panama. The cost is £12,000,000, as compared with La Loutre, which cost £1,500,000. The dam is to be 1,720 ft. long in four straight sections, with 81 ft. at each end.

Between the reservoir and the mouth of the St. Maurice there are 17 power sites, with a total capacity of approximately 350,000 h.p. under present conditions, while it is estimated that the flow will be available when the flow is regulated through the reservoir. At Shawinigan, Grandmère and La Turge, alone the potentiality will be raised from an aggregate of 190,000 h.p. to 400,000 h.p.

The Ontario Hydro-Electric Commission has threatened to cut off its supply of power to the city of Niagara Falls, Ont., if the City Council insists upon selling electrical energy at \$10 per h.p. to a new industry which recently decided to settle in the city. The Commission contends that the minimum rate must be \$14.

Carmarthen.—**PUBLIC LIGHTING.**—With regard to the contract between the Council and the Carmarthen Electric Light Co. for street lighting, the L.G.B. has written suggesting that the case is one in which the parties should come to an amicable agreement in the altered circumstances.

Castleblaney (Co. Monaghan).—**E.L. SCHEME.**—It was decided at a meeting of the B. of T. that electric lighting for public purposes would shortly be installed in the town.

Continental.—**SPAIN.**—La Sociedad Electrica Isaac Matas is the name of a new concern which has lately been formed in Barcelona, with a capital of £4,640, to establish a hydro-electric generating station near El Pasteral, in the province of Gerona.

Crayford.—**PUBLIC LIGHTING.**—The P.C. has signed an agreement with the West Kent E.L. Co. for the lighting by electricity of the Barnes Cray and Northumberland Heath Estates. The agreement is for five years at £2 11s. 6d. per lamp per annum, and at the end of that period the standards, &c., become the property of the Council.

Dublin.—**FIRE LOSS.**—At a civic luncheon in Dublin, the Lord Mayor mentioned that the loss to the Corporation in respect of electricity in the area destroyed during the rebellion of Easter Week amounted to £8,000, while the loss in rates would be £165,000.

Dundalk.—**PROPOSED LOAN.**—A deputation from the Urban Council is to interview the L.G.B. with a view to a further loan in connection with the electric lighting undertaking.

Greenock.—**YEAR'S WORKING.**—The annual report by Mr. Whysall, burgh electrical engineer, on the working of the Corporation electricity undertaking during 1915-16 shows that the total output sold amounted to over 19 million units, an increase of 33 per cent. on the previous year. Greenock took 15,386,838 units, Port Glasgow 2,285,582 units, and traction absorbed the remainder, 1,282,621 units. "About 25 per cent. of the increased business was obtained from Greenock consumers. The total income for the year was £85,650, while gross profits amounted to £33,038, and after meeting interest and sinking fund charges, and providing £4,668 for depreciation, there remained a net surplus of £6,998, as compared with £9,417 in the previous year. The average total working cost was 6.5d. per unit, as against 5.2d., the cost of coal having increased from £14,596 to £27,928. The total connected load was 24,207 kw. and the maximum load 7,480 kw.; the load factor improved to practically 29 per cent. The report refers to the difficulty of obtaining a sufficient supply of condensing water; as an emergency arrangement a temporary salt-water supply scheme from the harbour was inaugurated to provide make-up. Some 14,000 kw. of a.c. turbo machinery is installed in the power station, and arrangements have been made for installing two 30,000-lb. Babcock independent boiler units, also a large cooling tower. Some 2,500 kw. of converting machinery is installed for the Greenock network, and apparently another 2,000 kw. is required, while an additional 1,000 kw. of converting plant will be required for Port Glasgow. The h.r. scheme now embraces 17 sub-stations, nine rotary and eight static; a total of 9,400 kw. is installed in them. Although publicity work has practically been suspended, 284 motors, radiators, and other appliances, representing 468 kw., were sent out during the year from the departments' showrooms.

Hull.—**PLANT EXTENSIONS.**—The Corporation has decided to make application to the L.G.B. for sanction to the borrowing of the necessary money to proceed with the scheme for providing a water-cooling system at the electricity works. The scheme was dropped in February, 1915, at the request of the Treasury, but, owing to the increased output, it is considered necessary that the work should be proceeded with at an early date. The original cost was £6,900, but the increased cost of materials will add about 30 per cent. to that amount.

Johnstone.—**STREET LIGHTING.**—The T.C. is to utilise the electric supply of the Paisley Tramways Co. and to provide lamps in the centre of the town.

Kingstown.—**E.L. SCHEME.**—The Council has decided to pay £100 to Mr. J. B. Tierney, in respect of the preparation of plans and specifications in connection with the electric lighting scheme.

London.—**HACKNEY.**—Application is to be made to the L.C.C. for a loan of £6,500 in respect of the expenditure to be incurred in linking-up the electricity undertaking with the North Metropolitan Electric Supply Co.

St. Pancras.—Owing to a pit fire at the Newdigate Collieries, a considerable falling-off in coal deliveries to the electricity department has taken place, and the chief engineer has been forced to buy in the open market to replenish the stocks.

Poplar.—The Council is to support the proposals of the National Electric Power Supply Joint Committee with reference to the interconnection of electric supply stations.

Lossiemouth.—**PROPOSED LOAN.**—The T.C. is endeavouring to obtain a loan of £1,660 to defray the balance of the cost of the electricity works.

Mexborough.—**WAGES.**—The Electricity Committee has decided to grant a war bonus of 3s. per week to its employees; the application of the men was for an increase of 5s. per week.

Midlothian.—The U.D.C. has been informed that the contract for electric lighting expires on December 31st. The manager of the Electric Lighting Co. has submitted a proposal to charge the Council only for the electricity supplied until a fresh agreement was arranged.

Middlesbrough.—At a meeting of the Electricity Committee it was reported that for September there was an estimated profit of £863, exclusive of interest and redemption charges, and for October the estimated profit was £1,328, these figures representing increases of £44 and £50 respectively, compared with the corresponding months of last year. The engineer (Mr. Scotson) said the effect of the Daylight Saving Act had been a reduction of 7½ per cent. in the number of lighting units, but there was an increase of £450 in the revenue for the past six months, as compared with the same period of last year, due to the increase in the power load. The engineer was authorised to attend a conference of electrical engineers on the suggested linking-up scheme.

Newport.—**EXHIBITION.**—At the Trades Exhibition held last week, at the Pavilion, Stow Hill, the Corporation electricity department had an interesting exhibit of electrical apparatus and fittings suitable for domestic purposes. Those exhibiting included (according to the *S.W. Argus*) Messrs. Siemens Bros., Ltd., Simplex Conduits, Ltd., General Electric Co., Ltd., Chas. Joyner & Co., Belling & Co., British Electric Transformer Co. (cookers and heaters), Jackson's Electric Stove Co. (cookers and heaters), Ferranti, Ltd., and many other well-known firms. This winter it is expected that domestic heating and similar uses will account for well over a million units.

Oldham.—**STREET LIGHTING.**—With a view to improving the lighting of the main streets, the Electricity Committee proposes to suspend electric lamps from the tramway standards, about 40 yards apart. It is intended to run the necessary cable overhead by means of the tramway standards, and to use small electric lamps of about 60 watts each.

Peterborough.—**YEAR'S WORKING.**—The report on the working of the Corporation electricity department for the year ended March 31st shows that the output of electricity decreased from 973,762 units in 1914-15 to 861,050 units last year, entirely due to lighting restrictions. The net result of the year's working is a deficit of £470; just prior to the war, the capacity of the generating plant was increased from 840 kw. to 1,340 kw., in anticipation of a greater demand for electricity for all purposes; but this has not yet been realised.—*Peterborough Standard*.

Radcliffe.—**PLANT EXTENSION.**—The plans of the Lancashire Electric Power Co. for the extension of its power station have been approved by the U.D.C.

Rawdon and Yeadon.—**E.L. PROPOSALS.**—The Electrical Distribution of Yorkshire, Ltd., has given notice of its intention to apply to the B. of T. for a prov. order for electric supply within the urban districts of Rawdon and Yeadon.

The Rawdon U.D.C. has already given its consent to the application, and the question will come before the Yeadon D.C. at its next meeting.

Swinton and Pendlebury.—**PRICE REVISION.**—It was announced last week that, owing to increased cost of production, the U.D.C. was revising its scale of charges for electric supply.

Tottenham.—The General Purposes Committee has directed that notice be served on the North Metropolitan Electric Power Supply Co. to cease lighting all arc lamps, and to provide 50-c.p. incandescent lamps at 17 points, as agreed by the Council. The Committee will report further as to the question of the amount required by the company in respect of interest on capital expenditure during the suspension of the lighting, and also as to further reducing the accounts respecting unlighted lamps during the past quarter.

Walthamstow.—**PRICE INCREASE.**—The price of electricity for lighting is to be further increased by 5 per cent., and for power and heat by 10 per cent.; an endeavour is to be made to obtain an increased price in the case of periodic contracts.

Negotiations are in progress for supplying a firm with from 750 to 1,000 h.p., and application is to be made for sanction to a loan of £13,140 and a grant-of £8,063.

Wolverhampton.—In consequence of a temporary breakdown at the Corporation electricity works on Monday morning, there was a dislocation of the tramway service in the borough for a short period.

Widmermere.—Subject to the consent of the B. of T., the U.D.C. has decided to give Messrs. Borwick & Sons a supply of current by overhead wires to their works.

TRAMWAY and RAILWAY NOTES.

Bradford.—*Apud* the paragraph in the ELECTRICAL REVIEW of November 10th, on the difficulties of the queue system of tramway loading in Forster Square, one of the new barriers on the narrow causeway at the bottom of Kirkgate, which is one of the most congested corners in the city—is to be removed after an existence of about three weeks. The wonder of the public (according to our correspondent) has been that it was ever erected in such a position, with a wide and roomy space round the corner in Market Street. The decision was announced at a meeting of the Finance Accounts sub-Committee on Friday last.

On all routes the service of cars is to be curtailed by half-an-hour at the end of the day.

Continental.—**NORWAY.**—It is stated that the Norwegian Government has decided to convert to electric traction the existing narrow-gauge railway between Christiania and Drammen, and to transform it to the normal gauge. The preliminary expenditure was sanctioned by the Storting a short time ago. It is calculated that the reconstruction of the line, which has a total length of nearly 33 miles, will involve an outlay of £1,153,000, and the cost of the electrical equipment will represent a further sum of £384,000. It is proposed to erect a power station at the Hakavik waterfall, which was acquired by the Government in 1914, and to install turbo-generators of a total of 17,200 H.P., the first sets to comprise three units, each of 4,500 H.P. The scheme provides for the purchase of 20 locomotives, having a speed of 44 miles per hour. If further power is required than that furnished by the Hakavik waterfall, recourse would be had to the Nore waterfall for this purpose. The beginning of the new service is expected to take place in 1920. The question of the transformation to electric traction of the Ofoten railway, which forms a continuation of the Swedish frontier railway, and which terminates near Narvik, is also under consideration. Negotiations for the present are being conducted with the Swedish mining companies which forward iron ore to Narvik for shipment. This frontier railway, which proceeds from the Lapland iron ore district near Kiruna to the Norwegian frontier, was converted to electrical working a few years ago.

Huddersfield.—A scheme for training as motormen persons with spare time has been instituted by the manager of the tramway department, which is reported upon as very successful. It is thought that many men of suitable age may adopt this national service in preference to going into munition shops.

Middlesbrough TRANSPORTER BRIDGE.—Owing to a broken cable, the car of the electrically-driven transporter bridge recently stopped halfway across the Tees, but the provision made for such emergencies proved adequate, the car being in running order again in a very short time.

Newcastle-on-Tyne.—The drivers in the employ of the Corporation have petitioned the Tramway Committee for the curtailment of the night service. The Committee is to meet the theatre managers with a view to considering the position from the theatrical point of view. It is expected that the service will be curtailed.

Rossendale.—**ARBITRATION.**—On the 20th inst. Mr. J. M. McElroy held an inquiry on behalf of the B. of T. into the proposed alteration of tramway stages and fares on the Bacup-Rawtenstall tramway system which is operated by the latter Corporation. The Bacup authorities objected to the proposed fare increases, as they are all in their area, while, on the other side, it was claimed that Bacup passengers are now in a favoured position.

Walsall.—Owing to a failure of electric supply the tramway service was stopped for two to three hours on Monday. It was stated that this was due to the necessity of securing the supply to local factories, which, due to the dark morning, was greater than usual.

Walthamstow.—The clerk is to communicate with the Commissioner of Police, pointing out the increasing scarcity of men suitable for employment as motormen on the tramways, and urging that women should be licensed as drivers.

TELEGRAPH and TELEPHONE NOTES.

German Wireless.—The rates for telegrams by wireless from Germany to America have been reduced from 1s. 0½d. per word to 4½d. (Nauen to Sayville.)

Italy.—Inland telegraph rates have been raised by 40 per cent. for the first 12 words.

Hull.—The Corporation Telephone Committee has awarded war bonuses of 4s. to males over 18 whose wages do not exceed 40s. a week, and 3s. a week to males whose wages exceed 40s. but not 60s. a week. Females and males under 18 are to receive half these amounts.

New Press Telegram Rates.—The Postmaster-General proposes to postpone the operation of the new Press rates until January 1st, 1918.

Russia.—The *Sibir* says that on September 18th, at the village of Dudinka, on the Yenisei, 400 versts from the Arctic Circle, the most northern part of the Turuchan-Dudinka telegraph line, which is an extension of the Yenisei-Turuchan line, was opened.

Wireless Station under Censorship.—The U.S. Government has put a naval officer on duty in the wireless station of the *New York Herald* at the Battery in New York City, with instructions to prevent the use of that station for sending unneutral messages to vessels at sea. This action resulted from the interception by the Brooklyn Navy Yard of a message sent out by the *Herald* wireless station to ships at sea, reporting that the German submarine U-53 was operating off the Nantucket Lightship.—*T. and T. Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Argentina.—November 30th. Buenos Aires Municipality. Electric carbons required during 1917. Oficina de Licitaciones. Intendencia Municipal de la Capital, Avenida de Mayo, 525, Buenos Aires.

Australia.—**SYDNEY.**—January 3rd. N.S.W. Railways and Tramways Department. 50-ton electric overhead travelling crane for Yarra Street power-house, Newcastle.*

January 8th. Municipal Council Electric Lighting Department. 33,000-volt switchgear. E.L. Department, Town Hall. Specification 10s. 6d.*

January 22nd. Electrical plant (converter, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.*

Cape Town.—January 5th. Electric motors and starting panels, for the Corporation Electricity Department. Dock Road, Cape Town.*

Durban.—January 3rd. Corporation. One 3,000-kw. steam turbine, alternator, and condensing plant. Specification No. S. 238; drawing No. P. 597, both at the office of the Borough Electrical Engineer, Municipal Buildings. Deposit £2 2s.

Enniskillen.—December 1st. Sligo, Leitrim & Northern Counties Railway Co. Twelve months' supply of telegraph materials. Mr. J. Duff, Secretary to the Company.

Grenada.—December 31st. Government. Electric supply at St. George's and suburbs. Tenders to Colonial Secretary, Grenada, British West Indies.

Johannesburg.—December 9th. Corporation. 1,427 A.C. and D.C. electricity meters and 100 time-switches. Specification (21s. deposit) from Mr. E. T. Price, General Manager's Office, Electricity Supply and Tramways Department, President Street, Johannesburg, W.*

December 20th. Corporation. Automatic pressure regulators for the A.C. turbo-generators at the power station.*

January 3rd. Corporation. Iron axles and bushes.*

London.—**H.M. OFFICE OF WORKS.**—November 27th. Twelve months' supply of electric cable and wire. See "Official Notices" November 17th.

New Zealand.—**DUNEDIN.**—January 24th, 1917. Motor-generator, accessories and spares. City Electrical Engineer, Market Street, Dunedin.*

TATRANGA.—February 12th. Borough Council. Supply of six three-phase transformers, 11,000-400 volts. H. W. Clime & Sons Consulting Engineers, Raetih. —*N.Z. Shipping and Commerce.*

Trimdon Grange (Co. Durham).—December 3rd. Six months' supply of electric fittings. Storekeeper, Trimdon Grange Colliery.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Department in London.

CLOSED.

Government Contracts.—List of new contracts placed during October 1916.

WIRE OFFICE.

Electric cables.—W. Maxwell & Co., Ltd.; Peel-Comer Telephone Works, Ltd.
 Insulating materials.—Park Royal Engineering Works, Ltd.; Parmer, H. & Co., Ltd.
 Electric cable and wire.—B.I. & Helsby Cables, Ltd.; Crangpark Electric Cable Co., Ltd.; W. T. Glover & Co., Ltd.; Hooper's Telegraph and India-Rubber Works; St. Helens Cable & Rubber Co., Ltd.; Siemens Bros. & Co., Ltd.
 Telephone cords.—London Electric Wire Co. & Smiths, Ltd.
 Electric light fittings.—Cable Accessories Co., Ltd.; Edison Swan Electric Co., Ltd.; General Accessories Co., Ltd.; General Electric Co., Ltd.; C. H. Parsons, Ltd.; Peyton & Peyton, Ltd.; Sun Electrical Co., Ltd.; C. J. Thursfield & Co., Ltd.
 Generating sets.—Austin Motor Co. (1914), Ltd.; Fyfe, Wilson & Co.; Kesteghley & Oil Engine Co., Ltd.
 Motors and switchboard, etc.—Electric Construction Co., Ltd.; Siemens Bros. & Co., Ltd.
 Insulating tape.—Ancients Vale Rubber Co., Ltd.; Siemens Bros. & Co., Ltd.
 Volt- and ammeters.—Johnson & Phillips, Ltd.
 Copper wire.—F. Smith & Co., Ltd.
 Iron wire.—Dorman, Long & Co., Ltd.; Rylands Bros., Ltd.
 Works services.—Electric light installation, Digbate, & Co.; Ferranti, Ltd.
 Electric light services, Yatesbury: Siemens Bros. & Co., Ltd.

INDIA OFFICE STORE DEPARTMENT.

Accumulators.—Pritchett & Gold.

POST OFFICE.

Telephone apparatus.—Siemens Bros. & Co., Ltd.
 Telegraph apparatus.—Creed, Bille & Co., Ltd.
 Telegraph cable.—B.I. & Helsby Cables, Ltd.; Enfield Electric Cable Manufacturing Co., Ltd.; W. Geipel & Co., Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; C. Macintosh & Co., Ltd.; St. Helens Cable & Rubber Co., Ltd.; Union Cable Co., Ltd.
 Telephone cable.—Peel-Comer Telephone Works, Ltd.
 Dry cables.—Siemens Bros. & Co., Ltd.
 Telephone cords.—London Electric Wire Co. & Smiths, Ltd.
 Cable drums.—F. I. & Helsby Cables, Ltd.; Western Electric Co., Ltd.
 Insulators.—Taylor, Tunniffic & Co., Ltd.
 Insulator spindles.—Bayliss, Jones & Bayliss, Ltd.; Bullers, Ltd.; Guest, Keen & Snerfelds, Ltd.
 Insulated bronze wire.—B.I. & Helsby Cables, Ltd.
 Galvanised-iron wire.—Dorman, Long & Co.; Rylands Bros., Ltd.; Shropshire Iron Co.; F. Smith & Co. (Wire Manufacturers), Ltd.; Whitecross Co., Ltd.
 Battery zincs.—Eyre Smelting Co., Ltd.; Siemens Bros. & Co., Ltd.

H.M. OFFICE OF WORKS.

Supply of incandescent electric lamps to August 31st, 1917.—British Thomson-Houston Co., Ltd.; Pope's Electric Lamp Co., Ltd.

Walthamston.—U.D.C. Accepted tenders:—

Babecock & Wilcox, Ltd.—Water-tube boiler, £1,850; economiser, £929; steel chimney, £1,650; pipework, £890; hotwell tank, £170; pump, £345; universal draught plant, £490.
 Bruce Peebles & Co., Ltd.—1,000-kw. motor-converter, £3,250.
 British Thomson-Houston Co., Ltd.—E.R.T. switchgear, £233.
 General Electric Co., Ltd.—L.T. switchgear, £355.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, November 24th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary meeting.

Royal Society of Arts.—Monday, November 27th. At 5 p.m. At John Street, Adelphi. How "I" Lecture on "Coal and its Economic Utilisation," by Prof. J. S. Brame.

Wednesday, November 29th. At 4.30 p.m. Paper on "The Internal-Combustion Engine," by Dr. Dugald Clerk, F.R.S.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, November 28th. At the Engineers' Club. Paper on "The Parallel Operation of Electric Power Stations," by Mr. J. S. Peck.

Liverpool Engineering Society.—Wednesday, November 29th. At the Royal Institution, Colquhoun Street. Paper on "Notes on the Construction of Modern Dock Gates," by Mr. T. L. Norriok.

Greenock Electrical Society.—Thursday, November 30th. At 20, West Street. Paper on "What is Electricity?" by Mr. J. L. Hogg.

NOTES.

U.S.A. National Research Council.—Arrangements have just been completed in New York whereby the resources of the Engineering Foundation, under the auspices of the four principal national engineering societies, are placed at the disposal of the National Research Council, which was appointed by the National Academy of Science at the request of President Wilson. The object of the Council is to co-ordinate the scientific research work of the country, in order to secure efficiency in the solution of the problems of war and peace. The Council was without funds until the Engineering Foundation, established to further scientific and engineering research, offered to place its resources at the Council's disposal, including the services of its secretary, Dr. Cary T. Hutchinson, to act as secretary of the Council. The offer was accepted, and plans for immediate activities have been placed in the hands of an Executive Committee.—*Electrical World*.

Largest Generator in the World.—The *Electrical World* reports that the Siemens-Schuckert-Werke, of Berlin, Germany, is now building a 60,000-K.V.A. generator, wound for 6,600 volts, and running at 1,000 R.P.M. The generator is intended for the Rheinische Westfälische Elektrizitäts Werke, and will be delivered by April 1st, 1917, which throws an interesting light on the conditions of the German electrical industry in spite of the war. The generator energy will be stepping up to 110,000 volts for transmission by a 60,000-K.V.A. transformer.

Educational.—RUSSIA.—The Russian Universities have prepared a memorandum with a view to bringing the educational establishments of England, Russia, and France closer together. The memorandum contains the following recommendations:—

1. The study of English should be included as an obligatory subject in the curriculum of all Russian Secondary Schools and Universities.

2. Young scholars sent abroad by the Ministry of Education for special research studies should go preferably to England, and also to France.

3. Regular tours of Secondary School and University teachers and lecturers to England and France should be organised by the Ministry.

4. A system of exchange of all scientific publications should be organised between Russian and English educational institutions.

5. Similar exchange of scientific apparatus and educational objects. *The Times*.

The Russian Academy of Science has elected a special bureau, whose aim it will be to promote intellectual intercourse between England and Russia. It will publish in the English and Russian languages the works of modern scientists, and will organise lectures to be held by Russian professors in England, also inviting English professors to give lectures in Russia.

British Money for British Industries.—The *Daily Telegraph* states that the Trade and Industry Committee of the Royal Colonial Institute recently submitted the following resolution to the Governments of the Dominions and Colonial Governments having power to legislate, as well as to Chambers of Commerce, Boards of Trade, &c., in all parts of the Empire:—

"That with a view to encouraging the establishment of new industries in the British Empire, and giving a measure of confidence and security to capital to be embarked therein, as well as assisting the expansion of existing industries, the Governments of the Empire be urged to make it obligatory on all Government departments, municipalities, railways, dock and harbour boards, gas, water, and electric light corporations, and all such bodies spending public moneys, or enjoying charters from Government or other public authorities, to purchase Empire-made goods, and to place all contracts with British firms, exceptions to be made, by special permission of proper authority, only in cases where such a course is considered to be at variance with public interests."

In forwarding the resolution, it was pointed out that if it were made compulsory in each part of the Empire that Government departments and municipal and other public bodies should place contracts only with British firms, it would prove a very strong factor in stimulating the establishment of new, and the growth of existing, industries, as well as consolidating inter-Empire trade. Chambers of Commerce and Boards of Trade were asked to co-operate in bringing before their Governments the necessity of passing the required legislation to give effect to the principle embodied in the resolution. A large number of favourable replies were received.

Electric Flour Mill in the Caucasus.—In view of the continuous rise in price of grain products, the management of the Caucasian Railway has decided to construct an electrically-driven flour mill at Mineralnya Vody, to supply the servants of the railway with flour.

Engineers and the Question of a Truce.—The *Times* gives a list of the topics which will be brought before the annual Conference of the Labour Party at Manchester, in January. It describes the resolution submitted by the Amalgamated Society of Engineers as the most ominous. It reads as follows:—

"That this Conference, believing that the attempt to negotiate a binding industrial truce between Labour and Capital might well create more friction than it would prevent, cannot regard the conclusion of such a truce as either practicable or desirable; but that this Conference would welcome the initiation of negotiations between Trade Unions and Associations of Employers in each industry, with a view to the settlement by agreement, wherever possible, of the serious industrial problems that will arise after the war."

"This Conference, therefore, reaffirms its belief in the pre-war methods of negotiation between employers and employed, and affirms its opposition to any system of compulsory arbitration in trade disputes."

The *Morning Post* states that a meeting of representatives of the Employers' Parliamentary Association and the Trade Union Parliamentary Committee was held at the House of Commons, on the 16th inst., when the possibility of holding a Conference thoroughly representative of industry and of the Trade Unions was discussed. The meeting was of a preliminary character, and another meeting will be held in the near future further to consider the proposal. It is understood that the Conference, if held, will deal with the question of industrial peace after the war.

The Engineers' Club, Manchester.—On Tuesday evening members of this club met to consider the subject "Eclipse or Empire," the proceedings being opened by Mr. S. Turner, of Turner Bros., Ltd., Rochdale, joint author of a book with that as its title.

On December 5th Mr. E. C. Barton will open a debate on "The Decimal System," the Lord Mayor of Manchester (Councillor T. Smethurst) presiding.

On December 19th the subject for discussion will be "Engineering Education and Research," introduced by Mr. A. P. M. Fleming, of the British Westinghouse Co.

Institution and Lecture Notes.—Institution of Civil Engineers.—In a paper on "Keadby Bridge," on Tuesday last, Mr. J. B. Ball stated that the Great Central Railway Co. had recently completed an important bridge over the river Trent, at Keadby, of which the chief feature was a lifting span, built on the Scherzer principle, which claimed the distinction of being the heaviest lifting bridge yet constructed in Europe. The new structure consists of a combined railway and roadway bridge of five spans, including a lifting span of 160 ft., giving a clear waterway of 150 ft. The total weight of steelwork in the lifting span is 987 tons, exclusive of the machinery and gearing, and the total weight of the span, together with its counterweight, is approximately 2,920 tons. The lifting span is worked electrically by means of two 115-H.P. D.C. motors, carried on the leaf itself, the power being transmitted through trains of gearing to the main pinions on each side. The angle of maximum elevation of the bridge, when fully open, is 81°51, and the time taken to open or close it by electrical power is less than two minutes.

Owing to the absence of power supply in the neighbourhood, a special plant for the generation of current had to be put down, consisting of two direct-current petrol engines driving two 50-kw. machines, the current being delivered at the switchboards at 220 volts. A large storage battery is provided, capable of supplying the motors with current for about 30 operations of the bridge before re-charging is necessary. Two sets of electric brakes are provided, and at the fore end of the span two heavy forged steel bolts, worked electrically from the control cabin, engage with castings anchored down to the pier, so locking the bridge when in the "down" position.

Electrically-operated gates are provided for the protection of roadway traffic, which are interlocked with the railway signals; the latter are three-position signals, and are the first to be installed as a complete scheme in this country.

The bridge was commenced in August, 1912, and the bridge was opened to traffic on May 21st, 1916.

University College, London.—Opening the fourth of his lectures on "Long-Distance Telephony," Prof. Fleming dealt with "transition" losses at points of junction between cables of different characteristics, or between aerial and underground lines, and showed how they could be calculated and expressed in terms of "miles of standard cable" (M.S.C.). He then returned to the subject of loading, and explained how the formula for the attenuation constant could be greatly simplified when, as in a loaded cable, the ratio $R/\rho L$ had a small value, for then $\sqrt{R^2 + \rho^2 L^2} = \rho L$. $V I + R^2 \rho^2 L = \rho L + R^2 \rho^2 L$, and similarly $\sqrt{G^2 + \rho^2 C^2} = \rho C + G^2 \rho^2 C$, for $s/\rho C$ is always very small. Using these expressions, the attenuation constant $\alpha = \frac{1}{2} \sqrt{C L} (R/L + S/C)$, a very useful formula; in this R includes the resistance and L the inductance of the loading coils. From this it was shown that the theoretically best loading—i.e., that which made α a minimum—was attained when $L = R_0/(R^2/L + S/C)$, where R_0 = the line resistance per mile and R^2/L , the resistance and inductance of the loading coils. R^2/L may vary from 25 to 50, and S/C from 12 to 350; hence the best value of α depends upon S/C , which should not exceed 100 to 150. Generally, however, the "best loading" requires too close spacing of the coils, and it is not economical to load to that extent.

"Krupup," or uniform loading, is effected by winding a fine iron wire round the insulated conductor of a cable from end to end: it increases the inductance, but not so much as coil loading. After deducing a formula for the inductance of two parallel wires in air, Prof. Fleming showed how the presence of the iron between them affected the inductance, the increase being about $110.5 \times t(d+t)$ in millihenrys per mile, where t = the thickness of the iron wire and d = the diameter of the conductor. Unfortunately, the iron winding also introduces eddy currents and hysteresis, which increase the apparent resistance of the copper conductor by an amount = $8,000 \rho^2/(d+t)$ ohms per mile. The effective result, therefore, is that the ratio of the increase in resistance to the increase in inductance = $72,400 \rho$, and thus depends only on the thickness of the iron wire. In practice, t is about 0.012 in., and the lowest value of the ratio is about 110. This compares with the value 25 to 50 with coil loading, and cannot be much improved upon, unless iron wire of very low hysteresis and high specific resistance can be made.

Reference was made to the article by Mr. J. G. Hill in the ELECTRICAL REVIEW of November 29th, December 6th and 13th, 1912, in which cables loaded with coils and with uniform loading were fully compared.

Prof. Fleming next explained the method of superposing "phantom" circuits on ordinary circuits, and showed how the former could be loaded without affecting the loading of the latter. Perfect balancing of the circuits in all respects is essential, and can be attained more easily in the construction of cables than in aerial lines, which require elaborate schemes of spiralling and crossing to prevent cross-talk and external interference. Discussing the details of a large number of important loaded lines, including the line from New York to Denver, Prof. Fleming stated that the London-Birmingham cable, recently completed, was the best yet laid. The 300-lb. circuits, 109.5 miles in length, were equivalent to only 4.2 miles of standard cable; they had been extended to Liverpool, and could be extended to a total length of 500 miles.

Physical Society of London.—On October 27th a paper, entitled "The Influence of the Time Element on the Resistance of a Solid Rectifying Contact," was read by Mr. D. Owen. The resistance at a solid rectifying contact, and consequently the exact shape of the resistance characteristic, depends upon the time for which the testing current is allowed to flow. A series of characteristics are given corresponding to durations of contact extending over the

range one forty-thousandth of a second to 30 seconds. The following conclusions are drawn:—

1. That the variation of resistance with voltage may be attributed entirely to thermal effects.

2. That the characteristic obtained by applying the testing voltage for one hundredth of a second is, at moderate voltages, materially the same as that which would be found at the expiry of a period of the order of a millionth of a second.

3. That the sensibility of a wireless receiving circuit (in which the rectifying contact is used) does not differ very appreciably from that deduced from a slow period characteristic.

4. That an important fraction of the contact-resistance resides in a stratum of molecular thickness at the interface of the two elements of the contact; and that it is in this region alone that rectifying action at very high frequencies is effected.

Greenock Electrical Society.—In a paper on the I.E.E. rules for wiring, Mr. Herbert Piggett made suggestions with the object of improving their sphere of application. Several clauses in the rules were shown to lack conciseness, while in many cases the instructions embodied left the matter open to discussion. The opinion was advanced that the rules, to be absolutely binding, would require to be made more definite, and the intentions more clearly stipulated than was the case in the 1916 revision.

Mining Electrical Engineers.—A joint meeting of colliery managers and mining electrical engineers, with the staff branches, was held, on Saturday last, at Birmingham, when Mr. Jones, A.M.I.E.E., Chasetown, read a paper on "Colliery Electrical Installation." A discussion followed, and it was resolved that a special meeting be held to continue the discussion.

Sabotage at a Munition Factory.—According to the *Leeds Mercury*, the work of a factory, engaged entirely on work for the Government, was delayed and damage to the extent of £30 was done, apart from the delay which was caused to employment, by Robert Thompson, a labourer.

The defendant, who pleaded guilty, was an Irishman, and came over from Ireland with some fellow-countrymen about three months ago to work at the factory. On the night shift, on November 10th, a crane boy saw him alongside a tank which controlled the supply of electricity. There were resistance rods at the end of the tank, interference with which allowed the whole of the current to pass through the tank, thus causing waste and delay. Defendant was seen by a labourer, with a bar of metal, knocking off two of the rods, one of them being actually broken.

The Bench felt that the case could not be dealt with by a fine, and sentenced him to 14 days' imprisonment with hard labour.

Central Station Engineers.—ASSOCIATION OF ELECTRICAL STATION ENGINEERS.—The present activities of the Association of Electrical Station Engineers are concerned with the general assistance of individual members—such as legal assistance, solving members' difficulties due to the Munitions of War Act, giving general information to members with regard to stations and station work, &c. The policy of the Association has not altered, and still remains the same as stated in the "Correspondence" pages of the ELECTRICAL REVIEW of January 21st, 1916. It is regretted that several organisations have endeavoured to form special sections to deal with the affairs of electrical station men, who already have an organisation to protect their interests, but experience enables the A.E.S.E. to look to the future with every confidence, believing that now station engineers are realising the necessity for organisation they will join their *confrères* in the A.E.S.E., the only organisation devoted solely to the interests of station men.

ELECTRICAL TRADES UNION (LONDON POWER STATION ENGINEERS' BRANCH).—We are asked to state that an inaugural meeting of this branch was held on Wednesday, last week, at the Surrey Masonic Hall. An address was given by Mr. Kinniburgh, organiser, in which he dealt with the objects of the branch, which are to organise the London power station engineers; membership is to be open to all—London station engineers, electricians and switchboard attendants who can produce five years' credentials at the trade. Mr. Kinniburgh mentioned that there were already over 30 members in the new branch, and station men in the County of London who have the necessary qualifications will be welcomed at any of the branch meetings.

Parliamentary.—The West Kent Electric Power Co., Ltd., has given notice of application to Parliament in the 1917 session for further capital and other powers.

The Nottinghamshire and Derbyshire Tramway Co. is introducing a Bill for taking over the Ilkeston Corporation tramway undertaking.

The Aluminium Corporation is applying for powers for cancellation, rearrangement or concession of the participating shares of the company, and further capital provisions.

The South Metropolitan Electric Tramways and Lighting Co., Ltd., is applying for electric supply powers for Ewell and Cuddington, &c.

The Electrical Distribution of Yorkshire, Ltd., is applying for electric supply powers for Rawdon and Yeadon, also Clayton and Queensbury, Penistone, Wortley (rural) and Otley.

Cable Makers' Association.—At the invitation of this Association the post of secretary, which became vacant by the death of the late Mr. A. H. Howard, has been accepted by Mr. Llewelyn B. Atkinson, M.I.E.E., A.M.Inst.C.E. Mr. Atkinson is a director of Messrs. W. T. Glover & Co., Ltd., and has for the past 13 years been closely associated with the work of the Cable Makers' Association, of which, in the year 1913, he was chairman.

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS. Headquarters, Chester House, Euston Place. Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, November 27th.—Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10, Signalling Class. Lecture, "On Telephones," 7.30.

Tuesday, November 28th.—School of Arms, 6.7. Lecture, 7.15, "Entrenching," Company Commander Castell.

Wednesday, November 29th.—Instructional Class, 6.15. Platoon Drill, Platoon No. 1.

Thursday, November 30th.—Platoon Drill, Platoon Nos. 5 and 6. Instructional Class by M.O. 6.

Friday, December 1st.—Technical for Platoon No. 10, Regency Street. Squad and Platoon Drill, No. 9, Signalling Class. Recruits' Drill, 6.25—8.25. Lecture, "On Telephones," 7.30.

Saturday, December 2nd.—N.C.O.'s Class, 2.30. Company Commander Bentley.

Sunday, December 3rd.—Entrenching at Otford. Parade at Victoria (S.E. & C. Railway Booking-office), 8.45 a.m.

Inspection.—The Inspection by the County Commandant is unavoidably postponed for a few days.

(By order) MACLEOD YEARSLEY, Adjutant.

November 24th, 1916.

Fatalities. By the collapse of a stage whilst workmen were employed on the erection of a steel chimney stack at the Bradford Electricity Works, last week, three riveters in the employ of Messrs. Newton Chambers & Co., Ltd., of Sheffield, were thrown to the bottom of the stack, a distance of 60 ft. Edgar Yearley, the erector, was killed outright, Richard Gardner, his foreman, died later from his injuries, and the third man was injured.

At an inquest into the death of a woman, aged 64, at Wolverhampton, the driver of a car was exonerated from blame. Great complaint was made of the darkness of the town, and the jury recommended, if the authorities could see their way clear, that there should be a little more light. They also suggested that the speed of cars should be reduced after sunset, and that all cars should be equipped with hand lamps and other appliances in case of accident. The Coroner remarked that this was the third case of fatal accident which he had inquired into since the introduction of the restricted lighting, and it had struck him that in each of these cases a little more light might possibly have saved the deceased. Mr. Howell, the deputy town clerk, undertook to bring the recommendations under the notice of the authorities.

Sterling Telephone and Electric Co., Ltd.—From an advertisement which appears in this issue, it will be seen that the Public Trustee is inviting tenders for the purchase of 26,001 preference shares of £1 each and 7,400 ordinary shares of £1 each in the above company, vested in him as custodian by an Order of the Board of Trade, dated August 1st, 1916. It is mentioned that the trading profit for the year ended December, 1915, amounted to £58,904, before providing for depreciation, income-tax, excess profits duty, &c. Tenders must be submitted by December 8th.

Rifle Match.—A match between the "Ediswan" Rifle Club and the "G.E.C." Rifle Club was "shot by post" on Saturday last, under rather adverse conditions. "Ediswan" shot on their outdoor range at Ponders End, in wretched weather, while the "G.E.C." were more fortunate in being able to shoot in their indoor range at Witton, Birmingham. Hence it came as a great surprise to the "Ediswan" men themselves to learn that they had won the match under such "trench-like" conditions.

The "Ediswan" team were represented at Witton by Mr. W. H. Fletcher, of their Birmingham Branch, and the "G.E.C." team sent a very popular man to represent them in the person of Lieut. Ward.

The scores were as follows:

"Ediswan": Score, 1,280, average, 8000. Team captain, A. J. Corbett.

"G.E.C.": Score, 1,191. Average, 74'43. Team captain, A. D. Mackay.

Chemistry and Engineering.—Discussing this subject on Monday last, Dr. Charles Carpenter (President of the Society of Chemical Industry) said that the future of the chemical industry could be secured by the co-operation of the two professions. In the past there had been prejudice between the two professions, inasmuch as engineers had always kept their operations strictly secret from the chemists. The need for men with knowledge of both engineering and chemistry was becoming a national one. The engineer and the chemist should take each other into confidence. The engineer should be taught enough of chemistry to appreciate the chemist's point of view, and the chemist enough of engineering to know that the engineer might be left to advise as to what would be good chemical works.

Receiver Appointed.—SHIPSTON ELECTRIC CO., LTD., Shipston-on-Stour.—Mr. A. E. Mason, of 193, Wolverhampton Street, Dudley, has been appointed Receiver for, and on behalf of, debenture-holders in this company. Future orders will only be recognised when bearing his signature.

Walsall Electricity Extensions.—In connection with the illustrated description of the above, appearing on page 563, we should add that Mr. T. Llewellyn has acted as clerk of the works, and has rendered excellent service during the construction of the buildings and plant.

Appointments Vacant.—A shift engineer is required for a Midland power station (£410); two switchboard attendants, for Redditch (35s.); chief engineering assistant, for Leeds electricity department (£350); demonstrator for the Northampton Polytechnic Institute Department of Electrical-Engineering and Applied Physics (£125); switchboard attendant (35s.) for the Walthamstow U.D. Electricity Works; shift engineer for the Borough of Reigate Electricity Works. See our advertisement pages.

A Curious Lighting Incident.—At Loughborough Petty Sessions a curious breach of the lighting regulations was disclosed in a case against Messrs. H. E. Godkin & Co., hosiery manufacturers. A constable stated that on a Saturday night he saw a bright light shining through the skylight of the factory, Mr. Godkin, after going to see what had happened, said someone must have switched on the light. For the defence, it was stated that Mr. E. L. Fisher and an apprentice were at work on the electric light, and when they finished on Saturday night the switch was turned off. Since this occurrence Mr. Fisher had made a special examination, and had found an extraordinary state of affairs. There was a leakage, not yet satisfactorily located, which had got into the iron girders of the roof, and had the effect of lighting this particular lamp. The switch was undoubtedly off. Evidence in support of this was given by Mr. E. L. Fisher and his apprentice. A fine of 20s. was imposed.

Turbine-Driven Ships.—The annual report of Lloyd's Register mentions that during the past year three vessels fitted with Parsons geared turbines and six with Curtis geared turbines have been built. At the present time 52 vessels are in course of construction, with a view to being classed in the Society's Register, of which 25 will have Parsons single-geared turbines and 27 Curtis double-geared turbines. Two vessels are being built in the United Kingdom to the Society's classification, with Ljungstrom turbo-electric propelling plant—one of 1,500 H.P. and one of 5,400 H.P. *Shipping World.*

The Mechanism of Light Production in Animals.—We referred to this subject in our issue of October 6th; Prof. Harvey has since contributed a further article to *Science*, in which he states that the luciferase, and not the luciferin, is the source of the light, and he proposes the new names photogenin and photophelin for the two substances. The light-producing power of these compounds is very extraordinary. "Cypridina photogenin will give visible light with photophelin in one part to 1,600,000,000 parts water." It takes photophelin from 100 *Cypridina*s to use up the photogenin from one *Cypridina*. "A water solution of *Cypridina* photogenin preserved with chloroform for 56 days will still give light on mixing with fresh photophelin. It should be borne in mind that photogenin, the source of the light, is not only a very powerful substance, but also a stable substance. If we can see the light from a stable body in a concentration of 1:1,600,000,000, what might not be accomplished with the pure substance? We have, perhaps, in the power of photogenin the first indication of a really possible utility of 'cold light.' My work is not sufficiently advanced to state the chemical nature of photogenin, except to say that it is probably protein."

Telux Co. v. Efundem Co.—As we go to press we learn that in this case, which is reported in our "Legal" columns in this issue, his Lordship on Wednesday entered judgment for the defendants on the claim, the counterclaim being withdrawn. The question as to Mr. Gordon's interest as sole partner was left over to be discussed to-day, Friday.

The Scarcity of Platinum.—The steadily increasing price of platinum is attracting attention to the Ronda lode in the district between Malaga and Gibraltar, to which public notice was directed at the beginning of the present year. It is understood that the Spanish Government has assumed the task of prospecting the Ronda lode. As is generally known, the Ural platinum mines, which are the richest known platinum mines in the world, are gradually showing signs of exhaustion, the output for 1915 having been less by half than that for 1914. *Financial Times.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—Horsesham U.D.C. has appointed Mr. HARRY L. COTTON, of Colchester, as electrical engineer, in succession to Mr. J. B. Morgan, resigned. Mr. J. W. S. CLUNAN, who has acted as city electrical engineer at Cape Town since the appointment of Mr. W. E. Long as general manager of the Cape Town Tramways Co., has now been confirmed in that position by the City Council at a salary of £900 per annum, with annual increases of £50 up to £1,200.

Mr. ROBERT OWEN, deputy chief electrical engineer to the Leeds Corporation, has received the appointment of electrical engineer to the borough of Wigan, at a salary of £350 per

annum, with house, lighting, and fuel, or, in the alternative, a salary of £600 without those allowances. There were 106 candidates.

Mr. C. T. ASTBURY, who has been electrical engineer to the Atherton (Lancs.) District Council for some years, has left to take up an appointment in Scotland. He has been presented by his former colleagues at Atherton and the respective chairmen of the Electricity and Fire Brigade Committees, with an antique oak bureau.

General.—The Salford Electricity Committee has re-appointed Coun. BILLINGTON chairman and Coun. McDONNELL deputy-chairman.

Roll of Honour.—The *Times* states that Captain H. W. TREFUSIS, Northamptonshire Regiment, who was killed on November 7th, aged 34, spent some time in Canada with a Government survey party, and then returned to England to study electrical engineering. In 1912 he was appointed electrical engineer to the Borneo Co., at Kuching, Sarawak, and he was there when war broke out. He returned to England in December, 1914.

Bombardier OLIVER WASSALL, R.F.A., who has been awarded the Military Medal, was employed in the electricity department of the Glasgow Iron & Steel Works.

The Military Medal has been awarded to Private J. ESTICOTT, Oxford and Bucks Light Infantry, who was, on his enlistment, employed at the Rugby works of the British Thomson-Houston Co., Ltd. The award is for gallant conduct by attending wounded single-handed under heavy shell fire.

ROBERT BATES, R.F.A., reported badly wounded, was employed at the Blackburn Corporation electricity works before being called up as a reservist.

The Military Medal, for gallant conduct in taking charge of his section after his officer had been badly wounded, and getting it safely through a barrage, and afterwards doing good consolidation work, has been awarded to Sergeant H. KFER, Royal Engineers, who was an electrician with Messrs. Joseph Walker & Son, electrical engineers, of Whitehaven.

Private A. E. GRIFFITHS, London Regiment, who was an employé of the Telegraph Construction & Maintenance Co., East Greenwich, has fallen in action.

Able Seaman A. W. HINSON, R.N. Division, who has died of wounds in France, was also at the East Greenwich works of the Telegraph Construction & Maintenance Co.

Petty Officer JOHN CLARK, R.N. Division, who was in the electrical department, at Charlton, of the L.C.C. tramways when he enlisted, is in hospital suffering from the effects of gas.

Sergeant WM. BECKETT HILL, reported to have died of wounds, was on the staff of the City of London Electric Lighting Co.

Private EDWARD FARR, West Yorks. Regiment, reported killed in action, was in the Leeds Corporation electricity department.

Private SIDNEY BROWN, Dorset Regiment, who was on the staff of the Lowestoft Corporation electricity works, has died in hospital at Amara, Mesopotamia.

Obituary.—MR. J. GRAY SCOTT.—We regret to learn of the death, which occurred in Constantinople in July last as the result of an electric shock, of Mr. J. Gray Scott. Mr. Gray Scott wrote a series of articles on "Combined Lighting and Traction Stations" for the "Electrical Review" nearly twenty years ago, when he was on the Bradford central station staff. He subsequently became P. Eng. at Whitehaven, and Leith, and, later, at Croydon. In 1894 he resigned his position as borough electrical engineer at Croydon in order to become general manager and electrical engineer to the Hong-Kong electric tramways, and on the termination of that engagement he returned to England, where he remained for some time; he subsequently proceeded to Constantinople to become professor of electrical and mechanical engineering at the Roberts College there. The circumstances attending his death are described in a letter received by his brother from the president of the College, and from which we quote:

On July 12th, the current of electricity was automatically cut off, and Prof. Scott went to the transformer station to see why it was interrupted. He was accompanied by a student, to whom he gave some explanations. He closed the switch, which had opened, locked the door, dismissed the student, and went away. About 20 minutes later he returned, opened the transformer station again, and stepped in. At this station a current of 10,000 volts is received and transformed before sending it on to the College for lighting. In some way inexplicable to us, he touched the live wire with his hand, and received a shock which was instantly fatal. A servant heard a cry. Men ran to draw him out and worked to revive him, with the assistance of two American doctors, but there was no sign of life. Our whole community was saddened and shocked beyond measure. Your brother was so systematic and faithful in the discharge of his duties that it was very hard to get along without him, and he was so kind to everyone that he endeared himself to many, many friends. We buried him in the historic cemetery at Haidar Pasha—the Crimean Memorial Cemetery—purchasing a lot for the purpose. My own idea is that a sudden giddiness must have seized him due, perhaps, to the intense heat of the day."

Mr. H. SPILDTORF.—The death is announced from New York, at the age of 83 years, of Mr. Henry Spildtorf, one of the pioneers in the development of the magneto for ignition purposes of motor vehicles. The deceased was also an active worker in other fields of electrical development. Even up to the time of his death he was stated to be engaged on the development of a new type of storage battery; he was also the inventor of a coil for use in connection with the firing of explosive charges, a repeating relay for telegraph lines, and various X-ray coils, while as long ago as the 'fifties of the last century he was associated with Morse in the development of telegraphic apparatus.

Will.—The late Captain C. S. WOLSTENHOLME, 12th Durham Light Infantry, assistant superintendent engineer in the telephonic department of the Leeds Post Office, who was killed in France in July, left £1,285.

NEW COMPANIES REGISTERED.

Accuratrac Magnetics, Ltd. (145,257).—This company was registered on November 14th, with a capital of £4,000 in 41 shares, to carry on the business of manufacturers of and dealers in paper, contact breakers and magnets, electrical engineers and manufacturers, founders, smiths, and general engineering. The registered office is at 10, The Quadrant, Grant. The shareholders with one share each are: A. P. Horn, Hemel Hempstead; R. Munster, Dorset; engineer, H. D. Grant, 102, Elm Grove Road, B'ness; Surveyor, merchant, Private company. The first directors are: Mr. A. P. Horn, president, and Mr. H. D. Grant, secretary. The company is authorized to issue debentures, to borrow money, to hold property, to sue and to be sued, and to do all such other things as may be necessary for the carrying out of its objects. Registered office: 10, The Quadrant, Grant, Hants. Registered office: 10, The Quadrant, Grant, Hants.

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OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Anglo-Mexican Electric Co., Ltd. (S7,403).—Capital, £300,000 in £1 shares. Return date, October 18th, 1916. All shares taken up, £7 paid, £299,993 considered as paid. Mortgages and charges, £300,000.

Europe & Azores Telegraph Co., Ltd. (39,452c).—Capital, £200,000 in £10 shares. Return dated June 22nd, 1916. All shares taken up; £144,320 paid, £55,680 considered as profit. Mortgages and charges: Nil.

E. S. Co., Ltd. (139,230).—Capital, £2,000 in £1 shares. Return stated July 14th, 1916: 1,401 shares taken up, £503 paid, £828 on shares has paid. Mortgages and charges, £2,000.

Flather & Co., Ltd.—A memorandum of satisfaction in full on October 27th, 1916, of debts registered November 26th, 1902, securing £1000, has been filed.

Northampton Electric Light & Power Co., Ltd.—Issue on October 31st, 1916, of £1,000 notes, part of a series of which particulars have already been filed.

CITY NOTES.

Monte Video Telephone Co., Ltd. Mr. C. Lock, presiding at the annual meeting on Tuesday, said that they had had over 500 new subscribers during the year. There was also an increase in

tained at somewhat less cost than in the previous year. The working expenses were £558,000, but had been singularly free from wind storms. They were putting £8,000 to depreciation and £9,000 to reserve for renewals. That reserve would be a great standby for the not distant future should they be fortunate enough to obtain a concession for the underground plant. Considerable pourparlers had taken place during the year with the Minister of Industries on the latter point. The company was not yet within sight of the granting of the concession, nor could he say that it would be granted, but the atmosphere was rather more favourable than for some time past. On the other hand, in the present state of war, there was no great hurry to incur heavy obligations for putting down a large amount of plant. They hoped that the grant would be delayed for some little time, and that the terms provided for in the draft concession for getting approval of the plans and for commencing operations, and also as to the time allowed for raising capital, would be of a more liberal character. In other words, while the company was quite ready to take the concession when they could get it, they hoped the actual expenditure of money thereunder might be deferred as long as possible, not only in the interests of the company, but also in the interests of the Government. One of the terms of the concession was that the Uruguayan Government should have the right to expropriate the undertaking at their convenience and discretion on terms which, of course, the directors considered satisfactory, and the more the company had to pay

for the plant, however, and in installing the system the greater amount had to be sent to the Government when they came to expropriate.

Cape Electric Tramways, Ltd. Presiding at the annual meeting in London, on November 15th, Mr. L. B. BATHURST said that in the operations of the year there had been increased expenditure in almost every direction. The traffic receipts had continued their upward movement, passengers having increased by 797,206 and receipts by £1,000. After March 1st, however, there was a considerable falling off in passengers owing to the military forces from Cape Town leaving for the German East African expedition. No marked expansion can be expected until the men return to their homes and Cape Town resumes its normal aspect. The increase in traffic receipts was more than counter-balanced by the heavier operating expenditure, owing to rising prices of supplies, salaries and wages, employees' war allowances, and special war bonuses. Colonial income-tax had also increased by £2,168. The London expenses had grown owing to the excess profits duty and higher income-tax charges. Some of the additional amount might be recoverable under the allowance by the Treasury for relief under the double taxation which the company was paying here and in the colony. The chairman referred to the very creditable way in which Mr. Long, the general manager, had handled the labour troubles at Cape Town, the Port Elizabeth system maintained its position under the able management of Mr. W. H. Fremantle. The board had every confidence in the future of the undertakings at Cape Town and Port Elizabeth. They regarded any setback as of a purely temporary character. They regretted that they could not maintain the former rate of dividend, but any reduction in the amount carried forward to next year would not have been prudent, especially as the returns were not now so good as for the corresponding months of last year.

French Electrical Companies.

The Société des Constructions Electriques, of Nancy, has decided to pay a dividend at the rate of £1 4s. per share for 1914-15, and £1 4s. per share for the past year, being a total of £2 8s. for the two years.

The Société Industrielle des Téléphones, whose manufactures are in special demand for the requirements of the national defence, realised net profits of £74,000 in 1914-15, and paid a dividend of 12s. per share. The net profits in 1915-16 are stated to be considerably greater, and the dividend is to be at the rate of £1 4s. per share.

The accounts of *the Société Métallurgique de Dives* for 1915-16 show gross profits amounting to £323,000, as compared with £200,000 in the preceding year, the net profits being £231,000 and £126,000 in the two years respectively. It is proposed to pay a dividend of £2 8s. per share, as against £1 8s. in 1914-15, and to place £20,000 to the reserve fund, thus increasing the fund to £50,000.

The directors of *the Société L'Eclairage Electrique* report that new manufactures were embarked upon in 1915-16, and the various works experienced a considerable development, particularly those at Lyons. The Lorraine Works, at Jarville, resumed the construction of electric motors; an iron foundry and steel plant had been added, and an electric furnace was in course of erection. The equipment at the Paris works in the Rue Lecourbe had been increased, whilst the capacity of the wire and cable factory in the Rue Bolivar was also to be expanded. A large augmentation in the production had taken place at Colombes, where the manufacture of electrical apparatus was to be undertaken to meet the requirements of customers. The net profits are returned at £146,000, and the dividend is at the rate of 10s. per share, as compared with 5s. in 1914-15.

German Electrical Companies.

The accounts of *the Telephon Fabrik A.G. vorm. J. Berliner, of Hannover*, show net profits, after placing £31,000 to depreciation in 1915-16 as compared with £25,000 in the preceding year, amounting to £123,000, as against £100,000. It is proposed to set aside £15,000, so as to increase the reserve fund to £50,000, to allocate £10,000 to war benevolent funds, and to pay a dividend of 25 per cent., as contrasted with 18 per cent in 1914-15.

The financial statement of the *Bergmann Elektrizitäts Unternehmen A.G., of Berlin*, whose development as an investment or financing undertaking was suspended three or four years ago by the parent company (Bergmann Electricity Works Co.), shows profits of £4,900 for 1915-16, as contrasted with £4,400 in the preceding year. As a consequence, the debit balance has been further reduced to £21,000 on a paid-up capital of £300,000.

The report of the *Deutsche Gasglühlicht A.G. (Auer Co.), of Berlin*, which is one of the licensees for the manufacture of the Osram lamp, apart from its chief branch of producing incandescent gas light equipment, states that the principal scope of activity in 1915-16 was devoted to the output of peace products. The business in Osram lamps experienced an increase both in the domestic market and in those export markets which were open to the company, whilst at the

same time an augmentation also took place in the incandescent gas light department. As net profits, the accounts show the sum of £616,000, including the balance forward, this comparing with £239,000 in 1914-15. After defraying the interest on the 5 per cent. preference capital, the directors recommend the distribution of 25 per cent. on the ordinary shares of £1,155,000, being the same rate as in each of the four preceding years, and the amount to be carried forward is £118,000, as against £116,000 in 1914-15.

The accounts of the *Berliner Elektrizitäts Werke A.G.* have just been issued for the financial year 1915-16, and they include for a period of three months the revenue from the working of the Berlin central stations, which were expropriated by the Municipal Council in 1915, together with the whole of the subsidiary works and mains. The net profits are returned at £226,000, whereas in the previous year, after deducting the share of the Municipal Council in the profits, they amounted to £301,000. It is proposed to pay 4½ per cent. on the preference capital of £1,000,000, as in 1914-15, and 7 per cent. on the ordinary shares of £2,205,000, this comparing with 9 per cent. in the preceding year, leaving £14,000, as against £17,000, to be carried forward. The directors state in reference to the company's participation in the Electro Works Co., that working has commenced, but that the production of lignite is still in course of development under difficult conditions. Although not definitely asserted, this statement implies that the question of supplying from 500,000,000 to 750,000,000 kw.-hours per annum to the Government electrochemical works for the fixation of atmospheric nitrogen is far from having been solved at the present time. The official announcement also states that the supply undertakings controlled by the company have not remained unaffected by the unfavourable situation of the times.

The Oerlikon Maschinen Fabrik.

The report of the *Maschinen Fabrik Oerlikon, of Oerlikon*, for 1915-16 states that the year was one of intense activity which was not always profitable, but, on the contrary, was often of an uneconomic kind, and had chiefly to be directed to the overcoming of difficulties. Nevertheless, the final results were satisfactory. In the department for general electrical machinery and transformers the requirements of customers were restricted to orders for machines which were only unconditionally necessary, that is to say, almost exclusively to small units. A partial compensation for the unfavourable circumstances was afforded through the scarcity of coal, which imparted a great impetus to the extension of the use of electric power in industrial establishments. The result of this was the delivery of a noteworthy number of transformers and motors of smaller and medium powers, so that the company succeeded in maintaining the production on a normal level, and even in increasing it in the case of small motors. Many orders were received in the department for special drives for the textile industry, and business in lifting appliances and in electro-mechanical applications was also very active. In the turbo-generator department the delivery was effected of a large number of steam turbines, the forwarding of which had been formerly delayed in consequence of interruptions in the transport services, and the demand for turbo-generators experienced a great improvement as compared with the previous year. The stock of orders booked for electrochemical apparatus was the largest on record. Concerning the question of electric railways, the report mentions that the electrical equipment for the Solothurn-Bern railway was delivered during the year, whilst orders were received for the new railways Biel-Tauffelen-Ins and Solothurn-Niederbipp, the completion of which was to be effected next year. The directors state that the works produced material for the Swiss military authorities, but declined in principle to deliver any war material to other countries. After allocating £43,000 to depreciation, as compared with £34,000 in 1914-15, the accounts indicate net profits amounting to £39,000, as against £37,000. It is proposed to pay a dividend of 7 per cent. on the ordinary share capital, this contrasting with 6 per cent. each in 1914-15 and 1913-14, and 7 per cent in 1912-13.

Delabole Electric Lighting & Supply Co., Ltd.—The annual meeting was held last week. Mr. MORRIS WELLS mentioned that the smaller income was due to the lack of street lighting. The company had entered into a contract with the Parish Council to light the streets, and it was not their fault that this was not being carried out. He hoped that in a few days some settlement would be arrived at. During the next year there would be a reduction of expenses that would be favourable to the company.

India.—The Andhra Valley Power Supply Co. is the name of a new undertaking which has lately been organised in Bombay with a capital of 21,000,000 rupees to establish an electricity generating station in the Andhra Valley.

Edison Swan Electric Co., Ltd.—At the annual meeting, held on Wednesday, the CHAIRMAN referred to a scheme for providing new capital, and at the same time dealing with the liability upon the ordinary shares. We shall publish our report of the proceedings next week.

Globe Telegraph & Trust Co., Ltd.—Dividend 2s. per share on the ordinary shares, income-tax already deducted.

International Light & Power Co., Ltd.—The report for the year to June 30th shows that, after payment of interest on debentures and London and Canadian administration charges, and setting aside £2,500 as a special reserve, the net profit amounts to £7,994, plus £1,831 brought forward, making £9,825. During the year 1½ per cent. has been paid on the 6 per cent. preference shares, absorbing £3,082. The balance of £6,744 the directors propose to carry forward, so as to conserve the company's resources in the present difficult period. Dividends on the preference shares being cumulative, the balance due to the shareholders for the past year will be paid out of the future net earnings of the company. The subsidiary companies (excepting Mérida) have again placed to reserves for renewal and general purposes sums amounting, when converted, to £5,371, bringing up the total of these reserves to £32,102.—*Financial Times.*

Provincial Tramways Co., Ltd.—The report for the year ended September 30th last shows that the net revenue received from the local companies has been £52,288, against £48,789 last year and £40,297 in 1914. After setting aside £12,000 to the reserve and depreciation account and adding £1,000 to the reserve for third-party insurance there is left a balance of £27,375. The directors recommend a dividend of 10d. per share and a bonus of 6d., equal to 1s. 4d. per share, on the ordinary, making, with 8d. per share paid in June last, 2s. per share, being at the rate of 10 per cent. for the year. This will absorb £8,304, and leave £19,072 to be carried forward, but out of this amount the excess profit duty for 1915 and 1916, not yet adjusted, will have to be paid, and having regard to the possibility of greatly increased taxation, the directors consider it prudent to carry forward this considerable amount.

Companies Struck Off the Register.—The following companies have been struck off the register and are dissolved:—

Acton Lamp Co.
Carlisle Electro-Thermal Baths.
Flexible Transmission Coats.
Manchester Exhibition Co.
New Motive Power.
Superheated Steam Engine & Generator Syndicate.
Telephone Duplicating Recorder Co.
Thermo-Insulation & Engineers' Supply Co.
Warner International & Overseas Engineering Co.
Whisperphone Syndicate.
Woodhouse Steel Casing Co.

The Constantinople Tramways Co.—It is announced that the Constantinople Tramways Co. (Tramways et Electricité de Constantinople), of Brussels, has convened an extraordinary meeting to authorise an increase in the share capital by the issue of 36,000 £10 capital shares. At the same time the meeting is asked to sanction the acquisition of the tramways, railway, and electricity and gas works taken over by the Constantinople syndicate.

Russia.—It is proposed to increase the Russian General Electrical Co.'s capital from 12,000,000 roubles to 24,000,000 roubles.

The Electrostat, a new Russian company, began work on September 29th. Its head offices are at Moscow.

The Russian Electrical Enterprises Co. is being formed with a capital of 600,000 roubles.

Amazon Telegraph Co., Ltd.—The gross revenue for the past year amounted to £61,587, and the working expenses to £31,707. After providing £13,255 for debenture interest and £2,578 for the sinking fund, the directors recommend a dividend of 3 per cent., less income-tax, leaving £6,806 to be carried forward.

Electric Construction Co., Ltd.—Interim dividend at the rate of 7 per cent. per annum on the preference shares for the half-year ended September, less income-tax at 5s. in the £.

British Ever-Ready Co., Ltd.—Dividend at the rate of 10 per cent. per annum on the preference and ordinary shares for the half-year to September 30th.

Power-Gas Corporation, Ltd.—Dividend of 6 per cent., less tax, on the ordinary shares.

STOCKS AND SHARES.

TUESDAY EVENING.

We suppose that the next thing which the Stock Exchange will advance as a reason for its slackness of business is the coming of Christmas. Speculation as to the advent of the new loan has rather died down, on the assumption that the Treasury is not likely to take any active steps until the year is turned. Nevertheless, business is very quiet, and the refusal of the Stock Exchange Committee to close the House on Saturdays is accepted in a spirit of resignation by members who regard the keeping open as an ordinance of self-sacrifice rather than of necessity.

The feature of the markets with which we are concerned is the remarkable strength of Underground Electric Railways bonds and shares. We have dwelt too often upon the attractions of the 6 per cent. income bonds for the big rise of the past three weeks to cause any particular surprise to those who read these notes. The price has risen steadily from 75 until now it stands at 91½; while the £10 shares have jumped to 2½, after touching 45s. The shilling shares hold most of their recent improvement at 6s. 9d.

Rumour has revived as to a probable raising of the fares on the company's systems. Of course, the Underground Electric Railways has little or no competition worth mentioning; and if the fares were advanced, both on tubes and 'buses, this would not be likely to make much difference to the number of passengers carried. We see no particular reason to counsel a sale to those holders of the bonds who can now take substantial profits.

Concurrently with this big improvement in Underground Electric Railways has come a fresh forward movement in Metropolitan and in Districts, the rise in these two being hung upon that in the former. There is more business doing in them, too, than there has been for a long time past; and the prospects of other electrified companies are being studied by those who have derived no advantage from the rise in Undergrounds. North London ordinary has risen a point to 60. The various Central London stocks are steady. Brighton Railway deferred, after a break to 61½, recovered to 62½. But the Home Railway market as a whole is not a good one; and there is too much uncertainty felt with regard to the Labour outlook for the ordinary investor to take a hand in Home Railways at present.

The electricity supply companies' shares keep fairly steady, in view of the approach of dividend-time and the possibility which it foreshadows of further reduction in the distributions. How the companies are likely to fare in respect of the current six months it is somewhat difficult to prophesy, and some of the Stock Exchange authorities decline to commit themselves to any advance guesses which the results may falsify. On the whole, the tendency is still towards lower figures, though this disposition is more in tone than in anything else. Falls have taken place in County shares, in City preference, and in Charing Cross of both kinds.

Brazilian Tractions experienced another abrupt fall by reason of the unfavourable rate of exchange and the consequent unpopularity of most things connected with the Republic, weakness being noticeable in Brazilian Government, railway, and industrial issues of various kinds. In spite of the recent indignant denial that the Brazilian moratorium may have to be extended beyond the date of its original intention—that is to say, beyond July, 1917—a certain amount of uneasiness lurks in the minds of those interested, and this is reflected in Brazil Tractions as well as in other Brazilian securities. The price of the preferred shares keeps fairly steady.

On the other hand, an enormous business is being transacted in Wall Street in the shares of industrial companies which have any connection at all with the war, the iron and steel group being particularly buoyant at the moment. New Yorkers have abandoned railway shares in favour of industrials as media for investment and speculation; and the turn-over amounted last week to the huge total of 9½ millions shares.

The activity and strength are dimly reflected over here in such shares as those of the electric power companies operating in the States and in Canada. Consolidated Baltimore Gas and Electric common rose to 135, Canadian General to 124½, and the preference to 113. Shawinigan common is firm at 140. Vancouver Power 44½ per cent. debenture stock, however, although nominally quoted at 66, is really nearer 63, sympathising with the 4½ per cent. debenture of the British Columbia Electric Railway Co., which has dropped to 61. The Argentine list is dullish.

Marconis have been a lively market in the neighbourhood of 3, Americans being 17s. 3d. and Canadians 9s. 6d. The next dividend on the parent shares is not due until January; and this year the company has paid 2s. a share, in two dividends of 1s. each. The present strength is attributed, as before, to expectations of what the Government will give the company in return for its service since the outbreak of war, as to which nothing definite is known yet.

Cable shares as a whole are a steady market. The chief rise of the week is one of 3/16 in West India & Panama Telegraphs, the shares jumping to 23s. 9d. West Coast of America were raised to the same level, the improvement in their case being 7s. 6d. per share. Nobody seemed able to explain adequately why these rises took place. A certain House tip went round; and when the would-be buyers tried to get the shares, they found no supply available.

The Eastern group is firm, and Anglo-American Telegraph preferred is ½ better. West Coast of America 4 per cent. debenture stock attracted a little attention by reason of the rise in the shares; but as the price stands at 98, there is, of course, not much scope for improvement; in fact, the debentures seem to be fully valued, even allowing for redemption. West India and Panama first preference are a trifle better at 7½, but the second preference remain at £6, and in the 5 per cent. debentures no business has been done since the stock changed hands at 96 three months ago.

Mexican issues are very flat. Heavy falls have occurred during the past few days in several of the Government bonds,

that the market looks also developed weakness. In these circumstances it is impossible to suppose that the industrials will be anything but depressed. Reference to the following table is interesting, as it is passing from 2½ to 3½ points.

Para Electric ordinary remain at 3½, and the preference at 4½. The 10 per cent. preference stock being quoted at 72 on the London market a few days ago. British Columbia Electric Light & Power shares, after showing recovery, have further declined. The preferred ordinary has dropped to 49, and the deferred to 47.

These industrial shares are the market of the moment. The iron, coal, and steel group is particularly strong. Disappointing dividends count for nothing; they have a transitory effect upon prices, but in the course of a day or two this is worked out, and quotations improve again. One of the lively shares during the past few days has been British Aluminium ordinary, the price rising 1s. 9d. to 29s. 9d. on optimistic dividend anticipations. British Insulated went back 10s. after their recent rise; and General Electric ordinary shed 10s. to 14. On the other hand, Callenders are better at 12½. Electric Construction have risen to 1½. The Edison & Swan group is good, and most of the other shares connected with the electrical industry are difficult to buy.

Rubber shares, too, are on the up-grade. The price of the raw material has spurred, and with this has come another strong buying movement on the part of the public. Copper, the metal, has been soaring, taking with it the prices of most of the copper shares. Ammunition and ammunition shares are a good market. This Steel rose 20 points in the course of three days, then reacted 8, but money has been made in London out of these meteoric movements.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.					
	Dividend	Price	Rise or fall	Yield	
	1914.	1916.	Nov. 1916.	this week.	p.c.
Brompton Ordinary	10	10	69	—	47 11 0
Charing Cross Ordinary ..	5	5	89	—	7 8 3
do. do. 4½ Pref.	4½	4½	8½	—	11 11 0
Chelsea	5	4	3	—	6 18 4
City of London	9	8	113	—	6 16 2
do. do. 8 per cent. Pref. ..	6	6	10	—	6 0 0
County of London	7	7	104	—	6 13 4
do. do. 6 per cent. Pref. ..	6	6	10	—	6 0 0
Kensington Ordinary	4	4	12	—	6 4 5
London Electric	4	4	12	—	6 1 5
do. do. 6 per cent. Pref. ..	6	6	48	—	6 1 5
Metropolitan	5½	5½	92	—	6 6 4
do. do. 4½ per cent. Pref. ..	4½	4½	34	—	7 1 0
St. James's and Pall Mall ..	10	8	62	—	6 8 0
South London	5	5	2½	—	6 15 1
South Metropolitan Pref. ..	7	7	1½	—	8 7 3
Westminster Ordinary	9	7	6½	—	6 13 0

TELEGRAPHS AND TELEPHONES.					
	Dividend	Price	Rise or fall	Yield	
	1914.	1916.	Nov. 1916.	this week.	p.c.
Anglo-Am. Tel. Pref.	6	6	95½	—	6 5 8
do. do. Def.	80½	83½	2½	—	7 10 3
Chile Telephone	8	8	7½	—	6 12 3
Cuba Sub. Ord.	5	5	6	—	6 8 6
Eastern Extension	7	8	132	—	6 15 6
Eastern Tel. Ord.	7	8	142½	—	6 14 1
Globe Tel. and T. Ord.	6	7	12½	—	6 17 0
do. do. Pref.	6	6	104	—	6 17 1
Great Northern Tel.	22	22	97½	—	6 17 4
Indo-European	13	13	51	—	6 1 6
Marconi	10	11	24½	—	3 8 0
New York Tel. 4½	4½	4½	98	—	4 10 0
Oriental Telephone Ord. ..	10	10	2½	—	4 6 6
United R. Pacific	8	8	—	—	6 16 5
West India and Pan.	1	—	1½	—	—
Western Telegraph	7	8	142	—	6 5 4

HOME RAILS.					
	Dividend	Price	Rise or fall	Yield	
	1914.	1916.	Nov. 1916.	this week.	p.c.
Central London, Ord. Assented	4	4	65½	—	6 2 2
Metropolitan	12	1	2½	—	4 2 6
do. District	Nil	Nil	16½	—	Nil
Underground Electric Ordinary	Nil	Nil	46	—	Nil
do. do. "A"	Nil	Nil	69	—	Nil
do. do. Income	6	6	91½	—	6 11 4

FOREIGN TRAMS, &c.					
	Dividend	Price	Rise or fall	Yield	
	1914.	1916.	Nov. 1916.	this week.	p.c.
Adelaide Sup. 6 per cent. Pref.	6	6	41½	—	6 1 6
Anglo-Arg. Trams, First Pref. ..	5½	5½	34	—	8 9 2
do. do. 2nd Pref.	5½	5½	92	—	—
Brazil Electric	5	5	68	—	7 7 0
Bombay Traction	4	4	52½	—	7 14 5
Bombay Electric	6	6	102	—	7 17 8
British Columbia Elec. Ry. Plee.	5	5	69	—	7 5 0
do. do. Preferred	Nil	Nil	47	—	Nil
do. do. Deferred	Nil	Nil	47	—	Nil
do. do. Deb.	4½	4½	41	—	6 11 1
Mexico Trams 5 per cent. Bonds	Nil	Nil	3½	—	—
do. do. 6 per cent. Bonds ..	Nil	Nil	27½	—	Nil
Mexican Light & Power	Nil	Nil	1½	—	Nil
do. do. Pref.	Nil	Nil	2½	—	Nil
do. do. 1st Bonds	Nil	Nil	3½	—	Nil

MANUFACTURING COMPANIES.					
	Dividend	Price	Rise or fall	Yield	
	1914.	1916.	Nov. 1916.	this week.	p.c.
Babcock & Wilcox	14	15	21	—	5 2 0
British Aluminium Ord.	5	7	29½	—	5 7 4
British Insulated Ord.	15	17½	11½	—	7 6 10
British Westinghouse Pref. ..	7½	7½	12	—	6 3 0
Callenders	15	30	12½	—	7 16 4
do. do. 6 Pref.	6	5	42	—	6 17 8
Cassner-Kellner	20	—	—	—	6 6 8
Edison & Swan, 2½ paid ..	Nil	Nil	98	—	Nil
do. do. fully paid	Nil	Nil	19	—	Nil
do. do. 4 per cent. Deb. ..	5	5	62½	—	8 0 0
Electric Construction	6	7½	12	—	6 18 4
Gen. Elec. Pref.	6	6	10	—	6 0 0
do. do. Ord.	10	10	14	—	7 10 0
Henley	20	45	16	—	7 16 3
do. do. 4½ Pref.	4½	4½	10	—	12 8
India Rubber	10	10	12	—	17 0
Telegraph Con.	20	30	82½	—	6 4 7

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, November 22nd.

CHEMICALS. &c.	Latest Price.	Portnight's Inc. or Dec.
a Acid, Oxalic	per lb. 1/8	..
a Ammoniac Sal.	per ton 2/5	..
a Ammonia, Muriate (large crystal)	.. 2/4	..
a Bicarbonate of Carbon .. ..	.. 2/3	..
a Borax .. ..	.. 2/4	..
a Copper Sulphate	per lb. 2/6	25 inc.
a Potash, Chlorate	per lb. 2/6	..
a Potash, Perchlorate	per cwt. 14/2	10 inc.
a Shellac	per ton 2/6	..
a Sulphate of Magnesia .. ..	.. 2/4	..
a Sulphur, Sublimed Flowers ..	.. 2/4	..
a Sulphur, Lump .. ..	.. 2/4	..
a Soda, Chlorate	per lb. 1/-	..
a Crystals	per ton 120/-	..
a Sodium Bichromate, casks ..	per lb. ..	..
METALS. &c.		
c Brass (rolled metal 2 to 12 basis)	per lb. 1/4 1/2 to 1/4 1/2	1d. inc.
c " Tubes (solid drawn) .. ..	.. 1/4 1/2 to 1/4 1/2	1d. 1d. inc.
c " Wire, basis .. ..	.. 1/4 1/2 to 1/4 1/2	1d. inc.
c Copper Tubes (solid drawn) ..	.. 1/4 1/2 to 1/4 1/2	1d. inc.
c " Bars (best selected)	per ton 1/78	210 inc.
c " Sheet .. ..	.. 1/78	210 inc.
c " Rod .. ..	.. 1/78	210 inc.
d " (Electrolytic) Bars .. ..	.. 1/78	210 inc.
d " Sheets .. ..	.. 1/78	210 inc.
d " Rods .. ..	.. 1/78	210 inc.
d " H.C. Wire	per lb. 1/8	1d. inc.
f " Sheet .. ..	.. 2/6	..
f German Silver Wire .. ..	.. 2/3	..
h Gutta-percha, fine .. ..	.. 6/10	..
h India-rubber, Para, fine .. ..	.. 3/4	1d. dec.
l Iron Pig (Cleveland warrants)	per ton Nom.	..
l " Wire, Galv. No. 8, P.O. qual.	.. 2/36	..
l Lead, English Pig .. ..	.. 2/36	..
l Mercury	per lot, £17 12 6 to £17 16	..
l Mica (in original cases) small	per lb. 6d. to 8/-	..
e " " medium .. ..	.. 8/- to 6/-	..
e " " large .. ..	.. 7/6 to 14/- & up.	..
r Silicon Bronze Wire	per lb. 1/10	1d. inc.
r Steel, Magnet, in bars	per ton 2/5	..
r Tin, Black (English) .. ..	.. £194 to £196	£8 10 inc.
st " Wire, Nos. 1 to 16	per lb. 2/11	1d. inc.

Quotations supplied by—

a G. Boor & Co.	James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Tilt & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	l Richard Johnson & Sons
f India-Rubber, Gutta-Percha and	l F. Ormiston & Co.
Telegraph Works Co., Ltd.	r W. F. Dennis & Co.

Entertaining Wounded Soldiers.—A party of 300 wounded soldiers was entertained by the employees of Siemens Dalston Lamp Works on Saturday last. The Charringhall Hall, St. Pancras, was kindly lent for the occasion by Mr. Hopkins. Nine motor-buses were provided to convey the men from the various hospitals to the hall. The entertainment, which consisted of a concert, tea, and dancing, commenced at 2 p.m., and we understand that each wounded soldier had the attentions of a lady from the Wotan Lamp Works. A good proportion of the talent for the concert was drawn from the Dalston Works staff, but several professional friends readily gave their assistance. All the items provided were highly appreciated by the audience, and tea was served at 4 p.m., after which the hall was cleared for dancing. At about 6.45 the soldiers were conveyed back to their respective hospitals: incidentally, 200 of the party were from the King George's Hospital. It is hoped that this function will be one of a series of similar entertainments; it was undertaken at the initiative of the workpeople themselves. The arrangements were in the hands of a Special Committee, with Mr. D. Woolton as secretary.

Electric Steel Furnaces.—A lecture on "Electric Furnace Manipulation" was given by Mr. Harry Etchells to the Sheffield Society of Engineers and Metallurgists, on Monday last. The lecturer, dealing with the cost of smelting, remarked that even at the present comparatively high prices, which were caused by war conditions, the electric furnace had proved a good investment to many users and an immense boon in the economy of steel production and the utilisation of waste. The war had shown us how to make ourselves independent of Swedish Bessemer imports and to convert into valuable steel the accumulation of nickel and chrome steel scrap. In spite of difficulties of manipulation which still remained to be overcome, the electric furnace had a part of its own to play, and had come to stay.

The President (Prof. J. O. Arnold) observed that if the electric furnace had come to stay, they would have to have cheaper current. That was one of the greatest obstacles to the development of the electric furnace in Sheffield, and it would have to be got over in some way.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING OCTOBER, 1916.

AFTER a series of comparatively excellent months, the export values of electrical material for October show a considerable falling-off, the total of £501,822 comparing with £573,314 in September.

The imports of electrical material, valued at £187,261, were also on a considerably reduced scale as compared with the previous month, when the total amounted to £237,032, although still a trifle above the August total; and similarly with the re-exports, which fell in value from £18,596 in September to £11,763 last month.

The decrease in the export total was mainly due to the falling-off in values of cable and machinery exports, the former showing a decrease on the month of about £60,000, and the latter of some £30,000; other branches of electrical business were similarly

placed, and the falling-off was only partly compensated by improved telegraphic, telephonic and lamp exports. It is interesting to note that France was by far our best customer, although the combined total of business with Russia and the Scandinavian countries makes a good second. Business with India and Australia was on a reduced scale.

A considerably decreased value of electrical machinery was imported into this country: lamp and battery imports remained nearly stationary, and the only notable increase was in telegraphic and telephonic imports. With the exception of Japan, all the countries importing into this country, and more especially the United States, did a reduced business. Dutch lamp imports fell off considerably, but the influx of Japanese lamps practically compensated for this.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus, and electric bells.	Telegraphic and other apparatus.	Total.
Russia, Sweden, Norway and Denmark ...	5,945	12,075	568	889	1,940	2,040	24,606	1,562	156	878	807	21,153	72,619
German West Africa ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Netherlands, Java and Dutch Indies ...	1,408	2,883	773	20	...	30	3,358	88	105	237	1,098	69	10,069
France ...	3,504	12	790	...	283	68	13,457	9,568	628	196	37,146	14,137	79,789
Portugal ...	48	1,172	57	...	...	221	398	...	...	16	734	2,360	5,006
Spain, Canary Isles and Spanish N. Africa...	42	1,172	216	...	...	16	4,728	965	255	19	18	162	7,593
Switzerland, Italy and Austria-Hungary ...	1,027	378	85	...	...	327	2,033	...	...	171	615	4,554	9,190
Greece, Roumania, Turkey and Bulgaria ...	57	...	...	...	...	75	65	...	158	...	...	5,518	5,873
Channel Isles, Gibraltar, Malta and Cyprus...	104	51	28	64	...	38	168	4	25	...	13	1,028	1,523
U.S.A., Philippines and Cuba ...	852	17	265	140	...	85	335	...	...	27	130	157	2,008
Canada and Newfoundland ...	443	86	666	1,031	128	550	2,374	267	144	...	...	3,163	8,852
British West Indies and British Guiana ...	217	47	39	...	...	...	191	202	60	71	1	8	866
Mexico and Central America ...	50	...	87	...	...	...	73	...	...	...	...	...	210
Peru and Uruguay ...	112	584	...	11	...	...	107	...	11	35	...	226	1,116
Chile ...	...	164	188	255	39	627	613	731	...	...	553	30	3,200
Brazil ...	530	371	237	441	...	923	976	998	102	194	118	206	5,096
Argentina ...	815	4,930	529	662	518	1,587	1,957	114	2,062	8	1,072	76	14,330
Colombia, Venezuela, Ecuador and Bolivia...	20	3,177	137	52	...	285	...	...	...	...	104	47	3,822
Egypt, Tunis and Morocco ...	...	213	603	131	10	...	1,752	28	100	18	1,634	1,270	5,759
British West Africa ...	199	490	...	101	...	41	265	...	58	...	612	296	2,062
Rhodesia, O.R.C. and Transvaal ...	1,834	7,616	2,898	3,731	38	1,515	7,698	509	502	328	701	28	27,398
Cape of Good Hope ...	762	2,523	916	664	...	854	1,630	...	1,233	60	36	695	9,373
Natal ...	1,083	7,818	1,227	221	...	150	7,638	536	1,227	90	464	153	20,607
Zanzibar, Brit. E. Africa, Mauritius & Aden	114	317	179	242	...	56	535	1,480	248	...	42	592	3,805
Azores, Madeira and Portuguese Africa ...	145	282	98	107	...	37	212	...	49	...	19	44	993
French African Colonies and Madagascar...	11	...	...	20	...	...	10	...	...	...	...	...	41
Persia ...	2	154	10	20	...	...	460	...	...	...	90	736	...
China and Siam ...	1,582	4,750	628	938	...	499	1,739	760	452	96	237	880	12,561
Japan and Korea ...	766	...	61	50	...	612	692	66	302	138	...	1,150	3,837
India ...	3,675	16,763	4,201	2,195	364	1,813	18,814	2,799	6,419	428	840	634	58,945
Ceylon ...	309	877	252	195	...	14	106	...	281	...	860	210	3,104
Straits Settlements, Fed. Malay States and	...	985	545	558	13	778	653	10	666	139	122	462	5,725
Sarawak ...	764	1,368	1,091	237	170	109	799	69	86	121	378	888	5,704
Hong Kong ...	388	...	...	...	...	...	...	...	...	...	...	...	...
West Australia ...	5	3,111	149	501	118	414	1,615	...	1,176	13	887	410	8,399
South Australia ...	127	918	261	191	...	93	1,243	...	251	...	828	...	3,912
Victoria ...	1,274	12,602	3,104	730	36	1,466	9,441	1,304	674	4	1,404	80	32,119
New South Wales ...	1,895	14,643	2,950	774	...	2,080	11,463	3,440	652	929	804	264	39,294
Queensland ...	150	14	99	195	...	...	976	...	519	...	2,063	...	4,016
Tasmania ...	245	...	82	54	...	...	24	...	...	...	2	...	632
New Zealand and Fiji Islands ...	1,555	5,937	1,118	1,540	28	934	2,767	1,893	1,529	...	2,377	1,952	21,630
Total, £	32,089	108,500	24,537	16,968	3,685	18,337	126,106	27,123	20,160	4,216	56,719	62,992	501,822

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	...	...	...	...	3,702	...	2,488	...	3,417	636	3,133	13,376
Holland ...	...	...	...	18,722	6,019	...	585	60	860	...	...	26,246
France ...	167	...	330	48	375	303	96	6,701	1,581	...	...	9,601
Switzerland ...	2,973	...	34	50	...	2,987	580	...	228	1,650	243	8,745
Italy ...	...	2,660	...	...	...	...	...	...	...	...	1,040	3,700
Japan ...	1,740	...	1,470	9,009	490	...	...	611	...	...	...	13,320
United States ...	10,048	14,178	1,630	4,368	1,632	3,065	14,039	33,930	6,195	8,967	13,021	111,073
Total, £	14,928	16,838	3,134	32,479	11,891	6,427	17,995	34,086	18,012	12,834	17,437	186,061

Additional imports.—Spain, carbons, £749. Argentina, electrical machinery, £90. Canada, electrical goods, £75: batteries and accumulators, £286.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	660	774	...	4,616	633	405	2,273	...	344	138	1,920	11,763
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TOTAL EXPORTS: £501,822

TOTAL RE-EXPORTS: £11,763

TOTAL IMPORTS: £187,261

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned which is not necessarily the country of origin.

POWER STATION DESIGN.

ONE of the satisfactory features of the present war period has been the very striking progress made in electricity supply in industrial areas: never were the economic advantages of electric power so much appreciated as during the past two years, and in referring to it, one can only regret that so many non-industrial consumers have been turned away owing to the prevailing restrictions as to expenditure and the supply of material.

In some cases it has been possible to extend works, and even to build new ones, and amongst the fortunate undertakings in the latter category is the Walsall Electricity Department, whose new power station is the subject of a brief description in our present issue.

This station presents several features of interest to the designer, the most important probably being the arrangement of the boiler house and coal-handling plant, though the whole design has tended to space economy and low cost per K.W. of plant installed—well under £8 for the existing plant of 8,000-K.W. capacity, and falling to about £7 when the complete 12,000 K.W. of equipment is provided.

Power station design is, at the best, a compromise based on the judgment of the engineer, who has to meet efficiently both present and future requirements; to a large extent it is influenced by the standard types of plant available at the time, although local conditions and improvements in plant design or arrangement may introduce variations in the result.

In the new Birchills generating station at Walsall, we have as leading features high-speed turbo-generating plant running at 3,000 R.P.M.; self-contained boiler units, which include the superheater, a superposed economiser, induced-draught plant and stack, occupying small ground space; and outside coal storage, with only miniature coal hoppers in the roof holding some 10 hours' supply per boiler on high duty, which arrangement tends to a light boiler house—a most desirable feature.

Daylight means additional cleanliness—even in the boiler house—and leads to improved efficiency; to be consistent, we should give more, rather than less, attention to the lighting of an inherently dirty place, than to a normally clean one. In a great many cases, the boilers and coal bunkers enclose a gloomy tunnel; the boilers are essentials, but the question arises as to whether the overhead bunker is really necessary at all.

At Walsall, comparatively small roof hoppers are used, and a well-known Continental authority has stated that, in his opinion, not more than one hour's bunker coal capacity need be provided, because of the reliability of modern conveyors.

After all, one does not lift thousands of tons of coal up into a roof, and provide an expensive large-capacity storage there, merely in order that the coal may gravitate down to its original level, unless there is grave doubt as to the reliability of the conveyor, which, after all these years of use, is a considerable reflection on this type of plant, and on our steady perseverance in installing it.

The big boiler plant of the future will be free from cumbersome coaling arrangements, if gas firing is adopted, and there are possibilities in pneumatic coal conveying which are worth investigation, as it would seem to offer a much more compact method of coal handling than that usually employed. But so long as existing methods of coal firing persist, as no doubt they will do for some years, coal storage in bulk and in proximity to the boiler house will be essential; and for obvious reasons such storage—equal to, say, two or three months' requirements—will usually be on the ground or in shallow concrete tanks.

Bunker storage capacity can only represent a small percentage of the total, and its relative value as a reserve decreases enormously as the size of the boiler and its coal-burning capacity increase, unless the overhead structure is developed beyond all reason, so that it would appear well worth considering whether the stoker hoppers should be enlarged to hold several hours' supply, and be fed direct, by modern crane appliances, from the outside storage, without the intervention of overhead bunkers.

In our "Notes" last week, we briefly described an American arrangement which embodies this idea, though the coal storage is under what nominally represents the firing floor, and coal trucks run right into the boiler house over the latter, thus providing for the direct transfer of fuel from truck to stoker hopper or store. This boiler house is also equipped with three self-contained boiler-economiser-chimney units of large size to supply an 18,000-K.W. turbine unit, and its arrangement presents a considerable contrast to the Walsall design.

Space economy is not necessarily a virtue in design, though desirable if accompanied by equal efficiency and if it tends to a reduction in the all-in cost of electricity. For instance, in discussing Mr. Lackie's recent I.M.E.A. paper on boiler house design, Mr. S. L. Pearce said that in connection with the proposed Barton station, he had arranged the economisers behind the boilers, and found that owing to the lighter steel structural work, despite the fact that additional ground space was required, there was a saving of about £8,000 over the triple-storey arrangement with economisers above, and that such a boiler house could be erected at a cost of about 20 per cent. less. It would be interesting to know what the further saving would amount to were it possible or desirable to dispense entirely with overhead bunkers.

Within the limits imposed by modern practice, the particular disposal of plant appears to have only a slight influence on the relative areas occupied, the assumption being that the most economical arrangement is adopted in each case.

Judging by the rough drawings which have been published, the relative areas occupied by the Manchester (Barton) and Glasgow (Dalmarnock) plants—in each case designed for 160,000-K.W. capacity—taking the engine room as unity, are:—

	Engine room.	Switch room.	Boiler house.	Coal storage.*
Barton ...	1	·7	1·85	3·2†
Dalmarnock ...	1	·6	2·0	6·5

We believe that in neither of these plants is it contemplated to use cooling towers, sufficient water for condensing purposes being available locally, but the rough plans of the proposed Nechells plant of the Birmingham Corporation, the designed capacity being originally 100,000 K.W., show the great influence which the necessity of artificially cooling the condensing water has on the total space requirements, which are approximately as follows:—

Engine house.	Boiler house.	Switch house.	Coal storage.*	Cooling towers.
1	1·67	·3	5·1	3·7

Needless to add, the space economy resulting when no cooling-tower area is required, may be accompanied and off-set by considerable expenditure in other directions, as, for instance, at Barton, where, we believe, the estimated cost of bringing the circulating water to the site is some £60,000. A very large proportion—probably 30 or 40 per cent.—of the coal-storage area for a large plant may be utilised for the railways and canals required for transport purposes, and, altogether, the coal-handling and water-supply problems are the most difficult which the designers of super-stations have to meet in this country.

The new Walsall plant is, of course, a small one in comparison with any of the above, and the provision of coal and water is a relatively simple and inexpensive matter, as the adjoining canal will provide all the facilities required for both services up to the maximum capacity of the present station.

For comparison, it may be noted that the relative areas of engine and boiler houses, and coal storage (no railway or canal accommodation included) are 1 : 1·6 : 2·7, while the generating plant at normal rating represents $3\frac{1}{2}$ K.W. per sq. ft. of engine-room floor area, or about half the estimated amount in the case of the proposed Barton plant with 20,000-K.W. generating sets.

The coal pile end of the central station has always been a matter for concern to the engineer, and it seems curious that the very considerable amount of heat radiated from boilers and steam pipes should have been allowed to escape

* Includes railway sidings, special canal arms, &c.

† Coal to be stored in silos; railway sidings not included.

as a matter of course in the past, when, by enclosing the whole of the boiler space behind the firing floor, a reservoir of hot air could be made available for use in connection with the furnaces, or left as an air jacket for the boilers and pipes.

But if, as we think will be conceded, there is generally a lack of originality in our boiler-house arrangements, it must be admitted that the engine-house design through all the vicissitudes of plant design—open type engines, enclosed high-speed engines, slow-speed and, finally, high-speed turbines—presents a remarkable sameness. Originally, in the days of the open-type horizontal or vertical engine, the engine room housed the bulk of the running machinery which required attention; the condenser was, or, at any rate, was considered, a minor item, and was buried away in the basement.

To a large extent, this arrangement is still followed; the turbine, despite the comparatively little attention given to it when running, and its tendency to reasonable dimensions in spite of increased output, holds the floor of the house in almost solitary state, while the condensing plant, most essential to the well-being of the turbine and requiring more attention, is still either buried or placed in a position of doubtful visibility.

In a very few years we shall have turbines for driving the auxiliary plant of large units, equal in power to some of the main units in smaller stations, and the question will naturally arise as to whether they should not be given as much prominence as their big relations above the sacred datum line of the engine-room floor.

The condensing plant even now exercises a controlling influence on the area of the engine room, and the disparity between its space requirements and those of the actual turbine set will probably become even greater, unless some unlooked-for and revolutionary development in condenser design takes place.

So far as one can judge, the surplus engine-room floor space is mainly used for dismantling machinery, but is not essential to this purpose, and it would appear that the time has come to make our present basement floor the starting point for engine-room structures, thus bringing into full view the whole of the running plant, which will, no doubt, be supplemented by boiler-feed and other pumps in future stations.

The necessary attention to a turbine when running can be given from a comparatively narrow platform, and it seems questionable whether the huge mono-block foundation usually adopted is really necessary.

It should, for instance, be possible to develop a self-contained turbo-condenser of the horizontal pattern on the lines of the 10,000-H.P. Ljungström turbo-alternator and condenser illustrated in our issue of May 12th last, which would economise in floor space.

If the basement floor were to become the engine room floor, we should not find recently-installed large turbine sets situated, and practically isolated, on an elevated concrete mound in our engine rooms, as the datum line would be fixed, and the expensive structural alterations now prevalent would be avoided. The large open well frequently provided to contain condenser auxiliary plant is evidence that we realise the necessity of keeping running plant in sight, but it is only a half measure, and an extension of the idea to open up from 50 to 75 per cent. of the basement to daylight would seem to be a logical development, from an engineering, if not from an aesthetic, point of view.

OUR OVERSEAS ELECTRICAL TRADE.

SOME years before the outbreak of war, we devoted much attention and a great deal of space to the need that existed for our electrical and engineering firms to cover the various important Colonial and foreign markets with very thorough business organisations. Our efforts to this end will be well within the memory of those who at that time were leaders on the commercial side of electrical affairs. We did our utmost to keep the trade fully acquainted with the needs of

those markets, the methods of foreign competitors in those countries, and published advice first hand from experts who, together with us, were eager that British electrical exportation should grow to very large proportions. We had very good reason for knowing that our efforts were appreciated in the ranks of the industry, and we had considerable gratification in noting the success that attended the schemes of those firms who had both the courage and the wherewithal to act with a suitable spirit of enterprise. We say now, without any attempt at hiding our light under a bushel when we are in the midst of all sorts of after-the-war trade discussions, that a number of firms owed the establishing of satisfactory export trade connections to the ELECTRICAL REVIEW. Some of them have been generous enough to acknowledge the fact in writing to us, and many others, as our pages show, have done so in practical ways which mean so much in enabling a trade journal to assist the industry in whose interests it exists. After all, actions speak louder than words in this department of life as in so many others. Sometimes those who "came to scoff remained to pray," as experience showed them that we were in close touch with the electrical world everywhere, and were able to feel the pulse of the buying fraternity abroad. We were the better able to do this because we were read all over the world by men who wanted to keep in touch with the progress of the whole profession and industry, and not merely of a part. And we have plenty of reason for knowing to-day that as an electrical trade journal we stand no lower in the esteem of those who are potential buyers of electrical machinery: indeed, but for our natural modesty, we could a tale unfold of war-time appreciation of our average issues—without any earthquake efforts.

To all who quietly went ahead with their efforts abroad, notwithstanding all the difficulties which foreign competition produced, the fullest credit for their enlightened policy and action should be given to-day when we are discussing how in the years to come we are going to secure export orders enough to enable us to keep our vastly-extended manufacturing capacity and Labour occupied after the war is finished. The organisations established in Peace and kept in existence during the war will have little difficulty in securing business as soon as they are able to execute it in the factories at home. It is for each firm to say how its organisation will require adaptation or re-adaptation to meet the altered conditions consequent upon the war, but there will be no lack of knowledge and ability shown in that connection. In the main, no doubt, the existing machinery will "carry on" upon the broader basis which trade growth after the war will demand, and, in addition, we hope to witness the development of co-operative schemes to the same end, such as we have, in one or two cases, particularised in our pages. In the past, of course, the dominating feature in electrical overseas trade has been the activity of large electrical manufacturing companies canvassing energetically for business in even the remotest corners of the earth. The pace is set, so to speak, by the American and German electrical combinations, which have enjoyed protected home markets and other advantages not yet granted to British firms, but possibly to come before long—we hope so, at any rate. Competition under such conditions has not been an easy matter, but it has not been found impossible to "carry on" in spite of them. One of the concerns here which early recognised the need for conducting its operations on a scale as nearly as practicable comparable with that of the chief rivals abroad, was the General Electric Co., Ltd., which set itself many years ago to build up overseas companies capable of supplying the electrical demands of all the chief markets. These companies, through their connection with the co-ordinated manufacturing concerns of the G.E.C. in Great Britain, were able to quote for complete electrical installations. They were, moreover, provided with staffs capable of erecting the installations and putting them into operation. This organisation reached such a stage of development that the overseas companies have not only laid down complete power plants, but have actually placed stock orders for electric supply equipments, including power houses, switchboards, transformers, distribution cables, lamps, motors and all accessories. In a

wood, manufacturing and business-getting facilities have been correlated in a steady and vigorous growth.

While the wholesale selling organisation directly benefits the general electrical engineering, the cable, telephone, instrument, carbon, lamp and other factories of the parent company, it also brings a great deal of grist to British manufacturers allied with the electrical industry. Orders for turbines and other steam-driven engines, for gas, oil and other internal-combustion engines, for producer-gas installations, for boilers, condensers, pumps, economisers and numerous other accessories are involved in contracts for complete electric power equipments. Thus the G.E.C. organisation acts as a feeder for the manufacturers of non-electrical items, and has been the means of bringing orders to British firms from parts of the world where they were not represented.

It may be of timely interest briefly to give some idea of the G.E.C. overseas organisation and of the kind of plant it supplies:—

South Africa is covered by the British General Electric Co., Ltd., whose headquarters are at Johannesburg, with branches at Cape Town, Durban, Bulawayo, and other places.

A 1,000-k.w. "Witton" generator located at the power house of the Durban Corporation, and driven through gearing by a Parsons turbine, is a typical example of plant sent abroad by the G.E.C. One of the special lines of activity of the South African Co. consists of complete town lighting schemes—Ernelo, Pietersberg, and Bethel provide a few examples out of many. Undertaking to supply the whole of a power plant and distribution system, the South African Co. is able to deal with schemes in a manner far more satisfactory than if plant and apparatus were ordered piecemeal. Much other important work in South Africa has been undertaken by this company, including, for instance, a pumping plant for the Rand Water Board.

Australia.—The British General Electric Co., Ltd., of Australia, is actively engaged in the electrical trade of the Commonwealth. Its headquarters are in Sydney; its branches are at Brisbane, Melbourne, Wellington (N.Z.), and other places. As a typical instance of "Witton" plant supplied to Australia, it may be mentioned that two 275-k.v.a. alternators have been supplied to Adelaide Cement Works. These sets are driven by Premier gas engines, and are interesting as the only gas-driven alternators to run in parallel in Australia, and their operation has been entirely satisfactory.

Important work has been undertaken for the municipalities in Australia. As an example may be mentioned a motor generator supplied to the Melbourne Corporation. For this set a repeat order was given after many years of working. In addition, considerable work has been done in the smaller towns.

India is covered by the General Electric Co. (India), Ltd., with headquarters at Calcutta, and a branch at Madras. This company has secured many important Government contracts, of which a characteristic example is the plant in the Calcutta Mint, the power plant of which comprises three 270-k.w. "Witton" c.c. generators driven by Belliss engines; there is, in addition, a complete installation of "Witton" motors.

China.—One of the most important of the G.E.C. overseas companies is the General Electric Co. of China, Ltd., which is engaged in the heavy competition for the Chinese electrical trade. Headquarters are at Shanghai, with branches at Hong-Kong and Hankow.

A considerable number of completed electrical equipments for Chinese towns—for instance, Fatsban, Soochow, Ningpo, and Yangchow—have been undertaken by this company.

In South America, the Argentine is covered by the Anglo-Argentine General Electric Co., Ltd., of Buenos Aires and Chile, and other territories by Messrs. Huth & Co., of Valparaiso and other towns. Amongst the important plants installed by the G.E.C. may be mentioned the complete equipment of the power house of the large Chilean Naval Dockyard at Talcahuano, and the installation at the Concepcion Flour Mills, whilst in Brazil, G.E.C. machines are working in the Manaos power house.

A "Witton" plant installed nearer home consists of a complete rotary converter installation supplied for driving the Barcelona tramways.

France is covered by the General Electric de France, and Belgium by the G.E.C. of Belgium.

The foregoing remarks will give some idea of the overseas activities of the G.E.C. When, after the war, the home works are able to devote themselves to the huge volume of export trade, it is certain that the G.E.C. overseas selling organisation will be in an excellent position to handle a very large volume of the trade.

TRADE WITH RUSSIA.

MR. W. H. BEABLE delivered an address before the Sales Managers' Association, on Thursday last week, on his recent visit to Russia, during which he made business investigations on behalf of the Anglo-Russian Trade Commission. He described the desire of the people of both Britain and Russia to know and understand one another better as amounting almost to a craze on both sides. He devoted his address mainly to the subject of commercial relations, and after referring to the greatness of Russia, her vast territories and population, and the magnificent spirit that she is filling in the Allied fight against Prussian tyranny, he referred to the question of the language. He has made a 15,000-mile hurried trip through Russia, and as a result he says that some knowledge of the Russian language is absolutely essential, in order to travel with any degree of economy or comfort. "It is a fallacy to suppose that either French or German is going to be of much use to the business man in Russia. At the present moment the speaking of German is prohibited under the penalties of £300 fine or three months' imprisonment; and even in normal times, though it may be of some use in business conversation in Petrograd and the Baltic Provinces, it is of very little service outside of these districts, and no use at all in dealing with the ordinary happenings of life—the engaging of cabs, buying tickets at the railway stations, inquiring one's way, and dealing with domestic servants. French, it is true, is understood by most really educated people in Russia, but this confines it largely to Society, and not to the business class. It is, however, remarkable with how little Russian one can get along very comfortably, and the very great and sympathetic pains the Russian takes to understand the foreigner trying to speak in the Russian language." Petrograd, the capital of the Empire, has in its environs some large factories of cotton, rubber, wire, iron, and other manufactures, but the trade of the town is almost exclusively confined to its own population. Its trade opportunities lie largely in the fact that it is from Petrograd that all the Government contracts are given out, and, of course, the wants of its population of two millions are by no means inconsiderable. Taking the whole of the country north of a straight line drawn from Petrograd to Ekaterinburg in the Ural mountains, there are very few towns of any importance, and the entire district is very sparsely populated, and covered with huge forests which supply the fuel for the northern half of Russia. The district has only three towns worth mentioning: Vologda (lace), Viatka (woodwork), and Archangel, the only open port to Russia in Europe. Ekaterinburg is a town of about 100,000 inhabitants, and the centre of one of the richest mining districts in the world. 95 per cent. of the world's supply of platinum comes from this district; it has gold mines and copper and iron in abundance. The district offers a magnificent opportunity for the supply of all kinds of machinery, pumps, and mining requisites. It is also a splendid centre for almost every kind of article for general use. Siberia, on account of its distance from Moscow and Petrograd, or any other great centre of European Russia, needs special consideration and treatment in dealing with business matters. There is a strong prejudice against buying through agents at so great a distance, and moreover, agents at Moscow or Petrograd very seldom do anything like justice in promoting trade in Siberia. The author mentioned Novo Nicolaevsk, at present a little known town, which would have a great future during the next 20 years, and upon which, on account of its possibilities, a watchful eye should be kept. Western Siberia promised a rich harvest in the future for those who got in now. Moscow is perhaps the most representative city of Russia. With the influx from Poland since the war, its population is now approximately two millions. It is the centre of a huge manufacturing district of about 200 miles radius, within which are found some 400 factories, chiefly, but not altogether, devoted to textile industries. Some of these, like the Mozoroff Cotton Mill, employ as many as 50,000 hands, and Moscow is the chief trading centre for this immense district. It is naturally the seat of the movement for the development of Russian industries, and of the agitation for high protective duties. Most of the large distributing agencies have their centre at Moscow, and several large British firms, especially those engaged in textile and agricultural machinery, have well-established businesses here. It is without question the most important district to be covered by nearly every British manufacturer who wishes to get a foothold in the Russian market.

A 12 hours' railway journey east of Moscow brings us to Nijni Novgorod, the town of the great annual Fair. To the British manufacturer the Fair offers perhaps little of interest, although an exhibition of British-made goods in the retail section in normal times, when hundreds of thousands of Russians from all parts of the Empire visit there, might prove an excellent advertisement, and even be made to pay its cost through the sale of goods.

From Astrakan one proceeds by the Caspian Sea about 400 miles to Baku, which is very much more than merely the centre of the Russian petroleum industry and the oilfields. It is a town of about 300,000 population, and is the highway to Persia and the East. Large quantities of goods are exported, including the cheap cotton goods manufactured in Russia, as well as supplies for all parts of the world. The whole of the Southern Caucasus is perhaps less Russian than

Patent Restoration.—MESSRS. HUNTALITE, LTD., have applied for restoration of Patent No. 23,979 of 1911, granted to Christopher Harvey for "Improved incandescent electric lamp and holder therefor."

any part of Russia, and as a rule requires altogether different treatment.

Between Rostov and Odessa, and lying a little to the north, is the great iron and coal district of Southern Russia with Ekaterinoslav as its centre. Here are found blast furnaces and ironworks, employing tens of thousands of men and forming whole colonies of themselves. It is one of the richest districts, and full of the greatest potentialities for British trade.

The Black Sea ports more particularly consist of Odessa, Nikolaev, and Kherson. Odessa is, of course, the largest and most important. It is perhaps the most enterprising city in Russia, and, at the same time, one with the greatest risks in trade. One-third of its population is Jewish. Shipping and grain are, of course, its principal industries, and it is the port of entry for much of the goods that come into Russia by way of the Black Sea. Nikolaev and Kherson are by no means inconsiderable rivals, and promise to eclipse the larger town when the new railway from the west, through the Crimea and across the Caucasus, is built, and Odessa will then be left off the main line. If, however, as is expected, Russia becomes master of Constantinople, and controls the Dardanelles, then there will probably be a tremendous development in all three ports.

Kharkov is a large city about half way between the Black Sea and Moscow, the centre also of a rich agricultural district, and a town from which many agencies could be conducted with profit. Kieff is credited with being the handsomest and oldest town in Russia, and is the centre of the great sugar refining industry, affording ample opportunity for business in the machinery and equipment necessary for such, while its population being generally quite wealthy, can purchase the highest class of British products.

Of the huge factories of Poland and the Baltic Provinces, Mr. Beale knows very little, as they are in the war region and did not come under his observation. Most of them not under German control have already removed further west, where iron and coal are more abundant, and the tendency in Russian manufacture is to get nearer the source of supplies of raw material, rather than nearer the seat of distribution. The German-owned factories will probably be entirely suspended for a long time to come.

The importations into Russia have been in round figures 100 millions a year, of which, roughly, 60 per cent. is contributed by Germany and 10 per cent. by England. The demand after the war will be tremendously increased. The most pronounced movement in Russia to-day is, and after the war will be, the development of Russia's own manufacturing industries. With practically all its ports closed, Russia is realising to-day more than ever how much she has been dependent upon foreign sources of supply, and how thoroughly she has been exploited by Germany. She will never again allow herself to be found in the position she is in to-day, cut off from practically all supplies, except that of food. The feeling against Germany is very bitter, but even the friendship for England and France will not be permitted to allow these countries to exploit her as has been done by the enemy. The first and greatest demand after the war will therefore be the supply of plant, equipment, machinery, belting, and everything that goes to the creation and maintenance of manufacturing industries. On these lines there will be an enormous demand, and while, at the moment, manufacturers cannot do very much, they can at least begin to make inquiries as to the specific lines that will be wanted, and prepare catalogues and information for after the war. It will be some years before the new manufacturing industries will be able to make any appreciable influence, and in the meantime the almost entire depletion of stocks of general merchandise and the great increase in population will offer opportunities unparalleled for British manufacturers to take advantage of now. It should be remembered, however, that there are certain lines of goods which Russia is thoroughly competent to make herself, and of which she is producing, and will produce ample to satisfy all of her own requirements. There is a disposition to think that Russia only buys cheap and inferior goods. This is by no means the case. While it is true that the vast number of its teeming millions belong to the poorer classes, even a small percentage of the number represents a rich buying public of some millions. Mr. Beale did not pretend that it was possible that we should capture the whole of the German trade. A great deal, especially of cheaper varieties, will go to Japan; America is taking advantage of her position now to supply large quantities of goods, and is endeavouring to solidify the connections already established. He did not think, however, that America would make a very great impression upon Russia after the war, as the temperament of the American people and American methods were not at all appreciated in Russia, any more than the Russian temperament and methods were adapted to American ideas. "Sympathy is the key-note of the Russian character, and it applies to business, as everything else in Russia, and the bond of sympathy with England, created by a common sacrifice, gives this country a great opportunity."

But what we must be done in the two years immediately after the war, and preliminary preparations, at least, must be made now. "I insist most strongly that in time of war we should prepare for peace, and that those manufacturers who will want plenty of trade after the war to keep their factories going should now make some preliminary investiga-

tions, and get into touch with some good people, if they would reap the advantages that will present themselves immediately after the cessation of hostilities.

(To be concluded.)

EDINBURGH TRAMWAYS REPORT.

READERS of our "Tramway Notes" will be aware that a very lengthy joint report on the whole question of the Edinburgh tramway system has recently been presented to the City Council, on its instruction, by Mr. J. A. Brodie, city engineer, Liverpool; Mr. J. B. Hamilton, general manager of tramways, Leeds; and Mr. A. Horsburgh Campbell, burgh engineer, Edinburgh, to which latter gentleman we are indebted for a copy of the report.

Half-a-dozen questions were remitted to the reporters, and the reply to Question 1, "What methods of traction might be adopted for the tramways system of Edinburgh, keeping in view probable future extensions, with full information as to the probable cost of installation and working?" forms the gist of the report. The subject is rendered complex due to the fact that any works required to bring into operation a form of traction—other than cable—must be done without interference with the Corporation's lessees, or with their daily car service.

Apart from the cable system now in operation, it would be possible to use electric traction on the (1) overhead, (2) conduit, or (3) surface contact system; self-propelled cars driven by (1) petrol or petrol-electric power, or (2) by electric battery, or motor 'buses.

Dealing with the first system, the report cites the satisfactory financial results obtained in the case of 17 large undertakings comparable with Edinburgh, pointing out that of 2,704 route miles of tramways in the United Kingdom, 2,475 are operated on the overhead system. Its supposed disadvantages from an aesthetic standpoint are discussed at considerable length, to show that in practice they are usually more imaginary than real, while reference is made to the fact that if the desire of the Corporation in 1905 had prevailed, the Colinton, Broughton, and Claremont Street routes would probably now have been equipped with the overhead system, and that some of the outlying routes are now operated on that system.

The steepest gradients in the city streets vary from 1 in 12 to 1 in 17, and are, therefore, less than the gradients already negotiated by trolley cars in Leeds (1 in 8.4), Huddersfield (1 in 9.3), Sheffield (1 in 9.5), &c.

The estimated cost of installing the overhead system, for permanent way and electrical equipment, is taken at £16,000 per mile of double track, and this represents some £400,000 for the Edinburgh street system.

The numerous disadvantages of the conduit system (its only advantage being the absence of overhead wires) are too well known to need recapitulation from the report. The only conduit system in the country is that of the L.C.C. (extending over about 120 miles), and its heavy cost has led to extensions on the overhead system wherever possible.

The report estimates the cost per route mile for street work only of such a system at £34,000, or a total of £850,000 for street work in Edinburgh for the existing cable routes. The existing cable conduit is only half the sectional area of the London electric conduit, and the former would probably have to be broken up and completely reconstructed with a new foundation for the tramway; on the other hand, it is suggested that the existing foundation might be largely utilised for an overhead system.

If the existing cable conduit could be used, the problem would be simplified, but even this would not enable the Corporation to start the operation of an electric service in July, 1919, along the existing cable routes, for its adaptation to electric conduit could not be commenced until after that date, and a complete temporary overhead equipment throughout the city would be an essential preliminary if the car service is to continue.

The report deals briefly with the surface-contact system, the only existing examples of which are at Wolverhampton and Lincoln; it is considered unsuited to a complete city service. The self-propelled car is discussed at considerable length; its disadvantages are stated to be (1) its slow acceleration and low speed on ascending gradients, (2) noise and vibration, (3) the relative inefficiency of high-power engines (required for Edinburgh) when running on the level, and its consequent high cost of operation as compared with the electric tramway car, making it uneconomical when applied to the complete service of a great and hilly city. No reliable working costs of self-propelled cars of the petrol type suited to Edinburgh's conditions are available, but it is surmised that the total operating cost would be about 2d. per car mile above that of electric overhead traction.

A self-propelled car would cost about £1,250, as against £950 for an ordinary tramway car, and the reporters conclude that the extra cost of a fleet of such cars over trolley tramway cars would be £96,250, while as a set-off, £55,000 would be saved on overhead equipment. Such a car, it is suggested, might be of use for sectional service, or for through working

at a route already equipped with the cable. The reporters dismiss the electric battery car in a few lines, although they suggest the advisability of making a trial of such a car.

On the subject of the motor 'bus, the report becomes very interesting; its use in connection with various tramway systems and in London is referred to, as well as its advantages and disadvantages. The latter appear to be the determining factor, and the report mentions that it is customary to compare the cost of operating motor 'buses with that of tramway cars at per car mile; when, however, the relative size and carrying capacity of the vehicles is considered and compared, it will be seen that this is not equitable. The carrying capacity of a bus does not exceed 50 per cent. of that of a tramway car, and it is therefore unfitted to cope with large rushes of traffic. After allowing for a higher effective speed of the motor 'bus, to provide the same carrying capacity at the time of maximum demand as 235 tramway cars, would require an increase of about 80 per cent. in the number of motor 'buses.

The working costs are taken as 84d. per 'bus mile, and the estimates show a net direct deficit in operation for the first years of operation of £15,652 per annum. Supplementing this loss by indirect charges due to loss of rates, increased highway maintenance, extra wear and tear of roads—for which nothing is charged to 'bus operating costs—the total loss direct and indirect to the city is figured at £39,425 per annum. No charge is allowed for the general conversion of the granite-paved roads of the city into a smooth highway surface such as would eventually be called for.

The report points out that no city in the world depends solely on 'bus transit, and that no comparison can be made between London and Edinburgh conditions. It is admitted, however, that the 'buses may become a valuable auxiliary to the tramway in thinly populated districts.

The present tramway limits with one exception are fixed by the several cable termini, nearly always on the city boundary. The route length of the present tramway system is about 25 miles, and it all lies within the city. For various stated reasons the reporters consider extensions desirable, and suggest that about 9 route miles, half within and half without, should be regarded as immediate, that is, to come into operation on the expiry of the lease, while a further 6½ miles are mentioned as prospective extensions.

The advantages of linking-up with adjoining tramways and the necessity of avoiding duplicating services of 'buses and cars are referred to.

An appendix to the report contains half-a-dozen estimates relating to various possible schemes; it is pointed out that in comparing "balances available," the high balance from the cable system leaves the tramway problem unsolved, subsequent reconstruction having still to be undertaken.

A summary of the estimates is as follows:—

Form of traction and short description of areas of operation.	Revenue per annum.	Operating costs per annum.	Capital expenditure. New debt.	Interest and redemption charges in respect of new debt.	Annual balance available, + Surplus, - Minus.
	£	£	£	£	£
1. Cable (confined to present lines) ...	322,908	228,034	256,612	26,655	+68,219
2. Cable (confined to present lines) but two extensions operated by self-propelled cars ...	334,908	238,130	342,550	35,088	+61,690
3. Electric overhead as in No. 2 ...	340,908	207,112	836,750	66,747	+67,049
3a. As No. 3 but with conduit in Princes Street ...	340,908	211,112	924,250	72,747	+57,000
4. Electric overhead throughout (with 8½ miles extensions) ...	356,908	217,007	936,500	73,665	+66,236
4a. As No. 4 but with conduit in Princes Street ...	356,908	221,007	995,000	65,665	+58,000
5. Electric conduit restricted to existing cable routes (with Queen Street added) ...	328,908	211,639	1,335,750	99,305	+17,964
6. Motor 'buses over extended routes as No. 4 ...	350,000	283,334	602,000	82,318	-15,652

The answers to the other questions submitted can be inferred from the foregoing: the reporters find that the overhead trolley system is the only practicable and reliable system that can be brought into operation immediately on the expiry of the lease, and advise the use of top-deck double bogie cars with a seating capacity of 62 to 70 passengers; that if the cable remains any extensions to come into operation at the expiry of the lease are restricted in their form of operation, and that it would be inadvisable to retain the cable on any part or routes of the system; that it would be

possible eventually to operate the system in the centre of the city without overhead wires, at extra cost—estimated at £65,000 for conduit construction alone for 6½ miles of track and an annual charge of £8,000-£10,000 if Princes Street alone were retained as conduit. The report further suggests that as the Princes Street line is common to the whole of the city routes, if it were constructed as conduit, an alternative route *via* Queen Street should be constructed to provide against the contingency of the conduit being affected electrically, by the influence of storm, &c., to secure uninterrupted service in emergency and during the constructional period.

The existing cable system, the report states, will have valuable assets in the rails, foundations, paving sets, the four power stations, the land they occupy, and the power plant, and the value of the Ardmillan to Slatford electric line will be left intact; these are valued at about £200,000, to be deducted from the £100,000 unredeemed at the close of the lease.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

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- 15,824 "Bringing and ventilating down for electric accumulators which are then propelled by W. E. FREEMAN, November 16th.
- 15,843 "Electricity-shedders for railway and tramway tracks." O. AUSTIN, November 6th. (Italy, November 14th, 1915.)
- 15,847 "Interrupters for ignition magnets." F. A. WALSON & M.L. MANSFIELD, November 6th.
- 15,848 "Electric lamps." BRITISH THOMPSON-HOUSTON CO. (General Electric Co., U.S.A.), November 6th.
- 15,859 "Combined walking-stick, &c., and electric torch." M. BATEMAN, November 6th.
- 15,871 "Electrodes of electric furnaces." J. O. BOVING, November 6th.
- 15,901 "Magneto-electric machines." G. F. COOKE, November 7th.
- 15,906 "Electric switches." F. C. STOCKER & FAYE, WALSON & CO. November 7th.
- 15,926 "Control of prepaid gas meters, electric meters, &c." W. A. PAXMER, November 7th.
- 15,932 "Electrical heating elements." J. F. BARR, November 7th.
- 15,944 "Ignition plugs for internal-combustion engines, &c." A. E. BERR, M. & DUMLER CO., November 7th.
- 15,966 "Electric flashlights, &c." E. NUTTALL, November 7th.
- 15,975 "Method of supporting electric hotplates for cooking apparatus." F. P. FLETCHER, November 8th.
- 16,008 "Making magnetic material." BRITISH THOMPSON-HOUSTON CO. (General Electric Co., U.S.A.), November 8th.
- 16,032 "Means for starting engines of petrol-electric vehicles, &c." J. SANKEY & SONS AND W. A. STEVENS, November 8th.
- 16,041 "Electric signalling." H. GREEN, November 9th.
- 16,065 "Means for supporting electric lamps." BENJAMIN ELECTRIC, LTD., W. E. FOWLER, November 9th.
- 16,067 "Incandescent electric lamps." H. B. CLAPP & W. S. SIMPSON, November 9th.
- 16,077 "Electric portable high-speed grinding attachments for lathes and shapers, &c. machines." CANADIAN-AMERICAN MACHINERY CO. (Toronto Type Foundry Co.), November 9th.
- 16,090 "Electrically-operated striking device for clocks." M. E. PUGH, November 9th.
- 16,106 "Dash-pot retarding and time-limit devices for electric apparatus, &c." ELECTRIC CONTROL, LTD., & O. ELLEFSEN, November 10th.
- 16,144 "Magneto-electric machines." G. F. COOKE, November 10th.
- 16,145 "Electric contact breakers or interrupters." G. F. COOKE, November 10th.
- 16,155 "Ignition magnetos for internal-combustion engines." A. H. BOUTON & J. H. BOULTON, November 10th.
- 16,157 "Mechanical arrangement capable of being applied to any electrical motor making it differential." BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., November 10th. (Italy, December 18th, 1915.)
- 16,159 "Securing internal-combustion engine sparking plugs." SIR V. BEARDMORE & T. C. W. PULLINGER, November 10th.
- 16,170 "Manufacture of caps or bases for incandescent lamps and apparatus therefor." J. A. SCULLAR, November 10th.
- 16,171 "Apparatus for the manufacture of caps or bases for incandescent electric lamps." J. A. SCULLAR, November 10th.
- 16,175 "Sparking plugs." J. R. HAYES, November 11th.
- 16,201 "Armatures of magneto-electric machines." G. F. COOKE, November 11th.
- 16,202 "Electric contact breakers or interrupters." G. F. COOKE, November 11th.
- 16,206 "Electrical heating appliances." C. F. LUMB, November 11th.

PUBLISHED SPECIFICATIONS.

1915.

- 12,001 APPARATUS FOR CHANGING A SERIES OF SIGNS OF ANY LENGTH INTO ANOTHER SERIES OF SIGNS, THE INDIVIDUAL SIGNS OF WHICH ARE ARBITRARILY DISPOSED AS COMPARED TO THEIR POSITIONS WITHIN A STANDARD SERIES. A. G. DAMM, August 19th.
- 13,586 ELECTRIC TRANSFORMERS. C. H. THORNDARSON, September 24th.
- 15,008 SYSTEMS OF ELECTRIC SHIP PROPULSION. BRITISH THOMPSON-HOUSTON CO. (General Electric Co., U.S.A.), October 23rd.
- 15,124 RESISTANCE THERMOMETERS. CUTLER-HAMMER MANUFACTURING CO., October 26th. (Convention date, November 30th, 1914, U.S.A.)
- 15,186 ALTERNATING-CURRENT ELECTRIC MOTORS. BRITISH THOMPSON-HOUSTON CO. (General Electric Co., U.S.A.), October 27th.
- 15,287 AUTOMATIC AND SEMI-AUTOMATIC TELEPHONE SYSTEMS. RELAY AUTOMATIC TELEPHONE CO. & W. ALKEN, October 28th.
- 16,050 MINE-SHAFT SIGNALLING AND ANALOGOUS PURPOSES. F. HIRD, November 13th.
- 16,640 DYNAMO-ELECTRIC MACHINERY. ELECTROMOTORS, LTD., & E. GREENHALGH, November 25th.
- 17,160 ACCESSORIES FOR USE WITH TELEPHONES. J. G. STATTER & E. C. ST. JOHN, December 7th.
- 17,834 SYSTEM OF ELECTRIC WELDING. D. H. WILSON, December 21st.

THE ELECTRICAL REVIEW.

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BREAKDOWNS OF GERMAN PLANT.

THAT in the future German competition with British electrical manufacturers, not only in this country, but throughout the British Empire, shall be reduced to the vanishing point, is a sentiment which is cherished by every patriotic Briton; it is impossible that anyone of us who has lived through the past two years should regard the German nation otherwise than as a race of murderers and heartless savages, with whom friendly intercourse is inconceivable. But not only on the grounds of humanity and patriotism is German plant taboo—there are also important technical and commercial objections to it, of which the evidence has lately been rapidly accumulating. We have thought it desirable to bring together a number of instances in which disaster has resulted from its installation, as a warning to possible purchasers—for even if our Government summons courage to put in force the Paris Convention and exclude all enemy goods from our markets, there will still remain a considerable number of buyers in neutral countries whose orders will be eagerly sought by the Germans.

We have already reported the series of misfortunes suffered by Mr. T. H. U. Aldridge, electrical engineer to the Shanghai Municipal Council, as the penalty for installing German turbo-alternators on the score of quicker delivery. As Mr. Aldridge has frankly made public more complete particulars of the matter than are usually available in such cases, we have given, first, a *résumé* of his experience, from which it will be seen that three out of four German turbo-alternators, in the short space of three years, have come to grief.

As we briefly mentioned in our last issue, the local agents of the A.E.G. wrote to the Council with regard to Mr. Aldridge's report on the failure of the 5,000-kw. turbo-alternator, endeavouring to discredit his conclusions, and alleging that the turbine must have been run at an excessive speed, that the faults might have been due to defective switchgear, that the supervision was inadequate, that the set had been allowed to get out of balance and adjustment, and that the plant was not kept clean. Mr. Aldridge, however, in a detailed reply, pointed out that the agents had had nothing whatever to do with the contract, and remarked that the stator coils were loose in the slots, the switchgear was in good order, and the machine was running on the test tank with the automatic switches disconnected when it broke down. He stated also that extraordinarily rapid deterioration had taken place in the turbine, and that if the speed had been excessive it would have indicated that the emergency governor was ineffective; there was, however, no evidence that it had ever raced. In his opinion, the condition of the blades was such that their useful life could not be more than two or three years at the most, and already, owing to their condition, the steam consumption of the machine had increased above the guarantee. The A.E.G. machines were under the supervision of the same staff as the six British turbo-alternators, which had done excellent

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service for five to nine years, and showed not the least sign of erosion or deterioration of the blading.

It will be noticed that the majority of the failures and defects described in our later pages took place in connection with A.E.G. machines, though other makes are also represented; moreover, in most cases the faults were due to errors in design, not so much from a theoretical as from a practical standpoint. That is to say, whilst the German designers apparently knew what should be aimed at, they did not know how to attain the desired ends without introducing intricacies and complexities of construction which, from the user's point of view, as pointed out by Mr. Bernard Price, far more than outweighed the slight gain in efficiency or output that resulted. Now, it is precisely in the possession and use of "the engineering eye" that the British designer excels; he knows how far to go in the direction of refinement, and where to draw the line and effect a judicious compromise between the theoretically best and the practically expedient, with a bias, perhaps, towards durability and simplicity. This trait is by no means confined to electrical engineering; it is freely manifested also in connection with civil and mechanical engineering, and is one of the chief factors which have built up the reputation of British work as unexcelled in point of longevity, solidity, and reliability. But—and this is most important—in order to secure these desirable qualities some sacrifice of efficiency or rating, or both, and some increase in weight and cost, is unavoidable, and hence the German machine is enabled, on the face of things, to appear the cheaper, whereas, in point of fact, the British machine is a far better bargain, with a greater margin of temperature rise, reliability, and accessibility for inspection and repair. That there are exceptions we do not deny: not every British designer is a heaven-born genius, and not every workman is competent and conscientious. But we do claim that, taken by and large, British plant is the better, and the portentous list of failures of German plant that we have brought together supports this contention. We have by no means exhausted the possibilities of the subject; engineers who have been bitten are not proud of their scars, and are apt to conceal them jealously. Mr. Aldridge has set a patriotic example, which others might well imitate, and we shall be glad to publish additional illustrations of the clay feet of the German colossus if they are forwarded to us.

Banks and A New Efficiency.

OWING to the heavy demands made upon the newspaper Press by war news, the address of the president of the Institute of Bankers, Mr. G. H. Pownall, has not received all the attention that it merits. It is a review of "current events of surpassing importance," and deals in the main with the relation of banking institutions to trade and industry. In reply to the demand that there should be substituted for our well-tried and successful system of banking, which has acquitted itself so admirably under the unprecedented conditions of world-war, another contrived to meet the dissimilar conditions of Germany, he contrasts English and German business methods, and shows that the British system has assumed its present character and methods according to the development that has been taking place in our local and industrial life. The tendency is for all businesses to become larger, and larger commercial enterprises demand larger banks. Organised competition, says Mr. Pownall, stands in the way of success of the small trader; the banker is not to blame. We have to recognise that manufacturing processes can only be carried out successfully on a large scale. "The facts of life compel this, and not the banker." He goes on to show, what our

readers are perfectly familiar with, that in Germany large scale and controlled industry is the accepted basis of the business world. He tells us that the larger unit in business has come to stay because large-scale foreign competition can only be successfully met by bodies able to afford to resist the costly burden of attempts to crush them out of existence. "We, like Germany and the United States, are learning that production on a large scale is often the only efficient form of production." The German bank is in the habit of standing by the companies whose shares it has issued, and owing to its close connection with the industrial concerns its prosperity is bound up with that of industries which must suffer natural fluctuations of depression and inflation. It is questioned whether English traders and manufacturers would be prepared to submit to supervision. With control by the financial interest in Germany, the private will of the controlled establishment is gone. Mr. Pownall holds that it is in the interest of the community to preserve the huge fund of bankers' credit intact, liquid, but he goes on to show the possibilities that await skilfully handled development companies—not purely finance companies—to investigate the claims of new enterprises, and, without lessening the initiative of individuals, to secure that contracts abroad financed by British money are executed by British industry. "Adventurous banking . . . is not banking . . . it is utterly alien to the English system, or, indeed, to any system which involves dealing in deposits repayable at short notice." Quite legitimately, the president turns his searchlight upon "our defective trade methods," incidentally remarks that "now is the time to ensure the introduction of the metric system," alludes to our need for better technical education, and so on.

The address proceeds to dwell upon the vital importance to us of our export trade. "We must export to live. The moral is not despair, but a new national efficiency." We have to broaden our outlook. Mr. Pownall says that after the war we shall have no German competition to deal with in ruined Europe, but the neutral nations can, and will, compete everywhere, "and if our prices are high, they will do it effectively." Asking whether such a thing as this "new efficiency" is possible, and how we are to compete in the neutral markets of the world with neutrals who do not bear the burdens that we do, Mr. Pownall says that in the competitive commerce of the world efficiency not only in material, style, terms of payment, mode of touting for orders, but also in price, counts. "We can look only to increased efficiency in production . . . to such improvements as will cheapen cost." Can increased production be secured without sacrificing the welfare of the working classes? "The economic truth that the interests of Capital and Labour are identical may be accepted as axiomatic." Mr. Pownall states that in foreign trade, prices are international, and in our competition with America, Japan, and Scandinavia we shall be hampered by increased cost of production while higher cost of production, but in a greater degree, will be true of Germany, France, Russia, and, possibly, Italy. "We must find a new efficiency if we are to compete in the free markets of the world." We gather that, in his opinion, perhaps the greatest service that a Trade Bank, as suggested by Lord Faringdon's Committee, can render to the country is to introduce method in our dealing with our foreign business affairs and to provide exact and practical information as to what is going on in the world outside our coasts. Mr. Pownall naturally looks at the whole matter from the banking standpoint. There have been so many criticisms of the banks from the traders' point of view that contributions of the present kind form interesting reading, and those who are studying national problems would do well to read the address in its complete form.

THE CLYDE VALLEY CO.'S NEW CAMBUSLANG POWER STATION.

In a recent issue we referred to the opening of the first section of the Clyde Valley Electrical Power Co.'s new power station near Cambuslang; the building and equipment of this plant, which has occupied a very short time, in fact, less than nine months, will enable the company to cater for the rapidly growing demands of the industrial area which it supplies. It is situated on the south bank of the River Clyde, near the village of Carmyle, the company having acquired by feu charter the old Clyde's Mill, together with its ancient water rights. Water from the river is used for condensing and make-up purposes, advantage being taken of the siphonic action due to the 5-ft. fall between the sealed circulating water outlet and the river intake to reduce the power required for circulating-water purposes to a minimum.

The first portion of the generating plant consists of one turbo-alternator of 5,000 kW. output at .80 power factor, running at 1,500 R.P.M. The turbine is of the Rateau type, supplied by the British Westinghouse Co., who have already installed five practically similar machines at the company's power stations at Motherwell and Yoker.

struction, consisting of one panel with synroscope, voltmeters, power factor meter, ammeter, indicating or recording wattmeters. The outgoing feeders consist of 15 sq. in. three-core E.H.T. paper-insulated, lead-covered and armoured cables. The generator and feeders are controlled by oil-break switches, with Merz-Price and overload trips, these switches, together with the bus-bars and isolating links, being placed in brick cubicles in the basement and close to the control switchboard.

The engine room bay is served by a 30-ton overhead electric travelling crane, supplied by Messrs. John Grieve and Co. The fuel for the plant comes forward on an elevated railway, the loaded wagons being tipped by a hydraulic ram into the coal hopper, or by-passed through a crusher. The coal is then delivered into a bucket-conveyor, which supplies the bunkers above the boilers. The company has under consideration a large coal storage scheme, with relative coal-handling plant.

The boiler, economiser and generator house buildings are of steel framework filled in with brick, a feature being the general effective natural lighting of the entire plant.

The power company's staff carried out the complete railway work, river work, and general building construction. The river work, which comprised the building of the necessary coffer dams, rebuilding in concrete and extending



THE E.H.T. SYSTEM OF THE CLYDE VALLEY ELECTRICAL POWER CO. (OVERHEAD TRANSMISSIONS SHOWN DOTTED.)

Steam is supplied at 200 lb. pressure from two three-drum land-type Babcock & Wilcox boilers, each having an evaporation of 33,000 lb. of water per hour. The boilers are equipped with chain-grate stokers, integral superheaters and Green economisers. A Lassen-Hjort water-softening plant is also installed, together with two turbine-driven centrifugal boiler feed pumps supplied by Messrs. Weir, the exhaust being utilised for the heating of the boiler feed water in the hot well. Each boiler is fitted with an electrically-driven "Sirocco" induced-draught fan, and one steel chimney, 80 ft. high, handles the waste gases from the two boilers.

The turbine set exhausts into a Weir surface condenser, operating in conjunction with dual air pumps of the same make, the circulating water being furnished by a vertical centrifugal pump made by Messrs. Drysdale, and situate in a dry well near the river intake, where a mechanically-operated water screening plant is provided.

The main generator is of the two-pole star-wound type with rotating field, and generates three-phase current at 11,000 volts and 25 cycles; a 60-volt exciter is direct coupled to the main generator shaft. The star point of the generator windings is brought out and connected to Merz-Price protective gear.

An electrically-driven "Sirocco" fan, situated immediately underneath, supplies cool air to the generator, drawing its supply from a "Sirocco" air washer.

The control switchboard is at present of the simplest construction,

consisting of one panel with synroscope, voltmeters, power factor meter, ammeter, indicating or recording wattmeters. The outgoing feeders consist of 15 sq. in. three-core E.H.T. paper-insulated, lead-covered and armoured cables. The generator and feeders are controlled by oil-break switches, with Merz-Price and overload trips, these switches, together with the bus-bars and isolating links, being placed in brick cubicles in the basement and close to the control switchboard.

The whole of the work involved in the erection of the plant was carried out under the personal supervision of the company's general manager, Mr. David A. Starr, assisted by the chief engineer, Mr. D. M. Macleod, and staff.

The new power station is located in the centre of the company's E.H.T. distribution system, and approximately

halfway between the present generating stations. Already the company has derived considerable benefit on its distribution circuits through the starting-up of the new station, and Mr. Starr and his staff are to be congratulated on the rapid getting into commission of this station, and its satisfactory attendant results.

THE ROYAL DOCKYARD SCHOOLS.

[AN ACCOUNT OF THE ADMIRALTY METHOD OF TRAINING DOCKYARD APPRENTICES.]

By P. H. S. KEMPTON, A.R.C.S., B.Sc.

THE training of apprentices by the Admiralty, a report on which has recently been issued by the Board of Education,* has been carried on in H.M. Dockyard Schools since 1843. Reorganisations have, of course, taken place from time to time; changes in detail have been suggested by experience and a clearer realisation of the needs of the future, and to-day the Dockyard Schools are recognised as among the foremost technical institutions in the country. But the system of entry of dockyard apprentices by open competition and their training in educational subjects in Dockyard Schools dates back nearly three-quarters of a century.

In issuing the report under review, the Board of Education "realise that among the problems which are at the present time engaging the attention of employers, education authorities, and teachers, few can compare in importance and extent with those relating to the proper training of industrial workers and to the provision of suitable means for the development and advancement of workmen of special ability. These objects have been attained with conspicuous success by the Admiralty scheme, which the Board's Inspectors have found to be too little known in the country. The Board are, therefore, glad to be able, with the consent of the Admiralty, to issue this descriptive account of the system." The report deals successively, and in considerable detail, with (1) the aim of the scheme, (2) its chief characteristics, (3) entrance examination, (4) organisation and curriculum, (5) results attained. It has been prepared for the Board of Education by H.M.I., Mr. G. A. Baxandall.

There are at present seven Dockyard Schools established in our naval ports: at Portsmouth, Devonport, Chatham, Pembroke Dock, Sheerness, Haulbowline and Rosyth. All these schools are under the Department of the Director of Naval Education (Sir Alfred Ewing, K.C.B.), are staffed by University graduates and technical experts, and are adequately equipped for the instruction of apprentices in advanced scientific and mathematical subjects. The schemes of training in all the schools are identical, the examinations are common to them all, and general lists are issued each year upon which promotions, rewards, and appointments are based.

From the inception of the scheme to the present day the main objects of the Dockyard Schools have been, first, to provide men qualified for employment as draughtsmen and subordinate dockyard officers; secondly, to train a body of men from which to recruit the designers of ships for the Royal Navy; and thirdly, to increase the efficiency of the dockyard workmen as a whole.

After reviewing the history of the schools from their modest beginnings, through their complete reorganisation in 1905, to their present efficient condition, the report summarises the chief characteristics of the scheme under the following headings:—

1. Admission by open competition to six-year apprenticeship; choice of trade is dependent on position on entry list.
2. Compulsory attendance at the Dockyard School for at least one year; classification into Upper and Lower Schools

by position on entry list, Upper School attending on two afternoons and three evenings and Lower School on one afternoon and two evenings per week.

3. Annual rejection from the school by a weeding-out process, which promotes about half the pupils in each year to the next year of the course and rejects the rest. The report emphasises the importance of the keen competition arising from this weeding-out process, remarking that:—"It may safely be assumed that those apprentices in the Upper School who survive it represent material of first-rate ability."

4. Admiralty Prizes are awarded for inter-school competition, and sets of valuable text-books are lent to all apprentices for their school course, and retained by those exceeding half marks in the final examination.

5. Practical training—each apprentice is placed in the charge of a competent workman as instructor, and all students who pass into the fourth-year school course are allowed to spend one year of their apprenticeship in the drawing offices of their respective departments.

6. Prospects open to apprentices—Cadetships in Naval Construction to Greenwich Royal Naval College, and subsequent appointment as Members of the Royal Corps of Naval Constructors. Two or three such awards are made each year on the results of the school examinations.

"Apprentices who fail to win Admiralty Scholarships usually compete for Royal Scholarships, and Whitworth Exhibitions and Scholarships, which are awarded on the results of the examinations held by the Board of Education, and in recent years they have been remarkably successful in securing these awards. The successful candidates for such scholarships obtain leave from the Admiralty to continue their education at approved institutions—such as the Imperial College of Science and Technology, or other institutions of University rank—where, in virtue of their previous training, they are frequently allowed to omit a considerable part of the three or four years' course and devote part of their time to post-graduate and research work. They afterwards return to the dockyards, or find posts in other Government Departments or private firms; a few of them enter the teaching profession."

The organisation and curriculum of the schools is described in great detail. A good idea of the scope of the work done can be obtained from the table set out below, which is taken from the report:—

FIRST YEAR.	SECOND YEAR.
<i>For Apprentices of all Trades.</i>	<i>For Apprentices of all Trades.</i>
English.	English.
Practical Mathematics.	Practical Mathematics.
Elementary Science.	Mechanics.
Mechanics.	Heat and Metallurgy.
	Mechanical Drawing.
THIRD YEAR.	FOURTH YEAR.
<i>For Apprentices of all Trades.</i>	<i>For Apprentices of all Trades.</i>
Practical Mathematics.	Practical Mathematics.
Applied Mechanics.	Applied Mechanics.
Electricity.	Electricity.
Mechanical Drawing.	Mechanical Drawing.
	Heat and Metallurgy.
<i>Professional Subjects.</i>	<i>Professional Subjects.</i>
<i>For Engine Fitter Apprentices and those of Kindred Trades, and Electrical Fitters.</i>	<i>For Engine Fitter Apprentices and those of Kindred Trades.</i>
Steam and Heat Engines.	Steam and Heat Engines.
<i>For Engine Fitter Apprentices and those of Kindred Trades.</i>	<i>For Electrical Fitter Apprentices only.</i>
General Engineering.	Electrical Engineering.
<i>For Shipwright Apprentices and those of Kindred Trades.</i>	<i>For Shipwright Apprentices and those of Kindred Trades.</i>
Naval Architecture.	Naval Architecture.

The course in English, which covers the first two years, occupies an important place in the training of the young engineer or shipwright. Besides developing the power of expressing ideas clearly in writing, it serves to continue the cultural education of the apprentices (a notable omission from many otherwise commendable schemes of further education). The apprentices are introduced to good literature, and by including a special period of History on the lines of Green's "Short History of the English People," a thoughtful study and appreciation of the social, constitutional and intellectual advance of the nation is induced.

* Educational Pamphlets, No. 32: "The Admiralty Method of Training Dockyard Apprentices." Board of Education. August, 1916.

The mathematical work is continued throughout the whole course, and by the end of the second year considerable progress has been made with the calculus. In the third and fourth years, both branches of the calculus, co-ordinate geometry of two and three dimensions, and differential equations, with applications to physics and engineering, are studied. To quote from the report: "The standard attained is exceptionally high, and is probably not exceeded in any existing educational institution, if regard is had to the age of the boys and the schools from which they are drawn, and to the fact that they are receiving a part-time training. There can be little doubt that the excellent mathematical training which the apprentices receive in the Dockyard Schools accounts for the rapid progress which they are able to make in other engineering subjects, and for their confidence and power in attacking problems."

The scientific work begins in the first year with a general course, including physical measurements, heat, light, magnetism and electricity, mechanics, and chemistry. In the second year the mechanics course is continued, and heat and metallurgy are studied in some detail, the latter subjects receiving further and practical treatment in the fourth-year course. In the third and fourth years, all apprentices receive a course in technical electricity, and in the case of electrical apprentices this develops into electrical engineering in the fourth year. All apprentices also receive instruction in mechanical drawing from their second year onwards, and trial drawings connected with their respective trades, and made in the drawing-offices from their own measurements, form part of the final fourth-year examinations.

The bulk of this instruction is given by the permanent staff of the schools, but courses of lectures are also given by other dockyard officers on professional subjects—*e.g.*, electrical engineering and naval architecture—and in this way the instruction at the schools is kept in intimate connection with the actual working practice of the yards.

The school year extends from early in August till the middle of June, and, during this time, apprentices attend the Upper School on two afternoons a week for three hours, and three evenings for two hours. They thus receive 12 hours' school instruction a week: six during working hours, and six outside working hours. The Lower School apprentices attend on one afternoon a week for three hours, and two evenings for two hours, thus receiving seven hours' school instruction a week. The complete courses in the Upper and Lower Schools extend over four and three years respectively, and except that the Lower School work is of a more elementary character, the two courses run practically parallel. Each Upper School class spends about two hours a week in the school laboratory; no laboratory instruction is given to Lower School apprentices.

It may be confidently claimed that to our Dockyard Schools must be attributed a very considerable measure of Britain's present naval pre-eminence. This scheme, which is British in origin and democratic in character, has supplied the nation with a large proportion of its distinguished naval architects and engineers; Sir F. H. Biles, D.Sc., Sir A. J. Durston, K.C.B., Frank Elgar, LL.D., F.R.S., Sir J. B. Marshall, K.C.B., Sir H. J. Oram, K.C.B., F.R.S., Sir Wm. Pearce, Sir Edward Reed, Sir Wm. Smith, Sir Philip Watts, K.C.B., F.R.S., and Sir Wm. White, K.C.P., were all dockyard apprentices, and have all passed through one of H.M. Dockyard Schools. And the system which has produced such a galaxy of talent and enterprise is still yielding results which augur well for the future. During the past few years a remarkable succession of Whitworth, Royal, and National Scholarships has fallen to dockyard apprentices, and it can be prophesied with considerable certainty that dockyard apprentices will continue to play an important part in maintaining Britain's supremacy in naval and general engineering and shipbuilding.

The Board of Education are to be congratulated on giving to this highly-successful system a wider publicity, and Mr. Baxandall on the production of such a detailed and accurate account of the scheme. We would heartily commend this report to the notice of all who are interested in the training of apprentices, and especially to

Education Committees and employers of labour, to whom all matters concerning technical education must now appeal as urgent and vital.

BREAKDOWNS OF GERMAN PLANT.

BELOW we give particulars of a number of failures of German plant, to which we refer in our leading columns to-day:—

SHANGHAI.—In his report for the year 1915, Mr. T. H. U. Aldridge, electrical engineer to the Municipal Council, said that two 2,000-kw. German turbo-alternators that were installed two years ago at the Riverside station were accepted because the tenders were, on the face of things, the best offers received. They turned out, however, a very bad bargain, for serious breakdowns took place, and at one critical period no less than two-thirds of the plant was out of commission, owing to the development of serious defects. Unsuitable material had been used for the blading, and mechanical defects were also revealed, and almost simultaneously with the blade troubles a serious electrical burn-out took place. On the other hand, six British turbo-alternators aggregating 4,200 kw., which had been running for five to nine years, had proved to be so good that the average cost of repairs was less than £40 each per annum, whereas the two German sets, which had been running less than two years, had cost respectively £318 and £267 per annum for repairs, in addition to the loss of revenue whilst they were under repair.

German transformers also showed marked inferiority to British and American ones. But worse was to come. In June last, one of the two 5,000-kw. German turbo-alternators which were installed last year broke down very badly. Some of the stator coils were short-circuited or earthed, causing a very bad burn-out, the copper conductors and iron laminations being entirely fused together, whilst the insulation of half of the end windings was completely burnt off. The damage would require months to make good, and even then, Mr. Aldridge felt, it was doubtful whether the machine could be regarded as a reliable piece of apparatus. Thus three out of the four A.E.G. turbo-generators have broken down. While the actual cause of the breakdowns is uncertain, there was no doubt that rapid deterioration had taken place, both in the stator winding and in the turbine blading, the latter being badly eroded. Mr. Aldridge's conclusion was that the turbine plant was most unsatisfactory, and that the continuity of the public supply was jeopardised thereby.

SYDNEY.—In 1913 the City Council purchased an A.E.G. turbo-alternator through the Australian Metal Co.; it broke down in the following year, owing to defects in the turbine.

MELBOURNE.—A 5,000-kw. A.E.G. turbo-alternator was delivered to the Melbourne Electric Supply Co., Ltd., just before the outbreak of war—one of two sets ordered from Germany for the sake of quick delivery, the second of which was not delivered. Within three weeks of the set being put in service a shut-down took place, and it was found that the second diaphragm had broken away and fouled the blading of the rotor. The set was put to work again without this diaphragm and without the blading of one wheel of the rotor, but the third and fourth diaphragms also were found to be in a precarious condition, and are being replaced with others of English make. The blading was found to be of an alloy containing an excessive proportion of nickel—over 31 per cent.—a material well known to be unfit for use, especially with superheated steam. But this was not the end of the trouble; at any load above 3,500 kw. the disks vibrated laterally so far that they fouled the diaphragms on both sides. These disks were extremely thin—thinner than in British turbines—and when the machine was standing open they could be seen to vibrate violently in sympathy with the imperceptible vibration caused by other turbines, thus proving the presence of a high degree of resonance, a well known danger. Moreover, the rotor of the alternator was found to be permanently earthed, and as it could not be rewound owing to the extreme complexity of the winding, it had to be discarded and replaced by a spare rotor, which fortunately had been purchased. The engineer and manager of the company, Mr. F. W. Clements, states that the behaviour of the set has shown it to be very considerably inferior to most machines of British or American manufacture.

NEWPORT (MON.).—During the year 1915-16 a 3,000-kw. A.E.G. turbo-alternator, running at 3,000 r.p.m., broke down and was out of commission for five weeks.

SOUTH AFRICA.—The following notes on German electric power plant in South Africa are taken from a recent address on "The Power Supply of the Rand," by the President of the South African Institution of Engineers (Mr. Bernard Price), a full report of which has appeared in the *South African Mining Journal*:—

British engineers, the President said, are no less skilful than their German competitors, and, in his experience, the merits of German design have often been considerably overrated. It is not uncommon to meet with German plant in South Africa which betrays every evidence of scientific knowledge from a purely theoretical point of view, but it is hopeless when viewed from a practical standpoint. The winding of a large alternator, for example, is complicated enormously merely to gain some slight benefit in rating, but at the sacrifice of features which are infinitely more valuable to those

also will operate and maintain the finished machine. In this connection the following instances, taken from the experience of a large electric power supply company, were cited to show that although two leading German firms were somewhat ahead of British firms in developing electrical plant of the size and voltage required for large power schemes in South Africa, the German firms made many mistakes, and had still to acquire much experience at the expense of their customers.

Six 4,000-K.V.A. alternators made by a German firm had to be entirely rewound, and seven 12,000-K.V.A. alternators (including a spare stator) had to be entirely rejointed. The smaller machines were originally wound for 10,000 volts, so as to avoid the use of step-up transformers, and the design of these high-tension windings was totally inadequate. Lightning made short work of them, but, in any event, their life could not have exceeded a few years. On the largest sets the joints between slot bars and end connections overheated very soon after the machines went into commission, and caused a long succession of serious and expensive breakdowns. The design of these joints had to be radically modified, involving a most tedious and costly programme of work.

Numbers of sub-station transformers of 1,000 K.V.A. and 500 K.V.A. capacity, made by the same firm, proved incapable of standing the stresses imposed at times of fault on consumers' circuits. The method of clamping the coils had to be entirely redesigned.

The high-tension switchgear for 40,000, 20,000, and 10,000 volts proved lamentably deficient when called upon to meet working conditions on a system of this size and type, and it would be difficult to exaggerate the seriousness of the consequences which ensued. No scheme in the world had had to face such serious switch trouble, and, when approached, the makers could suggest no better remedy than a duplication of all important switches at the expense of the power company and to the profit of the makers. Needless to say, this course was not pursued. The trouble had been almost entirely removed by the application of engineering common-sense to the experience gained in practice. It was quite clear that in those days this firm knew very little indeed about the design of high-tension switchgear for large systems. They were quite satisfied to proportion up the dimensions of a low-tension switch.

When asked to advise on the problem of lightning protection, experts (so-called) were sent out by the German firm to report, but, despite all their theoretical argument, nothing of practical value was produced. This problem, like many others which arise in commercial engineering, had to be solved by weighing up experience and avoiding fantastic proposals.

Although the turbines were a good job in many respects, heavy maintenance charges were incurred on account of defective blading. There was no doubt that the firm had but little knowledge respecting the materials best suited to stand the peculiar conditions to which turbine blades were subjected. At one time accumulation of these blading troubles very nearly involved curtailment of supply, but it became clear that some of the defects which were most pronounced originated from faulty design, and these had now been rendered less acute.

The steam pipes, valves, and lagging were a most shoddy job. The flanges on the steam pipes were expanded on without riveting, and a serious accident was but narrowly averted at one power station due to the expansion and consequent withdrawal of one of these flanges. It had been necessary to re-expand and rivet-on every flange of every steam pipe at two power stations, and the whole of the lagging, which had begun to break away before the pipes were dismantled, had to be scrapped and replaced by material of better quality.

The arrangement and design of three of the electrically-driven compressors at another power station was a disgrace, and involved excessive cost in upkeep. The arrangement of intercoolers and pipe-work rendered it necessary to dismantle the compressor itself before the intercoolers could be cleaned.

Seven 12,000-K.V.A. 3-phase transformers made by another German firm had to be entirely rewound. The original windings were deficient in insulation, and the surface of the copper conductors had been burned during the process.

The President of the Institution added that while he was quite ready to admit the merit of much of the German workmanship and design, and while he could not but admire the organising power displayed by German concerns, he did not think they had reason to be proud of the record of the plant they had installed in South Africa. It was quite certain that leading consulting engineers and manufacturers in the United Kingdom would have avoided many of the mistakes which South African power companies had had to correct.

INDIA.—Not long ago we published a description of the plant of the Tata Hydro-electric Power Supply Co., Ltd., Bombay, which included four 8,000-kw. alternators built by the Siemens-Schuckert Co. When these machines were being put into commission serious trouble was experienced, owing to the steel magnet rings of the rotors becoming loose on the spiders. Considerable delay in starting up resulted from the defective construction, in addition to much damage to the windings of one of the generators. Eventually the trouble was overcome by inserting a thin liner between the magnet ring and the spider, and shrinking the ring on afresh.

SOUTH WALES.—At Messrs. D. Davies & Sons' Ferndale Collieries, the blading was stripped from an A.E.G. turbo-compressor rated at 5,000 cu. ft. per min.

Since the outbreak of war, four 3,000-kw., 20,000-volt, 3-phase, 40-cycle A.E.G. transformers, with oil-cooled air blast, which had only been in service for a few years, have had to be rebuilt and rewound. Four other A.E.G. transformers, rated at 3,000 K.V.A., 20,000 volts, 40 cycles, 3-phase, with oil cooling by forced circulation through a cooler, though quite new, were found to be so badly designed that the purchasers decided to have them reconstructed and rewound before even putting them in service.

NORTH-EAST COAST.—That German plant installed in North-country stations has broken down appears to be widely known; we have not, however, been able to obtain particulars regarding these incidents. As regards cables, however, some information is available. The A.E.G. obtained a contract for a large quantity of 20,000-volt underground cable, which it duly supplied, but when the cables were laid the makers were unable to joint them properly. The joints were, in fact, made three times over without success, and eventually the purchasers' engineers had to take the work in hand and joint the cables, developing improved methods of jointing for the purpose.

METROPOLITAN DISTRICT RAILWAY.—Some 12 or 15 miles of high-pressure cable were supplied and laid by the A.E.G., but here again the makers were unable to make satisfactory joints, and in the end English jointers had to be employed for this purpose. A similar trouble occurred when Lahmeyer's (now A.E.G.) laid cables in Cardiff some nine years ago.

LONDON.—It is well known, though the facts have not been published, that a German company supplied cable and laid it through London from Charing Cross to Bow; the cable proved defective, and had to be entirely replaced.

EDINBURGH.—A cable supplied by a German company some years ago broke down, owing to the use of unsuitable materials in its construction.

KINGSTON-ON-THAMES.—Four years ago a number of Diesel engines, manufactured by the M.A.N., were installed at the generating station of the Kingston-on-Thames Corporation. Recently the air-compressor on one of the engines broke down and put the set out of commission. It will not be available again till February or March next, and in the meantime, owing to the necessity of using steam engines, the cost of production has seriously increased; a new crankshaft is required, the cost of which is estimated at £1,000.

TRADE WITH RUSSIA.

(Continued from page 587.)

"There are three things that will operate strongly in our favour. First, the discriminating duties that will undoubtedly be levied by Russia in favour of the Allies. I quite anticipate that these will be more favourable to the Allies than to the Neutrals, and, of course, very much more so than to the enemy nations. In the second place, there will be for some time a very strong prejudice against the enemy in favour of ourselves. This sentiment will be a very strong factor, but it will gradually weaken under the stress of competition, and unless it is cemented, will eventually die away altogether. In the third place, the competition of Germany and Austria will be still further lessened by their inability to give the long terms of credit, which has been one of the most formidable elements of competition in the past." However much the Government can do, and they can do a great deal, yet, after all, our business relations with Russia, and the success of our efforts, will depend more on individual initiative and enterprise. All that the Government can do will be of very little use to any manufacturer who does not make his own personal inquiries, and use his own efforts. "Who would be free, himself must strike the blow."

"There is a general feeling in this country that in order to do business with Russia we must slavishly follow German methods. It is thought that we must make inferior goods, take enormous risks, give long credits, adopt a spy system, in which the Germans are past masters, and generally do many things that are repugnant to the English idea of business ethics. After a very exhaustive inquiry, I am convinced that these opinions are to a very great extent wrong. We must in the first place approach Russia in a sympathetic manner, entering into her aims and aspirations, convincing her that we only want to do business on permanently and mutually advantageous conditions; that we want to help her develop her own industries, and to supply her with such goods as she cannot advantageously manufacture herself, at any rate for the present. There is a sufficient field on these lines to satisfy all legitimate aspirations. We must be prepared to meet Russian conditions to some extent; we must be ready to, at any rate, deliver goods to a Russian port, instead of f.o.b. England. We must print our catalogues in the Russian language, and give the equivalents of English weights, measures, and currency in Russian terms. To the manufacturer who insists that he only wants business with Russia on his own lines and his own terms, who insists upon quotations in sterling, and English weights, upon prices at factory, with cases and packing extra, with cash against documents in England, I say "Hands off! You will never do business with Russia, and it is better for you to spend your energies in other directions." To the manufacturer who

is willing to meet, even to a reasonable extent, the requirements of Russian trade, I say, that a safe and profitable trade can be done, on comparatively short terms of credit, if the most elementary precautions are taken in ascertaining the *bona-fides* of agents and purchasers.

The question of credit has been the greatest stumbling block to trade between this country and Russia. During my six months' trip I gave this point closer investigation and more consideration than perhaps any other. It was always very grossly exaggerated; in many, if not most, cases a question of negligence in collecting, and in any event, is altogether changed by the war. Without wasting time in discussing the pre-war conditions, let me give my impression of the present situation. First of all, whatever element of competition there has been in the long credit given by Germany, she will not, for some time at any rate, be able to do so, even if she had the opportunity. It was only possible by the local German banks financing the manufacturers, and the local banks, in turn, getting their money through the Deutsche Bank, which discounted its bills on the London market. This, I hope, will not be possible again, and the Germans will want every penny they can get for their own purposes, without giving credit. Further, for more than two years the Russians have now been accustomed to pay in cash for all their purchases, not only in England and America, but also between one another. A prominent Moscow cotton manufacturer told me that after the war practically all business from his factory would be done on much shorter terms of credit than before, and that the precedent created now would make them only too glad to buy at three or four months' credit. The most effective contribution to shorten credit, however, lies in the abolition of vodka. I am thoroughly convinced from what I have seen and heard that this measure is producing, and will produce, the most marvellous change that Russia has seen for centuries, changes even greater than the influence of the war itself. It is not merely a question of roubles and kopecks, although this alone is enormous. The vastly increased savings in the banks only tell part of the tale; farms are being restocked with the money saved from vodka; peasants are demanding and getting more of the comforts and luxuries of life, and the productive capacity has been increased two or threefold. Money is, and will be, plentiful, and the necessity for long credit no longer exists, except in certain exceptional cases. Three, four, or possibly even in some cases six, months' credit will be required, if only from the fact that the distances are so great that it often takes several weeks before the receipt of the goods shipped. If possible, bills should be obtained for purchases. There is no cheque system in Russia as there is in this country; payments even for the largest amounts are usually made in cash, and the Russian waits for somebody to come and collect the money. I had some accounts to collect from 18 months to two years old. These were paid immediately I asked for them, with the statement that no one had previously asked for the money, or it would have been paid long ago. Firms having agents in Russia should insist upon their prompt collection of accounts, and refuse to pay commission until the cash has been received. If it is not considered desirable to trust the agent with the collections of moneys to be banked at once to the credit of the firm, then it is necessary that someone should go out once or twice a year, when, as a rule, he will have no difficulty in getting in the money due. A good plan would be for a number of firms to combine together, and appoint a responsible man entirely for the purpose of collecting accounts, and I have myself in contemplation the formation of such an organisation in connection with my own general bureau of information.

"The appointment of agents is one in which the greatest blunders have been made, and through which the greatest catastrophes have occurred. British manufacturers seem in many cases to have ignored the most elementary caution in the appointment of these agents. They send out their catalogues and trade terms to any Tom, Dick, or Harry that writes from Russia for them. This, in itself, compromises them at once, as the man goes round immediately, claiming to represent the firm, showing the letter he has received as his authority. With German goods out of the market, there are thousands of people in Russia who are looking out for British agencies, some of them with very high-sounding names. The majority of them are utterly irresponsible and very dangerous to do business with, while others, of course, are men and firms of the highest reputation and integrity. The utmost caution should be taken in appointing agents, or even in quoting agency terms. Another great mistake is to give the agency for the whole of Russia to one person, especially if it is for any definite period of time. It is only in very rare cases that any agent can begin to cover so vast a country, and a statement that travellers are sent over the country, or that there are correspondents in every centre, should be taken, as a rule, with a very considerable amount of salt. It is true that in some specific cases, such, for instance, as textile machinery, the ground can be covered fairly well from Moscow, and in dealing largely with the Government Petrograd would be the natural seat of the agent. But as a rule, for anything like general merchandise, there should be agents at both Petrograd and Moscow, at Kharkov or Ekaterinoslav, at one of the Black Sea ports, at Rostov or Don, in the Lower Caucasus, at Ekaterinburg, and in Siberia. Since a contract giving the agency for Russia, *ipso*

facto, includes Siberia, this should be borne in mind. No agencies should be given for any period without some guarantee of sales, otherwise the firm may find that it is simply being nursed for the benefit of German competitors. Generally speaking, there are two classes of agents, one is the firm with ample financial resources of its own, which buys and pays for the goods in its own name, selling at its own prices, and of course, reserving the sale of the goods in Russia or the distribution allotted to it. The other is the purely commission agent who sells goods in the name of the firm, which are invoiced direct to the customer. In this case, the financial standing of the agent is not of so much question as his integrity and ability, for these two elements involve risk and bad debts. An agent selling on commission is liable not to take as much caution in the financial responsibility of the purchaser as he should do, unless he is made responsible for at any rate part of the losses that may be sustained. It should, moreover, be a condition that commissions are only paid on accounts for which payments have been received. Even in this case, I think it extremely desirable that a representative of the firm should go out occasionally, getting into personal touch with the customers, looking after the overdue accounts, and generally seeing if he is getting the best service from the agent. Another excellent plan is to get a bright young fellow trained for the purpose, who has at least an elementary knowledge of Russian, and send him to Russia with samples, prices, &c. This plan has been worked successfully by comparatively small manufacturers of saddlery and other goods. It is comparatively inexpensive, and a bright man can soon, with a little initiative help from the Consuls, know what he is doing.

"Still another plan is to send out a traveller, or travellers, once or twice a year; and where the business warrants it this is, perhaps, the best plan for many trades. He should, of course, have a very fair knowledge of Russian, and should be a sympathetic rather than a clever man. In other lines of business, local factories can be set up with decided advantage, as naturally, in this way, the heavy Customs duties are avoided. Where possible it is, however, better that these factories should be devoted to the manufacture of the heavier parts, while the more intricate parts are made in this country, and sent out to be assembled in Russia. The Russian Customs duties are based almost entirely upon weight, and the heavy casting would pay as much per lb. as the smallest part with a hundred times as much value. The whole question of agencies and selling generally is, however, one that has to be decided by individual circumstances, and there is no golden rule to be adopted. It is one of the most essential of the preliminary inquiries to be made, to consider the best way in which any particular business can get a foothold in the Russian market, and this refers also to the distribution of territory and the methods to be employed."

Mr. Beale referred lastly to the needs for improving our Consular system in Russia. "We want more and better paid Consuls, we want men of commercial experience, we want larger staffs in our chief Consulates, and we want them more closely allied to and connected with the Board of Trade, rather than the Foreign Office. We want a Commercial Attaché or Commissioner independent of the Embassy, and with an office of his own. Even the Canadian Government have such an office and representative at Petrograd, whose sole business is to investigate and report upon trade possibilities, responsible directly to his own Government."

"There are possibilities of business in Russia beyond the dreams of avarice, and we can get our share if we approach the question in the right spirit, and if we adopt the right methods."

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Perfecta Boiler Circulator.

THE PERFECTA BOILER CIRCULATOR LTD., of 39, Victoria Street, S.W., in a recent pamphlet describes its circulating device as fitted to an ordinary Lancashire boiler. This apparatus consists of a hood or covering over the crowns of the twin furnaces, which, when steam is generated beneath it, creates a flow of water towards the back of the boiler over the flues, the water then passing downwards and returning along the bottom of the boiler to the furnaces. Such a circulation obviously tends to a more uniform water and boiler temperature; to the deposit of any sediment near the blow-off cock; the elimination of priming over the grates and reduction of scale. The fixing of the apparatus does not necessitate the drilling of any holes in the boiler or interference with existing fittings, and it can be dismantled in a few minutes. It is claimed that from 12 per cent. to 15 per cent. increased steam with a minimum of saturation can be obtained, and that from 6 per cent. to 8 per cent. of fuel is saved. The makers are prepared to prove the efficiency of their apparatus by a reasonable trial.

Simplex Universal Girder Clamps.

One of the greatest difficulties in present wiring installation work is the trouble experienced in negotiating steel girders.

The Engineering Standards Committee has done excellent work by choosing certain girders for general use, but the number is still very great. There are section rolled girders, riveted girders, also channels, angles and Tee-sections in great variety.

A large number of girder clips are on the market but nearly all of them are made for a particular section of girder and even when a certain amount of adjustment is embodied in the design it is only with a good guess that it can be used.

The Simplex clip supplied by MESSRS. SIMPLEX CONDUITS, LTD., of Easton Lane, Birmingham, consists of a pair of clamps which fasten onto the edges of the girder and hold a wood piece on to

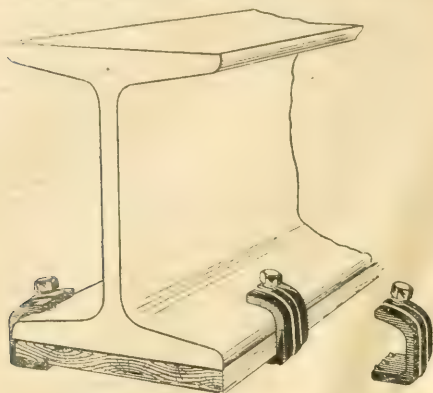


FIG. 1.—SIMPLEX GIRDER CLAMPS.

which a saddle for the conduit, junction box or other accessory, can be fixed by an ordinary wood screw.

The clamps are made of tough malleable iron in two sizes at present, and are provided with a set screw for drawing the wood tight up to the under side of the girder, two or three sharp points being arranged to ensure the wood being securely held.

For angles or odd sections the batten can be placed lengthwise and two girder clamps spaced along the free edges to securely hold it in position ready for the conduit erector.

Loop-in Dividing Box and Push-Button Contact Maker Combination.

In some places—for instance, on boiler-house conveyor plant—it is required to stop the machinery, in the event of an emergency, from several positions. To effect this it is necessary to install a



FIG. 2. REYROLLE DIVIDING BOX AND CONTACT MAKER.

cable extending from the main switch panel to the several points of control, and at these points to attach to the cable, contact

makers so connected that the operation of pressing the button will instantaneously release the switch controlling the motor circuits.

For such work a simple combination of cable dividing box and push-button switch, made by MESSRS. A. REYROLLE & CO., LTD., of Hebburn, is illustrated in fig. 2.

The dividing box provides for looping-in an armoured two-core cable, and for joining the terminals of the press-button contact maker to the respective cores. The whole is of armoured construction, strongly made and capable of withstanding rough usage.

The Prestwich Fluid Gauge.

An ingenious device for gauging articles in course of manufacture has been patented by MESSRS. J. A. PRESTWICH & CO., of Northumberland Park, Tottenham, London, N., and has been used with great satisfaction in their own works for three years on extremely accurate work. It is not subject to wear, and requires no manual skill in use.

It consists of a fluid-containing chamber A (fig. 3), having a flexible diaphragm B, a glass tube C of fine bore, which is connected with the chamber A, means for indicating the dimensions of the piece, and means for correcting for variations of temperature. The diaphragm B is provided with a hardened-steel anvil D. The article to be measured or gauged is passed between this anvil D and the fixed anvil E. Any pressure on the anvil D causes the fluid to rise in the glass tube C.

The chamber A is provided with a thread and micrometer index and pointer on the upper surface to indicate thousandths of an inch (or hundredths of a millimetre). The carrier F is provided

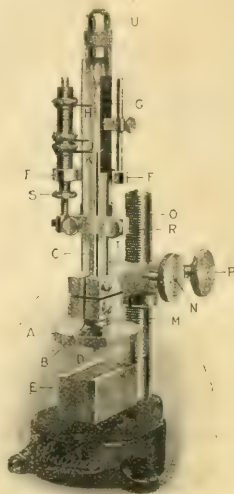


FIG. 3.—PRESTWICH FLUID GAUGE.

with a scale G and three adjustable pointers H, J, K, the scale being divided to indicate ten-thousandths of an inch (or one-thousandths of a millimetre). The two top pointers H, J, indicate the tolerance limits it is desired to work to. The carrier F is adjusted by the thumb-nut S to keep the bottom pointer K level with the normal level of the fluid in the glass tube C, and thus compensates for variations of temperature.

The instrument is roughly set by rack M and pinion N on the pillar O to suit the article; the clamping screw P is then tightened up, and the final adjustment is made by the micrometer adjustment to a standard gauge or piece of known dimensions.

A displacement of the diaphragm B causes a displacement of the level of the fluid in the tube C relative to their respective areas. Any variation in the size of pieces passed under the gauge is indicated by the difference in the heights to which the liquid rises in the glass tube.

Glass tubes of different bores are used to magnify 500 to 1,200 times, according to the accuracy required.

By using suitable anvils or work blocks, a very large variety of work can be gauged, and besides extreme accuracy, which is always retained, the gauge has the advantage of saving half to three-quarters of the time required for gauging with the micrometer.

The Effect of Temperature upon the Alkaline Storage Battery.—Tests made by Mr. L. C. Turnock on the Edison battery show that the temperature at which the battery is used has an appreciable effect on its performance and durability. At low temperatures the available capacity is decreased; the current efficiency increases with rise of temperature up to 50° C., above which it falls off rapidly. The best electrical efficiency is obtained by charging at a low temperature and discharging at a higher temperature.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Wayleaves.

We read with much interest the article on "Wayleaves" in your issue of November 10th, and had hoped to see further reference last week. The article applies, of course, equally to telephone work as to power supply; but we note that the writer is "interested."

So, too, we think is the writer of this letter, with a decided leaning one way, or ought to so lean, after nearly 40 years in the trade. At the same time circumstances alter cases, and ours we think, an example.

At considerable outlay our property has been acquired, the intention being to build on and utilise the surrounding vacant ground, which is pretty considerable: in fact, we are bound to build under the terms of the lease. Originally the place was a large L.C.C. school, the vacant grounds around forming a playground for the children; but we are transforming the premises, &c., into a factory—incidentally to capture a special German trade.

Now, as a children's playground, there was no objection to some 64 overhead wires, even though they occupy a space some 6 ft. x 6 ft., about 25 ft. above the ground; but we want to develop the site (in fact, have no option), and these wires are in our way.

After months of remonstrance the super-intelligent P.O. officials write that they are entitled by Act of Parliament to have them there, which is equivalent to saying that the tenancy was created by the vendors (represented by a well-known and highly respectable firm of City solicitors) by misrepresentation, as, according to these same super-intelligent P.O. officials, we are debarred from building, and are therefore bound to commit a breach of the terms of our lease.

Anyway, when some 64 telephone subscribers in this district find themselves (as they certainly will) all talking to one another at once, do you think we are to blame? We should much like to hear your views.

The Stanneries Metal Works.
H.S.

London, S.E., November 21st, 1916.

[Our sympathies are with our correspondents. We can hardly doubt that the law is on their side—either against the Post Office, which cannot possibly claim free wayleaves in perpetuity over private property, or if this incredible condition were found to obtain, against the lessors of the site, who cannot maintain the terms of the lease.—EDS. ELEC. REV.]

Final-Grade Classes in "Electrical Installation" Work.

Mr. A. P. Trotter says he quite agrees with the Editorial note to our letter (issue of 17th inst.): and he goes on to say that technical colleges should not concern themselves with handicrafts!

In your last issue we commented on your Editorial note, and pointed out that what some people term handicrafts are, as a matter of fact, dealt with in the London Polytechnics.

If they were not, there are very few other places where instruction would be obtainable, so we are very sorry to see that Mr. Trotter opines that technical colleges should leave "handicrafts" alone.

If we may say so, it is very easy to talk glibly about handicrafts and trade schools; but, after all, what is a handicraft, and how many trade schools worthy the name are there in London?

Such things as fretwork and clay-modelling are pure handicrafts, carpentry and joinery are partly so; but plumbing is half handicraft and half a technical subject: while electrical installation work is certainly more of a technical subject than a handicraft.

Mr. Trotter will, perhaps, allow us to point out that he does not say whether we are to infer, from the remarks of his we quoted in our first letter, that final-grade classes are, so far as London is concerned, only held at the two London Institutions he mentioned.

We gather that Mr. Trotter is fully alive to the importance of electrical installation work; but we think he has been misled if he really thinks that Principals of Polytechnics, &c. are enthusiastic about doing justice to the subject.

If Mr. Trotter desires to see the matter from the point of view of the public, we would respectfully suggest that he should first read carefully the City Guilds syllabus of the subject, think of the hundreds of thousands of individuals that would welcome tuition therein, and visualise the treatment and equipment necessary. If after doing this he will take the trouble to walk into the nearest Technical Institute or Polytechnic, and ask to see the manner in which the subject is dealt, with the chances are that he will be considerably disappointed at what he finds.

In some places he will possibly find that, though electrical engineering is taught, "wiring work" to give it its old name, has been forgotten. At some big Institutions he will find that seekers after knowledge are recommended to attend at some other Institution, perhaps two or three miles away. And we have heard of instances where the classes have been temporarily dropped because of the war, the authorities presumably fearing that they might have to pay the teacher his miserable pittance for teaching only a few students.

Speaking of teachers, reminds us of the treatment generally meted out to them; but that is another story.

We are sorry Mr. Trotter still thinks the demand should precede

the supply as this rather plays into the hands of those who do not encourage the supply. The supply of teaching facilities in a subject like this cannot be dealt with like an order for goods.

A. P. Lundberg & Sons

London, N., November 27th, 1916.

"Summation Watt" Capacity of Field Rheostats.

Referring to Dr. Garrard's letter of the 20th inst., I would point out that the various formulae advocated by me are in practical everyday use.

For a current range of, say, 1.0 to 1.5, or less, both his and my formula closely agree with the theoretical basis; however, if a designer has available a sufficient range of ohmic values and ampere capacity in his choice of resistors, then obviously he can in practice closely approach the theoretical size of rheostat required for any current variation. If the designer is limited to a small range of resistance, then for such wide current variation the maximum radiation possible of the resistors in circuit cannot be made use of throughout the whole range. That is to say, in this respect it is inefficient, although it is the best that the designer can do under the circumstances, and, of course, is not detrimental in any respect except that the bulk would be greater than another, having a wider choice of resistor values. This matter of resistors available is the whole crux of the question, and as only the individual designers know of their limitations in this respect, I submit that my formula, based on fundamental principles, is the correct method of determining the size of rheostat, the designer applying a correction factor, if necessary, to suit individual rheostats, as each manufacturer has a large number of sizes and various types of resistors.

This question of "summation watts" is only the preliminary factor that enters into the design.

With reference to Dr. Garrard's remarks on potentiometer rheostats, the following case may be interesting:—A potentiometer rheostat was required for a 10-ampere, 20-volt battery-charging generator having a hot field resistance of 3,200 ohms, separately excited from a 250-volt supply. Obviously 2 to 4 ohms per volt would not be too high, and alternatively two to four times the field resistance would entail either an undesirable very fine gauge wire, or a much larger rheostat than that supplied.

The moral of all this is (to quote the words of Mr. T. Carter), "the use of a formula without care and intelligence is certain to lead, sooner or later, to disaster: a formula is a good angel if a servant, but if it becomes master, it is more subtle in temptation than Satanus himself."

L. Boothman.

Stretford, November 27th, 1916.

LEGAL.

JAEGEL BROS. v. GREAVES.

IN the Lord Mayor's Court, last week, before the Recorder (Sir Forrest Fulton, K.C.), and a jury, a claim was made by plaintiffs, a German firm of electrical cable and fittings merchants, Finsbury, by Maurice Jenks, chartered accountant, suing under the authority of the Board of Trade as controller of the firm, against Mr. T. W. Greaves, of Barnes, to recover £201 11s. 8d., the price of electrical goods supplied. The defendant set up an arrangement made between the plaintiffs' manager and himself in August, 1914, by which he was to have goods of the value of £200 in satisfaction of an agreement which he had with the plaintiffs, whereby he was to serve them as sales manager for a period of one year, terminating in June, 1915. Alternatively, he said, if that was not the bargain, he claimed damages for wrongful dismissal.

Mr. Moreton Smith was counsel for the plaintiffs and Mr. Louis Green for the defendant.

COUNSEL, for the plaintiffs, said that the firm of Jaeger Bros. was owned by Germans resident abroad and managed in this country by a German. They did business in the sale of electrical cables and other electrical fittings. The defendant was employed as sales manager in that business. Upon the outbreak of war with Germany the business was closed down. Subsequently the Treasury sanctioned the business being carried on, the German manager being interned. At the time the business was closed down the goods, the price of which was now being sued for, were sold by the German manager of Jaeger Bros. to the defendant, in order that he should start in business, and the terms were that he should have the goods at cost price, paying 50 per cent. down and 50 per cent. within three months. Defendant made his selection of goods, and after getting delivery of them declined to pay, contending that having an agreement for service with the plaintiff firm he was entitled to compensation. The German manager by whom the arrangement was made with the defendant requested the return of the goods if the defendant was not satisfied with the arrangement. The defendant, however, kept the goods. The defendant had started business in Oxford Street as the Wholesale Electric Supplies Co., which business had since been turned into a limited company. Mr. Maurice Jenks was appointed by the Board of Trade first as inspector and supervisor, and subsequently controller of the German business. It was his duty as a public official to collect the assets of the firm, and in carrying out his official duties he had brought that action. The defendant's claim to the goods as a set-off for compensation for breach of agreement was repudiated.

Mr. H. G. M. OSBORN, formerly provincial representative of Jaeger Bros., gave evidence and said that upon the outbreak of war the business was closed down, the staff receiving a week's notice terminating their engagements. On September 18th, 1914, he witnessed the appointment of the firm by the German manager as sole and exclusive importer on September 23rd the business was carried on by the Treasury. In January, 1915, Mr. Maurice Jenks, chartered accountant, was appointed by the Treasury inspector on March 2nd supervisor, and on March 9th, 1916, controller of the business. In August, 1914, upon instructions from the German manager, an invoice was made out to the defendant for £225 10s. 6d. and of that sum £25 had been paid.

Mr. T. W. GREAVES said he had been in the electrical business for 25 years and in March, 1913, he entered the service of Jaeger Bros. The agreement was afterwards renewed. Upon the outbreak of war the manager said he came to the conclusion it was best to close the business and he said witness was entitled to some compensation under his agreement. He asked for a cash payment, but as that could not be obtained, it was afterwards arranged that he should be allowed £200 in goods at the firm's lowest selling price in settlement of his claim under his agreement. He was to go on August 15th. The goods he selected came to £225, and the £25 had been settled. Afterwards he refused to acknowledge the receipt of, or return, the goods as requested by the German manager, unless he was given some form of security for any claim he had against the firm in respect of his agreement. He had never agreed with Jaeger Bros. to take £150 worth of goods at cost price and discharge them from all liability in respect of their contract. The goods were not invoiced at cost price, but at lowest selling price.

The jury found a verdict for the plaintiffs.

The READERER directed the jury to return a verdict for the plaintiffs on the counterclaim, holding that the war put an end to the defendant's contract of service, and so far as the action for wrongful dismissal was concerned, there could be no claim for damages. Judgment was accordingly entered for the plaintiffs on the claim and counterclaim. A stay of execution for seven days was granted.

PEARMAIN v. JOHNSON & PHILLIPS, LTD.

IN the City of London Court, on November 24th, before his Honour Judge Rentoul, K.C., this case was mentioned. The widow and mother of the late Walter Pearmain, electrical engineer, Acton, claimed £300 against defendants, electrical engineers, Willesden Lane, Acton, as compensation for the death of their husband and son respectively.

MR. NEWMAN, counsel for the applicants, said that the widow was married on September 21st. The husband was killed on October 14th by electric shock in an accident at Messrs. Johnson & Phillips's works. The firm, recognising their liability, paid £300 into Court. The widow and mother of the deceased had come to an arrangement whereby the widow was to have £200 and the mother £100. Previous to the marriage the mother lived with her two sons, of whom the deceased was one. Both were electricians. The two sons allowed the mother 10s. per week each. On the marriage that payment by the deceased was still to be paid to her, and intended to be paid. The mother was living with the other son, who was married. For the last five years the mother had had £100 invested, so she knew how to take care of money. The widow was formerly a nurse. Her parents had a small boarding house at Eastbourne. Both the applicants had decided to start a small boarding house at Eastbourne, and they would like the whole £300 paid out to them. The parties were in a different condition to the average workman's relatives.

JUDGE RENTOUL granted the application, but warned the applicants to be very cautious in starting any business during the present circumstances, having regard to the uncertainties of success.

MINING ELECTRICIAN'S APPLICATION.

HARRY YOUNG (Hurlford), a mining electrical engineer, applied for a clearance certificate from Ardeer Co. at a Munitions Tribunal at Kilmarnock.

MR. HARRY FLETCHER, secretary of the Electrical Trades Union, Stevenston Branch, appeared for the applicant, and pointed out that to obtain munitions they must have coal, and to get the coal they must have at the pit a fully qualified mining electrical engineer, which applicant was. At Nobel's he was only employed as a general electrician. He had a definite offer as a mining electrician, and then he would be nearer home. He stayed in Hurlford, and each morning at 5.10 had to walk to Kilmarnock to get the train there for Ardeer. If he got the other job he would only have a distance of 5 miles altogether.

The Ardeer representative said they had a special train from Kilmarnock. They were so placed that they could not get sufficient men in the surrounding district.

The application was refused.

MEDLEY v. DINGWALL.

IN the Shoreditch County Court, on November 25th, before his Honour Judge Cluer, the hearing was resumed and concluded of an action in which Mr. C. P. Medley, the London Hoist and Machinery Co., of 103, Worship Street, E.C., electrical engineers, sued Mr. T. G. Dingwall, of 53A, City Road, E.C., packing-case makers and shippers, to recover £40 3s. 6d., the balance of an account of

£150 3s. 6d., for supplying and fitting a second-hand electric gear to a lift, together with accessories.

Mr. Foster appeared for the plaintiff, and Mr. D. Rowland Thomas was counsel for the defence.

Evidence was given for the plaintiffs that they entered into the contract for the fitting up of an electric lift, which they carried out. The motor which was fixed on a cast-iron bed, was complained of, so they put in another, but, to save time, they banked it up with blocks of wood on the top of the cast-iron bed. They left it in perfect running order.

MR. J. SHEARMAN WILKERSON, foreman bale packer, called for the defence, said that after the new motor was installed the lift worked so badly that he went and implored the plaintiffs to come and put things right, but things got no better. One fault was that the sheave did not grip, and left the wheel running, and the defects were still present. It was fitted to take 10 cwt., but at times would not take 5 cwt. If the rope was pulled for it to go up, it would, at times, go down, and it became dangerous to work it, as they never knew when it might deposit the operator and the load in the well of the lift. He had told the operator to put less weight on, which meant that two journeys had to be taken for one.

MR. FOSTER: Do you know it is not possible to reverse without reversing the armature of the connection?

WITNESS: I have seen the rope pulled for it to go up, and it has gone down.

MR. DINGWALL gave evidence, and said that a few hours after the new motor was put in he had complaints. The controller was the cause of most of the trouble, as it worked so critically that when pulled one way, it went the other. As an electric lift it was quite a failure.

Four experts, Mr. Ernest Ellison, A.M.I.E.E., Mr. Bourne, Mr. Gallon, and Mr. Percy H. Arber, A.M.I.E.E., were called, all of whom said the lift would not do its work properly as it was. It stopped, reversed, would not start with its full load at times, and so on.

MR. BOURNE said that to put it in proper working order as an electric lift of good quality would cost £200.

A witness having said it was dangerous to life, JUDGE CLUER said it was lucky for them they had not lost a lot of lives, he supposed, and the witness agreed.

JUDGE CLUER said he went to the factory; he paid a special visit to view the electric lift: it did not reverse while he was there. He thought the fault lay in the human operator being incompetent, as the plaintiffs could work it quite well. The motor had been put on wood blocks instead of cast-iron, which might cause vibration, so he would allow £2 for that, and give judgment for the plaintiffs for £38 3s. 6d. Leave to appeal was granted, on the amount of the claim being paid into Court.

WAR ITEMS.

Black Lists.—The "London Gazette" for November 24th contains a further list of persons or bodies with whom trading is prohibited in Brazil, Denmark, Greece, Netherlands, Norway, Spain, Sweden, and other countries.

Lord Balfour's Committee.—According to a statement made in the House of Commons last week, the interim report of Lord Balfour's Committee on the resolutions of the Paris Economic Conference has been received.

German Electric Lamps for Italy?—An Exchange dispatch to the *Westminster Gazette* says it is stated in the Rome Press that half a million German electric lamps have recently arrived at a city in Northern Italy.

Sales of Enemy Interests.—The "Times" states that Messrs. Fuller, Horsey, Sons & Cassell have been instructed by the Board of Trade to realise the assets of the Bosch Magneto Co., Ltd., and the London Emery Works, Ltd.

To be Wound Up.—The Board of Trade has ordered the following company to be wound up:—

Sanitas Electrical Co., Ltd., 61, New Cavendish Street, London, W., dealers in medical electrical apparatus. Controller: James Fraser, 31, Cophall Avenue, E.C.

Women Workers.—We read in the "Times" that women are to be employed as electric train drivers in Vienna. More than 5,000 women are already acting as train conductors there. Our contemporary also states that Saxony has just permitted the employment of women as stokers for steam engines and boilers.

Export Prohibitions.—A Supplement to the "Board of Trade Journal" of November 23rd contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported from Denmark, France (including Algeria), Greece, Italy, Japan, and the Netherlands. This Supplement also contains the list of articles (complete to date) which are prohibited to be exported from the United Kingdom.

War Metals.—The Minister of Munitions has appointed a Committee, under the chairmanship of Mr. C. W. Fielding, to advise him upon the steps which can be taken to secure the most economical use of the metals required in the manufacture of munitions of war. The *Times* states that Mr. Fielding has been chairman of the Rio Tinto Co. for the past 12 years.

Austrian Copper Shortage.—Having requisitioned the church bells throughout the country and stripped off the copper from the roofs of churches and public buildings, the Austrian Ministry of National Defence has now announced the confiscation of the copper on private buildings.—*Times*.

Air Raids and Electric Flashing.—Major-General Sir Francis Lloyd states that from observation made, it is interesting to note that sparking from electric trains and tram tends rather to confuse than to assist hostile aircraft in finding their way over London.

Glasgow War Bonus.—At a meeting of the Glasgow Electricity Committee it was agreed to recommend (1) that all meter inspectors and clerks employed in the electricity department, whose salaries are £95 and do not exceed £250 per annum, be granted a war bonus at the rate of 1s. per week and (2) (a) that the female meter inspectors and female clerks, and (b) junior male clerks, whose salaries are under £95 per annum, be granted a war bonus of 2s. per week.

Entertaining Wounded Soldiers.—The wholesale and retail electrical trades of Bristol on Thursday last week, gave a very enjoyable entertainment to the convalescent soldiers who are recovering from their wounds in some of the hospitals of Bristol. Some 320 disabled warriors accepted the invitation to the Art Gallery (kindly lent for the occasion by the Bristol Corporation, and the musical programme went with a good swing, the applause which greeted the various items testifying to the appreciation which was felt. Refreshments were provided, and the arrangements for the comforts of the men reflect great credit on the committee, who were untiring in their energies. Mr. A. H. Dowson (chairman), in a few well-chosen words, welcomed the "boys," and said it was only a very small way of showing how they all appreciated what they had given for those at home. The National Anthem concluded a very enjoyable evening. The committee, who in conjunction with the Inquiry Bureau had charge of the arrangements, were representatives from the Crypto Electrical Co., Veritys, Ltd., the Ediswan Co., the General Electric Co., Ltd., Siemens Bros., and several retail firms.

An Australian Law Suit.—The "Melbourne Age" of October 17th contains a report of the case Welsbach Light Co. of Australasia, Ltd., v. the Commonwealth of Australia. Plaintiffs' case was that it was a company, incorporated under the law of Great Britain, and was a seller of incandescent mantles, and sold such goods in Australia. An injunction was claimed restraining the Commonwealth Attorney-General from taking further action on a notice in the *Government Gazette* that the company was managed or controlled mainly for the benefit of persons of enemy nationality, and £95,000 damages were asked for.

For the defence, a demurrer was pleaded on behalf of the Commonwealth, that the statement of claim was bad in substance and not sufficient in law for the plaintiff company to maintain the action.

The Lord Chief Justice, in delivering his judgment, said that the statement of claim disclosed no cause of action, and there must be judgment for the defendant. Justices Barton, Isaacs, Duffy, and Rich agreed. Mr. Justice Higgins was not prepared to dissent from the views of his colleagues, though he had doubt. Mr. Justice Powers disagreed with the view of the majority of the Court. The demurrer, on a majority judgment of the Court, was allowed, and judgment was entered for the defendant.

The Use of Electric Torchlights.—In Dumbarton Sheriff Court last week, according to the *Glasgow Herald*, a number of prosecutions were made against young men and girls for having, during the hours in which lighting is restricted in the streets of Dumbarton, displayed a light by means of an electric torch, which might act as a signal, guide, or landmark. George Connor, caulker, Dumbarton, pleaded guilty, and it was stated by Mr. H. L. Yeudall, Procurator-Fiscal, that in the opinion of the authorities this torchlight business had become a regular danger. In this case, besides being a real danger, it was a real nuisance. Sheriff Macdunnid said that he thought it would be obvious that the restrictions and regulations would not have been made regarding lighting in houses if accused and his companions were entitled to walk about the street flashing torchlights in the sky and about the streets. It was a practice which must be stopped. A penalty of 60s., with the alternative of 10 days' imprisonment, was imposed. Penalties of 30s. or 10 days' imprisonment were imposed on William Kennedy, David Cochrane, Joseph Quinney, John Hendry, Catherine Drysdale, and Jessie Bonman, all of Dumbarton. His Lordship said it must be understood that while a shaded light or faint light, such as was used on moving vehicles, if carefully used would not be interfered with, nothing in the nature of a bright light would be allowed.

Exemption Applications.—At the Wigan Tribunal, application for exemption was made on behalf of an electrical engineer employed at a local picture palace. Exemption was granted on the understanding that applicant went to work in a coal mine.

At the Bedworth Tribunal, application was made for three men on the Tehidy estate, including an electrical engineer (aged 41, married), in charge of the electrical plant, water supply, &c. The electrical engineer was the only man left with the whole of the plant, &c., whereas there were pre-

viously two. Mr. Shopland said they did not want the man so much as a soldier as a skilled mechanic. The Chairman: The farms cannot do without water. The engineer was exempted to February 1st.

At Southwark, Messrs. H. Dunn & Son, electrical and mechanical engineers, of Newington Causeway, S.E., applied for the exemption of an electrical fitter, 25 years of age, and an armature winder, 29 years of age, both passed for general service. It was stated that the firm was exclusively engaged on the repairs and oversight of the electrical plant in a munition factory, where over 3,000 workpeople were employed on important work. They were also making special machinery for this firm. Mr. T. Haynes, J.P.: The difficulty is that they are both young men fit for general service. Mr. Dunn said they could not get old men for electrical work. They had advertised extensively in the technical papers, but got no replies. He read a letter from the Auxiliary Army Ordnance Depot stating that the men were indispensable, and could not be spared. The fitter was placed in a certified occupation, whilst two months' exemption was granted the armature winder.

At Weston-super-Mare, the Electrical Supply Co., Ltd., appealed for P. W. Paul (27), cable joiner, originally medically rejected, and now passed in Class C2. He is the only joiner on the staff, and cannot be replaced. The Military Representative assented, and conditional exemption was allowed. The company also appealed for F. E. Spearing (38), foreman electrician of the installation department, classed in C3, after being rejected under the Derby scheme. The Tribunal allowed conditional exemption, with the assent of the Military.

Evesham Tribunal has granted final exemption to March 31st, with the Volunteer condition, to A. J. Howard (28), in sole charge of the electrical works of the Evesham Motor Engineering Co.

At Chatham, the Tramway Co. appealed for four of the staff, and, on their behalf, Mr. F. F. Smith said that some time ago arrangements were made by which the working staff was reduced to an absolute minimum. Captain Reid suggested that if the four men were fit for service they should be relieved if suitable substitutes were found by the Military authorities. Mr. Smith said that Mr. Jensen, the manager, would be quite agreeable to this, but he pointed out that 12 men who were medically unfit for military service had been tried, and they had to give up the work. It was arranged that the four men and others on the staff should be released when proper substitutes were found and given a trial.

Pochdale Tribunal has granted conditional exemption to Edmund Holden (31), motorman in the service of the Corporation tramways department.

The Tribunal at Castleton (Yorks.) has granted conditional exemption to Mr. J. W. Etherington (36), electric light bulb mould manufacturer, who is engaged on Government work, and is exempted for general service.

At Weymouth, a certificate of conditional exemption has been granted to Mr. T. H. Scott (28), electrician and manager for Messrs. Brooking & Co.

Before the Northants Appeal Court, Major J. C. Lewis, of Darnote Hall, applied for extended exemption for Duncan Cameron (31), attendant to the electric light plant at the Hall. In reply to a question, he said he thought that a wounded soldier would not be competent to do the work. A final two months were allowed.

At Reigate, on November 21st, it was reported that the Surrey Appeal Court had reviewed the case of C. Morgan (29), shift engineer at the Corporation electricity works, and had, on the appeal of the Military, made exemption until January 1st final.

At Dover, on November 22nd, the Military applied for withdrawal of conditional exemption allowed to G. Hopkins (32), coal and ash trimmer at the Corporation electricity works, and recommended a month's exemption only. Mr. Vosper said the man was in a certified occupation and, irrespective of age, was exempted. The Mayor suggested that the man's services should be retained until a substitute could be found by the Military, and this was adopted. Mr. Woodman, for the electricity department, pointed out that the trouble was to get the substitutes to stay. He had had seven applications from men of between 50 and 60 years of age, but the job could only be carried on by a tough man, as he had to trim over 10 tons of coal and seven tons of ashes seven days per week on an eight-hour day.

At Romford, seven tramcar drivers, whose ages ranged from 31 to 36, were appealed for by Hford U.D.C. The Clerk to the Council said that the staff had been considerably reduced.

Mr. L. Harvey, tramways manager, said that it was impossible to run the present service with a smaller staff. Captain Howard suggested that women should be trained as drivers, and that women should take the place of conductors, but Mr. Harvey replied that the Commissioner of Police would not license women drivers. The Chairman said that the Tribunal was satisfied that some reduction could be made in the present staff; the public might suffer some inconvenience, but it would not be substantial. Two of the men would be allowed two months, and in the case of the others the appeals would be reviewed at the end of the same period.

Before the Stratford-on-Avon Rural Tribunal, Lieutenant Crosland, of Ullenhall, asked for leave to appeal for his elec-

man, aged 28, Mr. Irving failed to get a substitute. The Tribunal refused leave, considering that Lieutenant Crosland had had time to make arrangements.

At Eastleale, an appeal was made by Mr. J. H. Batho, of Alfriston, for the retention of A. N. Gander (29), electrician, and exemption to December 31st was granted.

At Strood (Kent), on November 22nd, Messrs. Martin, Earl and Co. appealed for S. Richardson (27), electric machine attendant, and conditional exemption was allowed.

At the Leeds Appeal Court, an electrical engineer, in applying for an employee married, stated that out of 20 men 11 had joined and four were on munitions. Temporary exemption was given on January 31st.

At Buxton, an applicant, aged 35, stated that he was the only practical electrical engineer in the town employing labour, and if he went his business would stop. Conditional exemption was granted.

At Douglas (Isle of Man), on November 15th, exemption was claimed for W. White (35), electrician, by Mr. Faragher, and exemption until February 12th was conceded.

At Douglas, on 15th May, on November 15th, exemption was granted until their apprenticeship was finished to P. A. Robinson (35) and W. A. Cowen (38), electrical engineers, by the Manx Electric Railway Co., who were to employ them in the summer of the coming year. Mr. Edmund Cowen stated that he wished to keep the lads for the company's summer work, but it would be better for the company if they were to be trained at that time, and then join. Robinson was directed to join when called up, and Cowen, passed in Class C2, was granted time to complete his apprenticeship.

Kidderminster Tribunal has given three months' exemption to C. J. Middleton (36), electrical engineer, engaged at the Opera House.

At Preston Tribunal, application was made for 10 Corporation tramcar drivers. Mr. J. F. Simpson (tramway manager) said he understood the Military were prepared to substitute these men, and all he asked was for exemption until the substitutes were forthcoming. If the men were taken at once it would mean stopping nine cars. They could not get men to take their places. He had an understanding with the Labour Exchange to send him three men a week to train as drivers, but during the past three months they had sent him only one man. The Military Representative accepted the condition, and it was decided to exempt the men until February 1st, the men to go in the meantime if substitutes were available.

At Bolton Tribunal, on November 22nd, an electrical engineer, aged 27, applied for exemption. The Assistant Military Representative strongly urged that the man should be taken for the Army on account of his age. The man's father said if he were taken the business, in which all his life's savings were invested, would be ruined. Exemption until December 31st.

Mr. G. H. Baker appealed at Bexhill-on-Sea for F. W. Climpson (37), electrician, who attested. Mr. Baker said that all his other men had joined up, and without Climpson he would be like a ship without a rudder. Three months were allowed.

Woking Tribunal has granted two months' exemption to J. S. Fowler (33), electrician, appealed for by the Electric Supply Co., Ltd.

At Eastleigh, on November 21st, the British Westinghouse Electric and Manufacturing Co., Ltd., appealed for six men engaged on work at Eastleigh in connection with the electrification of the London & South-Western Railway Co.'s suburban lines. It was decided that three of the men, who are unmarried, should join up at once; the other three were allowed three months each.

Wantage Tribunal has granted exemption to March 1st to Mr. W. A. Noble (41), manager of the Tramway Co., on his joining the Volunteer Defence Corps; the same term to J. R. Wilkins (32), fitter and erector, appealed for by the company; and to January 15th to R. Skinner (32), tramway conductor.

BUSINESS NOTES.

Lamp Manufacture in the U.S.A.—Licences to manufacture tungsten filament lamps under the Just and Hanuman patents are being issued by the General Electric Co., of Schenectady, owners of the patents, the validity of which has been recognised by the U.S. Courts. The owners could have shut down the independent lamp makers, but preferred to issue licences rather than to destroy the capital invested in their businesses. The licences permit the licensees to continue to manufacture lamps up to the same percentage of the General Electric Co.'s output in any year as they were manufacturing in 1915. The licensees are not restricted as to selling prices, but must not use the trade name "Mazda" and will not have the benefit of the research work carried on by the owners of the patent.

The effect of the decision is to put an end to the importation of tungsten filament lamps into the United States. The *Electrical World* states that the Laco-Phillips Co., the defendants in the case, who were large importers of lamps from Holland, have gone out of business so far as the United States is concerned. Before the war there was a very appreciable trade in foreign-made lamps, mostly of the miniature type; but in September, 1914, the price

of American lamps was lowered to a value that could not be met by foreign manufacturers.

Book Notices.—*Proceedings of the American Institute of Electrical Engineers*. Vol. XXXV. No. 11. November, 1916. New York: The Institute. 81.

"Scientific Papers of the Bureau of Standards." No. 294. "Fleeting Point of Mercury." Washington: Department of Commerce.

"Spon's Electrical Pocket Book." By W. H. Molesworth. London: E & F N Spon. Price 6s. net.

Trade Announcements.—**MESSRS. ALBERT DICKINSON, LTD.**, of 19 Upper Mill Hill, Boar Lane, Leeds, have circularised their customers, stating that owing to the pressure of military necessity they are compelled temporarily to suspend operations. They have arranged with Messrs. Wallis & Watson, of 26, Park Row, Leeds, to take over the business *pro tem*.

New offices and showrooms for the electricity department, have been opened at 1, St. James's Street, by the Taunton T.C.

To meet the demands of increasing business, the directors of the **VELLUM BOILER AND GENERAL INSURANCE CO., LTD.**, have decided upon certain rearrangements of, and additions to, the official staff at the head office, which in future will be constituted as follows:—C. Bullock, Wh. Sch., A.M.Inst.C.E., managing engineer; J. M. Dale, F.C.I.S., managing secretary; Frank H. Bullock, A.M.Inst.C.E., deputy managing engineer; G. R. Vine, assistant secretary and accountant; R. Quinney, assistant secretary and agency superintendent; J. Cauley, chief boiler engineer; E. H. Scholes, departmental chief, consultative department.

THE INDIO-EUROPEAN TELEGRAPH CO., LTD., announce that the whole of the radio-telegraphic business hitherto carried on by that company has been transferred to Messrs. Creed & Co., Ltd., telegraph engineers, East Croydon, to whom should be addressed all communications on subjects previously dealt with by the company. The board of directors of Creed & Co., Ltd. (until recently known as Creed, Bille & Co., Ltd.) has been enlarged to accommodate, amongst others, two directors of the Indo-European Telegraph Co., Ltd. A fuller announcement concerning Messrs. Creed & Co.'s developments appeared in our issue of November 17th, page 545.

Dissolutions and Liquidations.—**SHAW WIRELESS, LTD.**—According to an Australian paper, this company is winding-up voluntarily, with Mr. L. J. D'Antoine, of T. and G. Buildings, Elizabeth Street, Sydney, as liquidator.

GOODENOUGH & SKINNER, motor engineers, electricians, &c., 62, Hampton Road, Redland, Bristol.—Messrs. W. D. Goodenough and J. B. Skinner have dissolved partnership. Mr. Goodenough attends to debts, &c., and will continue the business.

LEITNER ELECTRICAL CO., LTD., Maybury, Woking.—December 14th is the last day for receipt of proofs for dividend. Liquidator, Mr. G. E. Corfield, 119, Finsbury Pavement, E.C.

Patents and Alien Enemies.—Application has been made to the Board of Trade by the North British Rubber Co., Ltd., for the avoidance or suspension of Patents Nos. 11,530/13 and 11,615/13, granted to Fabbenfabriken vorm. Friedr. Bayer & Co. for the vulcanisation of rubber: the hearing was fixed for yesterday.

Applications for the grant of licences in respect of Patents Nos. 12,777/13 and 12,661/14, granted to Newton on behalf of the same alien firm and in respect of the same subject, have also been made by the North British Rubber Co., Ltd., and were to be heard yesterday.

The suspension order dated August 17th, 1915, granted to Messrs. G. H. Forrester and G. Marsh in respect of Patents Nos. 12,868/05, 12,869/05, and 12,870/05, for the detinning of tin plates, has been revoked.

Patent Restoration.—Application has been made by L. St. C. Brach for the restoration of Patent No. 18,513 of 1911 for "Improvements in soldering composition paste."

Catalogues and Lists.—**MESSRS. F. HUSBAND, LTD.**, Craven House, Kingsway, London, W.C.—Illustrated circulars giving prices and particulars of Husband-Quead electric fires and Ensign electric fires.

THE B.T.H. CO., LTD., of 77, Upper Thames Street, E.C., have issued the first of a series of incandescent lamp handbooks. It gives a great deal of information and data regarding Mazda lamps of both vacuum and half-watt types, suitable for general illumination, train lighting, projector work, &c. There is also a glossary of technical terms used in connection with glow lamps, as well as rules and terms for the sale of Mazda lamps to private consumers, trade users and re-sellers. The handbook (56 pages) illustrates to scale all the forms of standard lighting lamps falling under the heading of Group I, and gives detail of size, type of cap, efficiency, wattage, voltage range, illuminating output in lumens, standard packing quantities, &c. Readers who have not received copies can have same on application.

THE STERLING TELEPHONE AND ELECTRIC CO., LTD., 210-212, Tottenham Court Road, London, W.—Publication No. 254 (eight pages) containing a description of their mining bells and relays, specially constructed with parallel windings for use in fiery mines, in order to comply with the new Home Office Regulations.

GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—A folder (O.S. 2061) has been issued, giving prices of Osram drawn-wire lamps. It bears the coloured "Elephant" design "Osram the Strong," already referred to in these columns. Copies are being supplied to the trade, overprinted with their name and address. The company has also issued to the trade an effective window bill (29 in. x 39 in.) of the same design.

LIGHTING AND POWER NOTES.

Australia.—The N.S.W. Public Works Department is making inquiries in connection with the proposed electric lighting scheme for Wollongong. The Department has in hand a comprehensive scheme for lighting the towns on the south coast, and on the table lands from the power house at Port Kembla, and probably before long Bowral, Moss Vale, Mittagong, and the mountain towns may be lighted from this source. The price of materials is chiefly retarding the negotiations.

The Melbourne (Victoria) City Council has been advised by the Electric Supply Committee that it has been found necessary to install an additional 5,000-kw. generating plant, so that it may be in operation during the winter of 1918; the cost is estimated at £22,500. The demand for power is increasing at the rate of 20 per cent. yearly, and it is expected that the same rate of expansion will continue in the future. Tenders are to be invited for the plant.—*Tenders.*

A deputation recently waited on Mr. H. McKenzie, Minister of Water Supply, with a view to securing extending rights to the use of the water of the Kiewa River for hydro-electric power. The proposal is to establish on the higher reaches of the Kiewa River hydro-electric works to distribute electricity in the country districts and down as far as Melbourne. Under the Water Act the syndicate could only secure a 15 years' lease, and it is desired to have this extended to 50 years.

A special Act of Parliament would be necessary, and the deputation asked that provision might be made for the Government to fix the prices of supply, and for the State to take over the whole concern if thought fit.

The Minister said the Water Commission had no objection to the syndicate using the water for power production; he could not hold out any hope that a Bill could be introduced this season, but he would bring the request before the Cabinet.

The Brunswick City Council is raising a loan of £7,500, of which £5,000 will be devoted to extending the electric lighting throughout the municipality. *Melbourne Age.*

A representative deputation has interviewed the Victorian Premier to protest against any proposal to compulsorily take over the Melbourne City Council's electricity undertaking and place it under the control of a proposed tramway trust. The Premier mentioned that a Sub-Committee had been appointed to consider the matter and prepare a draft Bill; no decision had been come to; and he promised that the representations of the Committee should be considered.

Baldon (Yorks.).—**PROV. ORDER.**—The B. of T. has agreed to extend the powers obtained by the Council in 1913 in respect of the supply of electricity; the matter has arisen owing to a recent proposal to supply electricity in the district.

Bingley.—The D.C. has resolved upon the adoption of the maximum demand system as an alternative system of charging for energy supplied for lighting; also to charge for energy supplied for power £3 per annum per metered H.P. required, plus 1d. per unit supplied.

Birmingham.—In order to enable the Electric Supply Committee to give the necessary supply of electricity to the tramways, it is suggested that the power load should be reorganised, and if the necessary approval can be obtained, it is hoped that the tramway difficulty will be overcome.

Bury.—**LINKING-UP.**—The chairman and deputy-chairman of the Electricity Committee, the town clerk and the electrical engineer have been deputed to attend any conferences which might be held on the question of interconnection of electrical undertakings in the district, the Committee being in agreement with the general idea.

Cahiriveen (Co. Kerry).—**E.L. SCHEME.**—A public meeting decided to urge the Council to adopt an electric lighting scheme for the town.

Chile.—Permission has been granted to Señor Victor Leon Nunez to utilise the Rio Chillan for the production of power required in connection with the electric lighting of the town of Chillan. *Board of Trade Journal.*

Colombia.—The Municipal Council of Pensylvania, Department of Caidas, has been authorised to raise a loan of £3,000 for an electric power plant; the Municipal Council of Angostura, Department of Antioquia, to raise a loan of £800 for an electric power installation; and the Municipal Council of Venecia, Department of Antioquia, to raise a loan of £1,000 for an electric power plant and aqueduct works. *Board of Trade Journal.*

Continental.—**AUSTRO-HUNGARY.**—Owing to the serious condition of the Buda-Pesth finances, the Municipal Council has decided to raise the prices of gas, electric light, and water, hoping to raise an additional revenue of £300,000 to £350,000.—*Times.*

SPAIN.—La Sociedad Energia Electrica Catalana, of Barcelona, has applied to the authorities of the Province of Lerida for a concession to establish a hydro-electric plant of about 4,800 H.P. on the River Noguera de Cardos, near Triva.

PORTUGAL.—Concessions have been granted to Senhor Martinho Pinto de Miranda Montenegro, of Castelo de Paiva, to use the Rio Paiva, at two different points in the Aveiro district, for the generation of electrical energy. Two hydro-electric power stations are to be established, each having three sets of turbo-generators; each turbine is to be of 2,500 H.P. *Board of Trade Journal.*

Cork.—The Trafford Co., Manchester, a branch of the Ford motor concern, U.S.A., is in negotiation for the establishment of works which it is expected will involve an extension of electric lighting and power.

Dover.—The T.C. has further postponed the question of installing a new turbine set in place of the smaller sets at the electricity works. The question was held over a year ago. An additional loan of £3,881 to meet the cost of laying a new cable to East Cliff is to be taken up.

Dundee.—**PLANT EXTENSIONS.**—The Electricity Committee of the T.C. reports that the Scottish Office has sanctioned the expenditure of £27,000 for proposed extensions, on condition that a contribution of £5,000 towards the cost of the contemplated extension is made out of revenue, and that provision is made for reduction of the loans raised under the present sanction by setting aside annually to a sinking fund not less than 4 per cent. of the amount borrowed.

Epsom.—**PROVISIONAL ORDER.**—The South Metropolitan Electric Tramways and Lighting Co. Ltd. is applying for a provisional order for the supply of current in the parishes of Ewell and Cuddington, in the area of the Epsom R.D.C.

Exeter.—It was reported to the T.C. that the present stock of electrical materials cannot be increased, and that when it was used up no further E.L. connections could be made.

Falkirk.—**PRICE INCREASE.**—A proposal to increase the price of electricity for power by 10 per cent. is being considered by the T.C.

Llandudno.—**PRICE OF ELECTRICITY.**—The Electricity Committee has considered the statement showing receipts and expenditure during the year ended March 31st, and also for the half-year ended September 30th, and reports that it appears that the increasing loss on the undertaking is due to the higher price of fuel; it was therefore recommended that the Council raise the flat rate for electricity to 8d. per unit, and other rates in proportion, which, however, the Council declined to do.

London.—**HAMMERSMITH.**—The Electricity Committee reports that it is still in negotiation with the Battersea and Fulham B.C.'s upon the proposed linking-up scheme. In the meantime, a suggestion has been received from the Fulham B.C. that the Hammersmith Council should take over some of its load for a period of six months or so, pending the carrying out of certain important alterations to the Fulham electricity works. The engineer has reported that this can be done in such a way as to form a part of the proposed larger and permanent linking-up scheme, by connecting the ordinary high-tension mains at a sub-station in the Fulham area near the Hammersmith boundary, the only apparatus to be purchased being two auto-transformers necessitated by the difference in the two pressures of the respective undertakings. This will enable a temporary bulk supply of approximately 400 kw. to be given to Fulham, and the Committee recommends that it be carried out. The Committee reports that the mains laid by the Council's contractors for the bulk supply to the Chiswick Electricity Supply Corporation are now in position and available for supply at any time.

Application is to be made for sanction to a loan of £2,000 for the purchase of cable and apparatus on the termination of the contract.

STEPNEY.—The B.C. has been recommended that all charges for electricity supplied, including meter rentals, except in cases where there are special contracts, should be increased by an additional 13½ per cent., making a total increase on the pre-war rates of 33½ per cent., to commence with, and include, the accounts to be rendered for the month of November.

Market Drayton.—The Blore Heath R.D.C. has given its consent to the Market Drayton Electric Light and Power Co. to supply electricity to Peatswood, Tyley Castle and Tern Mill.

Midlothian.—The electrical plant of the Arniston Oil Co. is being duplicated.

New Zealand.—Mr. Evan Parry, the chief electrical engineer of the Lake Coleridge (Government hydro-electric) scheme, in his report on the year's operation to March 31st, 1916, states that 4,860,260 units were generated and 3,994,757 units sold; the maximum load was 1,328 kw., the average load 555 kw. and the load factor 41·8 per cent., while the connected load was 6,893 kw. Operating expenses amounted to £9,383, making, with depreciation and interest (£16,783), a total of £26,166. The revenue was only £8,255, resulting in a deficit on the year's working of £17,911. Three generating units were originally installed, equal to 6,000 H.P.; 12 months ago the demand for electricity warranted the installation of a fourth unit of 2,000 H.P., and the expanding business now necessitates the addition of a fifth unit of 4,000 H.P. Contracts to the extent of 8,000 H.P. have already been entered into, and when the power under these contracts is supplied it is expected that the plant will be earning sufficient to pay interest in full, as well as working expenses, and possibly leave a small surplus towards sinking fund and depreciation. The total capital expended to March 31st, 1916 was £211,700.—*New Zealand Wealth Engineer.*

Rawtenstall.—The T.C. has received sanction to the borrowing of £107 for transformers in connection with the supply of electricity to Hastingden, and £200 for the provision of a transformer in connection with the supply to a local firm.

Tasmania. The Government has obtained a loan of £100,000 from the Commonwealth Bank for the purpose of enabling it to supply 3,500 h.p. to the Hydro-Electricity Board for the amalgamated Zinc-Ore-Battery plant, to be used for consumers in and around Hobart.

West Ham. The electrical engineer is to report on the proposed siting of the generating station, and to supply certain data in connection with the linking-up proposals.

Willesden. It is reported that the Daylight Saving Act for the midsummer quarter reduces the private lighting revenue by £118 as compared with the previous year. During the two summer quarters 2,735,813 units were purchased from the Power Co., the average cost being, for the June quarter, '72½d. per unit; for the September quarter, '17½d. per unit, being a reduction as compared with the previous year.

A proposition is to be made to the L. G. B. to sanction the borrowing of £2,500 for main extensions. The Board has sanctioned a loan of £2,887 for certain urgent work.

TRAMWAY and RAILWAY NOTES.

Australia. The quarterly report of the Prahran and Malvern Tramways Trust to September 30th shows that the revenue for the quarter was £33,619; the passengers carried were 724,875 and the car mileage, 590,515 miles. During the year ended September 30th the total number of passengers carried was 2,909,512, and the total revenue from fares was £150,444.

Having practically completed arrangements for the borrowing of £100,000, the Footscray (Victoria) Tramway Trust has decided to make an early start with the construction of four of the five short lines in the scheme, each of which has its terminus at the Footscray Railway Station; the Trust recently obtained an Order in Council authorising this work.—*Traders.*

A deputation from the Municipal Tramways Conference recently waited on the Premier of Victoria on the question of tramway control. The deputation protested against any proposals to constitute a permanent tramway authority not composed of representatives from the Municipal Councils, and strongly objected to the proposal to take away from the Municipal Councils the ownership and control of all tramways in the metropolitan area; objection was also made to the insertion in the proposed Tramways Bill of any provision for subsidising the Railway Department out of tramway revenue.

The Premier in reply, said that the Government was fighting for municipal ownership as against nationalisation; the real point at issue was as to the question of management. He would, however, submit the views of the deputation to his colleagues in the Cabinet. As regards the subsidy, he was afraid the deputation had not looked at it from a broad standpoint. The metropolitan area had been largely developed by the railway system at the expense of the people as a whole. If by any chance the tramways were going to compete with that system, it only seemed fair that something should be paid for the right to compete. He could not hold out any hope that the Government was likely to vary the proposals, which would be thrashed out in Parliament.—*Melbourne Age.*

The effect of the suburban electric tramway services on the railway revenue is discussed in the annual report of the Victorian Railway Commissioners, who estimate the decrease on the Essenden, Prahran-Malvern and Hawthorn-Camberwell lines at £60,945 per annum. The Commissioners say:—"So long as the existing principle governing the construction of tramways is continued, the proposition that the railways should in some way be compensated from the tramway receipts for the loss of revenue resulting from the competition of the tramways, though open to criticism, is, perhaps, on the whole, an equitable arrangement, but they consider that the adoption of such a scheme should not be regarded as finally disposing of the problem arising from the conflicting interests of the railway and tramway systems."

The Commissioners express the belief that much of the traffic lost will be regained after the suburban lines are electrified.—*Commonwealth Engineer.*

Bradford.—**TICKET BOXES.** The practice of the Tramway Department of attaching boxes for used tickets to the cars, results in the saving of 12 tons of used tickets yearly, which will save £100-£120 per year.

The Tramways Committee has decided that the tramway service of the city shall be entirely suspended on Christmas Day.

A Sub-Committee has been appointed to meet the tramway workers in connection with applications by several sections of the staff for advanced wages.

Continental.—**SPAIN.** The *Gaceta de Madrid* publishes a notice authorising the Sociedad Tranvia del Este de Madrid to undertake the construction and working of an electric tramway in Madrid from the Calle de Alcad to the Calle de Diego de León.—*Revista de la Industria Eléctrica.*

Dublin.—The Dublin Electric Tramways Co. last week inaugurated a new service between Westland Row and Fair View, linking up the Dublin and South-Eastern Railway and Great Northern Railway termini.

Halifax. The Tramways and Watch Committees have decided to make representations in the proper quarters for more light in the streets and for power to have better head lights on the cars, owing to serious nerve strain on the tramcar drivers.

The attitude of the Committees in appealing to the lighting powers for some moderation of the lighting restrictions, is endorsed throughout the cities and towns of the West Riding, where an agitation for better street lighting has recently been spreading amongst local authorities, the view being that the restrictions are excessive and cause dangers out of all proportion to the purposes of the restrictions.

Lancaster.—**ELECTRIC BUSES.**—Two Edison battery buses, each to accommodate 22 passengers, and having a speed of 12 miles an hour, have been delivered to the Corporation. The chassis of a third bus was lost at sea; all the bodies were supplied by the Brush Co.

Newcastle. As the result of a conference between the Tramways Committee and the managers of the amusement houses in the city last week, it was decided to stop all cars at 10 o'clock. It was explained that the strain upon the tramway employees had reached breaking point.

Rawtenstall.—**WAGES.** The T.C. on Thursday decided that in future there should be no war bonus for tramway employees, and in lieu thereof drivers and conductors will receive 1d. an hour more than at present and the shedmen 1d. an hour more.

TELEGRAPH and TELEPHONE NOTES.

Bolivia.—A radiographic station was inaugurated last Saturday at Viacha, which permits of wireless communication between Bolivia and Argentina. *Review of the River Plate.*

German Wireless.—It is reported that during October 300,000 words were sent over the German wireless routes to America. During the winter, improvements and enlargements of the principal stations will enable the service to be still further increased.

It is reported that a Dutch company is being formed with the support of various big shipowners for the manufacture of apparatus for wireless installations on board Dutch and other ships, with a view to being independent of the British Marconi Co. and the German Telefunken Co. *The Times.*

New Zealand.—The N.Z. Government is negotiating with the Eastern Extension Cable Co. with a view to the removal of the cable station from Wakaquaka to Wellington. The Auckland wireless station, which has been closed since May, 1915, has been reopened, and the Government has decided to erect a station at Karotonga. *T. and T. Age.*

South America.—The Western Union Telegraph Co. is making arrangements to extend its activities to South American countries, which at present are connected with the United States only through the Central and South American Telegraph Co.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—**SYDNEY.**—January 3rd. N.S.W. Railways and Tramways Department. 50-ton electric overhead travelling crane for Yarra Street power-house, Newcastle.

January 8th. Municipal Council Electric Lighting Department. 33,000-volt switchgear. E.L. Department, Town Hall. Specification 10s. 6d.

January 22nd. Electrical plant (converter, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.

QUEENSLAND.—December 12th. P.M.G.'s Department. Caps and lamps for switchboard, covered wire, benders, sleeves and tapes. See "Official Notices" to-day.

January 1st. P.M.G.'s Department. Cords, switchboard, parts and accessories, measuring instruments and telegraph instruments. See "Official Notices" to-day.

Bingley.—D.C. Electric light installation at Public Baths. The Engineer, Council Office.

Bradford.—December 5th. Motor-driven or other mechanically propelled road-sweeping machines. W. H. Inger, Superintendent to Street Cleaning Department, Harris Street.

Cape Town.—January 5th. Electric motors and starting panels, for the Corporation Electricity Department. Dock Road, Cape Town.

Durban.—January 3rd. Corporation. One 3,000-KW. steam turbine, alternator, and condensing plant. Specification No. S. 238, drawing No. P. 597, both at the office of the Borough Electrical Engineer, Municipal Buildings. Deposit £2 2s.

Enniskillen.—December 1st. Sligo, Leitrim & Northern Counties Railway Co. Twelve months' supply of telegraph materials. Mr. J. Duff, Secretary to the Company.

Grenada.—December 31st. Government. Electric supply at St. George's and suburbs. Tenders to Colonial Secretary, Grenada, British West Indies.

Johannesburg.—December 9th. Corporation. 1,127 A.C. and D.C. electricity meters and 100 time-switches. Specification (21s. deposit) from Mr. E. T. Price, General Manager's Office, Electricity Supply and Tramways Department, President Street, Johannesburg, W.*

December 20th. Corporation. Automatic pressure regulators for the A.C. turbo-generators at the power station.*

January 3rd. Corporation. Iron axles and bushes.*

London.—L.C.C. The Stores and Contracts Committee recommends that the Committee be authorised to open the tenders to be received on December 5th for the supply of electric traction glow-lamps for the Tramways Department under Schedule 17 D. The Highways Committee recommends that tenders be invited for the supply of about 3,000 yards of trolley wire for tramway purposes.

New Zealand. DUNEDIN. — January 24th. Motor-generator, accessories and spares. City Electrical Engineer, Market Street, Dunedin.*

TAURANGA. — February 12th. Borough Council. Supply of six three-phase transformers, 11,000-400 volts. H. W. Clime & Sons, Consulting Engineers, Rasthii. *N.Z. Shipping and Commerce.*

Spain.—The municipal authorities of Alberique (Province of Valencia) have just invited tenders for the concession for the electric lighting of the town during a period of five years. The electric lighting contract for a period of one year in the town of Albarda, in the same province, was also lately up for tender.

Trimdon Grange (Co. Durham).—December 3rd. Six months' supply of electric fittings. Storekeeper, Trimdon Grange Colliery.

Warrington.—December 12th. Electricity and Tramways Committee. Twelve months' supply of earthenware conduit. See "Official Notices" to-day.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Department in London

CLOSED.

Australia.—P.M.G.'s Department, N.S.W. :—

12½ miles of paper-insulated lead-covered cable, 100 pairs, £20,439. B.I. & Helsby Cables, Ltd.

P.M.G.'s Department, Victoria :—

One Wheatstone transmitter and one ditto receiver, 1467. Messrs. Nove Bros. (Sydney), Ltd.

Trades and Customs Department :—

Wireless apparatus for use of the lighthouse service, £895. Messrs. G. Weymouth Pty., Ltd.

Home Affairs Department :—

Installation of electric lighting plant at North Head quarantine station, £428. Messrs. Sutcliffe and Ashman Pty., Ltd.

Glasgow.—The Tramways Committee recommends acceptance of the following :—

Chilled brake-blocks (three months' contract).—Miller & Co., Ltd.

Glass (three months' contract).—Pilkington Bros.

Glass (six months' contract).—Chance Bros., Ltd.

Car-wheel tires (six months' contract).—Brown, Bayley's Steel Works, Ltd.

Malleable castings (six months' contract).—Alex. Shanks & Son, Ltd.

Iron and steel bars (six months' contract).—P. & W. MacLellan, Ltd.

Springs (six months' contract).—L. Sterne & Co., Ltd.

Oils (six months' contract).—John Murray & Son, Ltd.; Marks & Johnston; and J. & D. Hamilton, Ltd.

Paints (six months' contract).—Blacklock & M'Arthur; Hird, Hastie & Co.; J. S. Craig & Co., Ltd.; and Lewis Berger & Sons.

Iron and steel scrap for disposal (six months' contract).—John Jackson and Co.; P. & W. MacLellan, Ltd.; and David Smith.

London.—HAMMERSMITH.—The Electricity Committee recommends that the Main Colliery Co., Ltd., be paid the authorised increase of 2s. 6d. per ton for all deliveries subsequent to June 1st, 1916, under their contract for the supply of Welsh steam coal, with the exception of deliveries which should have taken place prior to that date; and that their contract for the supply and delivery of 150 tons weekly of Welsh coal be extended for a further 12 months from November 1st, 1916, at the price of 28s. 2½d. per ton; and that the offer of Messrs. Cory Bros. & Co. to continue the supply of 100 tons weekly for a further six months from January 1st, 1917, of Aberlwyd rough small coal, at 27s. per ton, be accepted.

Rawtenstall.—Corporation. 4,000 tons of slack for the electricity works; J. Morris & Co.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, December 2nd. At 4 Messrs. Lancaster & Tonge, The Lancaster Works, Pendleton. At 6.30 p.m., at the Royal Technical Institute, annual general meeting.

Royal Society of Arts.—Monday, December 4th. At 5 p.m. At John Street, Adelphi, W.C. Howard Lecture, "Coal and its Economic Utilisation," by Prof. J. S. Brane.

Institution of Post Office Electrical Engineers (London Central).—Monday, December 4th. At 6 p.m. At the Institution of Electrical Engineers, Victoria Embankment, W.C. Paper on "The Western Electric Co.'s Auto-Tele. System," by Mr. B. O. Anson.

Institution of Civil Engineers of Ireland.—Monday, December 4th. At 8 p.m. At 35, Dawson Street, Dublin. Ordinary meeting.

Engineers' Club.—Tuesday, December 5th. At 7.30 p.m. At Albert Square, Manchester. Debate on "The Decimal System," to be opened by Mr. E. C. Barton.

Greenock Electrical Society.—Tuesday, December 5th. At 7 p.m. Visit to Messrs. John Dunnington & Sons, Rio End Street.

Institution of Civil Engineers.—Tuesday, December 5th. At 5.30 p.m. At Great George Street, Westminster, S.W. Discussion on paper "Keady Bridge," by Mr. J. B. Ball, and paper on "Experiments on Lath Pressures," by Mr. P. M. Crosthwaite.

Rontgen Society.—Tuesday, December 5th. At 8.15 p.m. At the Institution of Electrical Engineers, Victoria Embankment, W.C. Ordinary meeting.

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday, December 6th. At 7 p.m. At the University, Edmund Street. Paper on "The Parallel Operation of Electric Power Stations," by Mr. J. S. Peck.

Chemical Society.—Thursday, November 7th. At 8 p.m. At Burlington House, Piccadilly. Ordinary scientific meeting.

NOTES.

"Safety First."—A movement is on foot to carry out a "Safety First" campaign for the London area, and a Conference will be held at Caxton Hall, Westminster, this afternoon, at 3 o'clock, to explain the objects of the campaign and to elect a Council. The notice convening the meeting is signed by Mr. H. E. Blain, operating manager of the London General Omnibus Co., Ltd., and London Underground Railways, and the main purpose of the movement is to reduce the dangers to passengers and pedestrians arising from the existing condition of traffic in the streets by organising a scheme for the education of the public and the instruction of employes.

The Marconi and Telefunken Companies.—In reply to questions in the House of Commons, on Tuesday and Wednesday last, Mr. J. A. Pease stated that the Government were satisfied that there had been no connection between the Marconi and Telefunken Companies since the war began. He had seen the agreement which existed between them before the war, and found that, as the company had stated, it solely regulated rival interests, and did not enable the Germans to obtain information which they could not otherwise secure. The operators on British ships were British subjects, and in no case of enemy parentage.

The Coal Trouble in Australia.—The *Times* states that it is now a punishable offence in Australia, for any electric undertaking or gas company, without official consent, to supply motive power to any unspecified industry. Specified industries are those connected with the public services. Coal and coke may not be used for industrial purposes except by special permit.

Sale of Enemy Holdings.—From an advertisement which appears in our pages to-day, it will be observed that the Public Trustee is inviting tenders for the purchase of 2,099 ordinary shares of £1 each in the Flottmann Engineering Co., Ltd., Cardiff, makers of Flottmann compressed-air hammer drills.

Whist Drive.—The Meter Department of Messrs. Ferranti, Ltd., Hollinwood, held a very successful whist drive and dance on Saturday, November 25th, at Copster Hall, Oldham. Mr. O. Coupe presented the prizes. Refreshments were served, and dancing was afterwards enjoyed. Mr. C. Finch conducted the drive. Mr. F. Buckley officiated as M.C., Mr. N. Collinson proved a capable pianist. The profit is to be handed over to the Soldiers' Fund.

Export Prohibitions.—A Supplement to the *Board of Trade Journal* of November 30th contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported from Norway, Portugal, Roumania, Russia, Spain, Sweden and Switzerland. This Supplement also contains a reprint of the United Kingdom Contraband List.

Fatalities.—An inquest was held at Eston, near Middlesbrough, last week, into the death of a mechanical engineer named Walker, aged 23, who met his death at the steel works of Messrs. Bolckow, Vaughan & Co., Ltd. It was stated that deceased was called to attend to the coupling on the top of the electric crane. To do so he had to get into the cabin of the crane, and he attempted to do this by stepping from the platform, as was customary, instead of getting in by the steps provided for that purpose. He hung on to a girder, but being short in stature, he was unable to reach the box. He swung his body, and the result was that his heel came into contact with a live wire, and he fell to the ground, a distance of 20 ft. Verdict: "Accidental death."

A workman was killed at the works of Messrs. Thwaites Bros., ironfounders, Bradford, on the 22nd inst. His arm came in contact with the feed arm of an electric arc furnace on which he was engaged, and he died before reaching the infirmary.

High-Temperature v. Low-Temperature Carbonisation of Coal.

The correspondence between the *Iron and Coal Trades Review*, on the one hand, and the *Electrician*, on the other, has recently been given to low-temperature carbonisation of coal, and it can in no sense be regarded as a vindication of low-temperature carbonisation plants of this or any other system. An array of figures has been put forward purporting to show that on these lines low-temperature carbonisation will solve all our fuel problems, whereas, as a matter of fact, either a Mond gas-producer plant or a coke-oven plant will produce equally good or better results. To the electrical engineers it is merely a question of getting a supply of fuel at a rate slightly less than they are compelled to pay at present. All low-temperature carbonisation plants suffer from one great drawback, viz., they have in themselves no satisfactory outlet for their gas, and hence as an alternative to wasting it, they can afford to sell it at a very low price. Carbonisation at gasworks and also at coke-oven plants is economically a success, but until conditions alter greatly, low-temperature carbonisation cannot be. At a gasworks, the revenue per ton of coal is derived approximately in the following way: From the coke, three-eighths; from the gas, a half; from the by-products, one-eighth. On a coke-oven plant, the proportions may be taken as—coke, four-fifths; gas, one thirty-fifth; by-products, six thirty-fifths, the proportion for gas being almost negligible. Now, with a low-temperature carbonisation plant, the results are not comparable with a gasworks from the point of view of revenue, because the gas cannot be sold at anything approaching the figure for town gas. If we allow—and this allowance cannot be justified as yet—a higher price for the low-temperature coke, and also a slight increase from by-products, the total increase by no means balances the decrease due to the low value of the gas. Hence, from the revenue point of view, gasworks have nothing to gain by substituting low-temperature carbonisation for their present system. Again, comparing with coke ovens, low-temperature coke has not nearly the same value as coke-oven coke; the gas is worth no more than the coke-oven gas, and it is very questionable if the by-products are worth as much as those obtained in a by-product coking plant. It will be seen, then, that the balance is against low-temperature carbonisation in this connection also. As a purely carbonising proposition, then, low-temperature carbonisation cannot compete with gasworks or coke-ovens.

Referring to the Brighton Corporation proposal, it says:—"From the point of view of the Brighton Corporation, the scheme is merely one of gas firing. The whole onus of the carbonisation side is thrown on the Coalite Co., and all that the Corporation has to do is to utilise the gas. The gas is to be a mixture of coal gas and producer gas, and will have a calorific value of approximately 300 R.H.U. per cb. ft. Approximately 40 cb. ft. are required to give the same heating value as 1 lb. of the coal. According to the calculations of Mr. Christie, the Brighton electrical engineer, at the price which the Coalite Co. offer the gas, the Corporation will obtain for 11s. 3d. the same quantity of heat as they get in a ton of coal at 20s. It is estimated that 110 cb. ft. of gas will be required per kw.-hour, and that, with an annual production of 71 million Board of Trade units, the cost of fuel per unit will be reduced from 0'321d. when using coal to 0'165d. when using gas. There is also a certain saving in other directions, as with gas-firing no labour is required for coal-handling, clinkering, &c. The only factor necessary for the complete success of the scheme is the successful operation of the Coalite plant, and this appears to be the weak link in the chain."

The Engineers' Club, Manchester.—In addition to the events announced in our last issue, the following further debates have also been arranged for [Tuesdays, at 7.30 p.m. Dinner served from 6 p.m. Price 2s. 6d.]—

- January 9th.—"The Magnets in Peace and War." Opened by Lieut.-Commander W. A. Bristow, R.N.V.R.
- January 23rd.—"The Empire's Metal and the German Octopus." Opened by T. S. Baughman.
- February 6th.—"Ethical Influences in Great Britain and their Effect." Opened by Stafford Ran-cune, Secretary, the British Engineers' Association.
- February 20th.—"The Engineers' Club: What It Is, and What It Might Be." Opened by E. Imbuhl L. Hill.
- March 6th.—"Engineering and Imperial Production." Opened by T. C. Elder.
- March 20th.—"German Banking." Opened by J. Drummond Paton.

The Edison Battery.—According to reports from America, the Edison Battery Co. is at work on an improved form of its nickel-iron-alkali accumulator, which, while being on the same lines, generally speaking, will have the advantage of a higher voltage per cell.

Electric Vehicle Committee.—At the last meeting, Mr. E. S. Shrapnell-Smith presiding, Mr. J. A. Priestley, representing the Institute of Cleansing Superintendents, took his seat for the first time.

In the course of an interesting discussion, Mr. Harrison, borough engineer of Southwark, explained why he had reported recently against the use of electric vehicles for certain work for which he proposed using motor traction. This was owing to there being no electric vehicle on the market which complied with the requirement that the loading rail of the body should not be higher than 4 ft. 6 in. above the road level. The particular purpose in view was the quick and easy removal of street sweepings from the depths or stauls in the streets where they are collected, and the collection of house refuse.

In connection with the provision of charging facilities on the route from London to Birmingham, correspondence was read from the electric supply department of the City of Coventry, setting forth that they were unable to give any facilities for charging, and from the manager of the Northampton Electric Light and Power Co., promising to afford every possible facility for charging vehicles, and stating that when the amount of business warrants it they will consider putting down a proper charging plant. They have decided to adopt the E.V.C. standard tariff.

The secretary was instructed to lay before the Ministry of Munitions the views of the Committee as to permission being granted to British electric vehicle manufacturers to continue manufacturing electric vehicles for commercial purposes.

It was decided to invite the Institute of Automobile Engineers and the British Rubber Tyre Manufacturers Association to nominate a representative upon the Committee; it was also decided that the official designation of the Committee in future should be: "The Electric Vehicle Committee of Great Britain, formed under the auspices of the Incorporated Municipal Electrical Association."

A communication was received from the Anderson Electric Car Co., of Detroit, stating that they were arranging to fit the E.V.C. standard plug to all electric vehicles exported to Great Britain and France.

It was decided to recommend to the Accumulator Section of the B.E.A.M.A. that in the case of lead-plate batteries on electric vehicles, the upper and lower limits of sp.g. should be clearly marked in raised or moulded letters on the battery.

Linking-up Electricity Stations.—An important meeting was held on November 21st last at the South Wales Institute of Engineers, Cardiff, of representatives of the electricity supply undertakings in the district in order to form a Local Committee for South Wales and Monmouthshire, and to consider with regard to linking-up existing electric power stations, in the national interest. The meeting was convened by Mr. W. A. Chamen, of Cardiff, chairman of the Joint Committee dealing with this subject. It was resolved that the Committee should consist of all the representatives invited to the meeting. Mr. Arthur Ellis, Cardiff, was elected chairman and Mr. Lewis W. Dixon, Merthyr, vice-chairman and hon. secretary, and the following gentlemen were elected members of a Sub-Committee:—Mr. W. A. Chamen (South Wales Power Distribution Co.), Mr. William Burr (Swansea), Mr. A. Nichols Moore (Newport), Mr. G. H. Thomson (Neath), Mr. J. E. Teasdale (Pontypridd), Mr. J. M. Bowman (Porth) and Mr. J. C. Howell (Llanelli). The secretary was instructed to obtain necessary information, &c., and to arrange a meeting of the Sub-Committee as soon as the information is obtained, in order to consider further steps.

Electrolytic Zinc.—The first of five sections, composing the new zinc refinery of the Anaconda Copper Mining Co., at Great Falls, Montana, was placed in operation on September 11th. The first stripping of the plates netted 25 tons of zinc that was sent to furnaces at Anaconda for transforming into the commercial article. The two new 50-ton furnaces that are to handle the output at Great Falls are being constructed and, according to the *New York Engineering and Mining Journal*, would be ready for operation about October 1st. By that time it was also expected that two additional units would be operating at the refinery, and by November 1st the entire plant, with a capacity of 5,000,000 lb. to 6,000,000 lb. of high-grade zinc per month, should be in operation.

The first week's trial of the new plant proved most satisfactory. The zinc is brought in concentrates from the new concentrator at Anaconda. On arrival at Great Falls it is taken first to the roaster, where it is changed into calces. This fine powder carries, in addition to zinc, copper, lead, silver and gold. It is next distributed to leaching tanks having a depth of 20 ft. and a diameter of 10 ft. In these it is agitated in acid solution by compressed air forced in from below. After agitation the pulp passes into Dorr thickeners, where the lighter solution containing most of the zinc is drawn off and filtered, the pregnant solution being pumped into storage tanks in the refinery proper, and sent from there to the electrolytic tanks. These are arranged end to end with six tanks in each battery, the solution cascading from tank to tank. Each tank is 5 ft. long, 3 ft. wide and 3 ft. deep, and contains 28 lead anodes and 27 cathodes consisting of aluminium plates, upon which the zinc forms. The zinc is 99.9 per cent. pure.

Ground for the new plant was broken on January 1st of this year, and close on \$3,000,000 has been expended in the construction and equipment of this department. The aluminium cathodes for the electrolytic tanks alone represent an investment of nearly \$500,000. Each one contains 14 lb. of aluminium and 16 lb. of copper, and there are 20,000 of these in the five sections of the new plant. The copper metal for each cathode is worth between \$4 and \$5. In addition, there is the expense of manufacture. The plant will use 33,000 H.P. when it is operating at capacity. This power will come from the Rainbow and Big Falls plants of the Montana Power Co., situated within 10 miles of the new refinery. The concentrator at Anaconda is completed, and there will be no lack of zinc concentrates for the new refinery as soon as the additional units are put into operation. By November 1st it was estimated that fully 2,000 tons of zinc ores per day would be used for this new department. —*Financial Times*.

Copper Prices.—THE WEEK'S CHANGES.—Messrs. F. Smith & Co. report, Wednesday, November 29th:—Electrolytic bars rose from £160 to £167; ditto sheets, from £178 to £185; ditto rods, from £169 to £176; ditto H.C. wire, from 1s. 8d. to 1s. 8½d.; silicon bronze wire, from 1s. 10½d. to 1s. 11½d.

Messrs. James & Shakespeare report, Wednesday, November 29th:—Copper bars (best selected), sheets and rods rose from £178 to £187.

Inquiries.—Makers of the "Rox" electric brush and "Barker" electric hair drier, of ball and socket insulating beads, and of a wrist light, complete with battery and lamp (for ambulance purposes), are asked for.

Legal.—WINN v. CLARK.—In the City of London Court, on Monday, before Mr. E. B. Tattershall, the Assistant Registrar, Mr. Edward Winn, of Cophall House, E.C., sued Mr. John H. Clark, of 144-146, Bethnal Green Road, for £17 6s. 9d. for electrical work done and material supplied at his place of business. Instructions for the work were given by the defendant to the plaintiff's foreman, and an estimate was given amounting to £8 15s., but during the carrying-out of the work the defendant gave orders for extra work and alterations outside the items of the estimate, which necessitated extra labour, time and materials. This increased the original quotation from the £8 15s. to the amount now claimed. The case had been before the Judge, and the defendant was found liable, and the question of the amount had been referred to the Assistant Registrar to ascertain what was due to the plaintiff. After hearing the evidence, the Assistant Registrar said he thought the work was properly done, and he could find no objection to the charges for material, but with regard to the hours of labour and the evidence as to the fair number of hours, he was disposed to think 100 hours sufficient, instead of the 140 charged, and he would find for the plaintiff for that time. He must therefore submit to a deduction of £2 10s. for the overcharge of 40 hours. Judgment for the plaintiff for £14 16s., and costs.

LOWE v. BLUNDELL.—In the Court of Appeal, November 28th, before Lords Justice Swinfen Eady and Banks, and Mr. Justice Lawrence, this case was down for hearing, on the application of defendant for judgment or new trial, on appeal from verdict and judgment at trial before Mr. Justice Ridley and a special jury in March last.

The matter was mentioned to the Court on November 17th, when, on a suggestion of the Court, the appeal stood over with a view to settlement.

Mr. Parfitt, K.C., now said that since the adjournment of 10 days granted, the parties had had an opportunity of considering the figures which their Lordships had kindly helped them with, and the matter had now been settled in terms endorsed on counsel's brief. The only order he asked for was for payment out to the respondent Lowe of £350, which was part of the £1,000 paid into Court, and the balance to be paid out to the appellant, Mr. Weld Blundell himself.

Lord Justice Swinfen Eady: Out of the money in Court pay £350 to the plaintiff, and the balance of £1,000 to the defendant; no other order.

Mr. Parfitt: Yes.

Mr. Coles Preddy said he appeared on behalf of Mr. Lowe, who was grateful to their Lordships for their suggestion of a sum, which he felt he ought to act upon. He had no desire to make money, but to vindicate his honour, which he hoped he had done by the verdict of the jury.

Lord Justice Swinfen Eady, in assenting, said it was a wise settlement on both sides.

Central-Station Men and Military Service.—At the Swindon Tribunal, S. Bowler (29), single, stoker; Frederick Newey (22), married, electrical engineer; George Frederick Lane (22), single, electrical engineer; and H. E. Grimes (22), single, electrical engineer, were appealed for by Mr. A. Dimmack, manager of the Corporation electricity works. He said he could not spare any of them. He had to keep the undertaking going, and it would be impossible to do so if they took these men away. They had to run the electricity works for 24 hours a day and for seven days a week. His proposal was that the Army should provide substitutes who had already been in the electrical trade, and as these men became efficient the others would be released. Mrs. Whitworth said that women were filling these posts in London. Mr. Dimmack stated that in stations where women were employed they would find that there were shift engineers. The Swindon station had never been over-staffed as compared with other stations. They could not leave women in charge of a station by themselves. Mr. Harding said that according to the Government instructions issued to Tribunals the previous week these men were exempted. Mr. Dimmack offered to release Grimes and Lane if substitutes were given.

The cases were adjourned for a month and referred to the Substitution Officer.

Appointments Vacant.—Applications for the post of shift engineer for Reigate should be sent in by Wednesday, December 13th, not 12th, as incorrectly printed by us in the advertisement of last week.

Boiler house shift engineer (£150), for the City of Birmingham electricity supply department; junior assistant engineer (38s.), and switchboard attendant, for the Borough of Wimbledon electricity department. See our advertisement pages to-day.

Electrochemical Industries for South Africa.—The report of a Committee of the South African Institute of Electrical Engineers (Inc.) on the possibilities of manufacturing in South Africa, by the aid of electrical power, several products of commercial importance which are necessary for the agricultural and mining industries, which was abstracted in our issue of March 24th, may now be consulted by British firms interested at the Offices of the Department of Commercial Intelligence of the Board of Trade.

The Decimal System.—The Holborn Borough Council, on November 22nd, unanimously adopted a resolution that it was not only desirable, but essential, to adopt a decimal system of

coinage, weights, and measures throughout the British Isles, to enable our manufacturers and merchants to compete more easily and successfully with rival nations.—*The Times*.

In October a recommendation of the Finance Committee of the Stepney Borough Council, that the Government be urged to take immediate steps to adopt the decimal system, was adopted by the Council, and similar recommendations were made to the Deptford, Hammersmith, Fulham and other Borough Councils.

The Bradford Chamber of Commerce received a letter from the Clayton District Council enclosing a resolution in favour of the adoption of the decimal system, and on October 31st discussed the subject; no resolution was put forward, but several members strongly advocated the adoption of the system on the ground that our present units hindered the development of our foreign trade, some firms abroad declining to do business with British firms unless they adopted the decimal system.

The Council of the Association of Chambers of Commerce will consider at the next meeting the question of the adoption of the metric system of weights and measures and the decimal system of coinage.—*The Times*.

As announced in our last issue, a debate will be held at the Engineers' Club, Manchester, on the evening of Tuesday, December 5th, at 7.30 p.m., on "The Decimal System," at which many members of the recently-formed Manchester and District Decimal Association will be present. The debate will be opened by Mr. Edward C. Barton, M.I.E.E., formerly chief engineer to the Brisbane City Council, Australia, who has made a special study of decimal coinage and the metric system.

Parliamentary.—Wimbleton Corporation seeks powers to supply electricity in the Parish of Cuddington.

Ripon Corporation seeks powers to supply electricity within the City of Ripon and parts of the rural districts of Ripon and Knaresborough.

The Ebbw Vale U.D.C. is applying for a Bill for various powers, including further powers in regard to the supply of electricity.

Blackpool Corporation is applying for powers to supply electricity in certain parts of Carleton and Marton, which it is sought to include within the borough.

Sheffield Corporation seeks powers to appropriate lands for erection of new generating station, construct electric lines, &c.

Ashton-under-Lyne Corporation seeks powers to purchase tramways authorised by the Oldham, Ashton-under-Lyne, Hyde and District Electric Tramways Order of 1896.

The Electrical Distribution of Yorkshire, Ltd., seeks supply powers for Garforth, Featherstone, Luddenden Foot, and Horbury.

The Smithfield Co.'s Employees.—At the City of London Tribunal, on Tuesday, November 28th, the Smithfield Markets Electric Supply, Ltd., appealed on behalf of the following 15 men:—J. Anthony (29), married, wireman's mate; W. H. Allemande, shift engineer (22), single; J. I. Biggam, shift engineer (29), single; E. A. Copelin, driver (26), married; W. H. Harper, shift engineer (34), married; F. H. Tutt, foreman and meter reader (25), single; T. F. Austin, installation and fuse attendant (36), married; T. G. Deller, assistant driver (40), single; H. J. Lazenbury, driver (39), married; P. F. Roberts, shift engineer (27); J. Richardson, wireman's mate (27), married; C. E. J. Stevens, wireman (29), married; E. W. Warren (33), married; S. Hidson (36), married; and A. E. Fyears. Mr. Powell, the secretary of the company, appeared in support of the applications. It will be remembered that when the case was last before the Tribunal, it was stated that there had been a fire on the company's premises, and this had thrown the whole thing into confusion. The station had been wrecked, and the men were appealed for because they were engaged on work of public utility, every man being absolutely necessary for the carrying-on of the business. The claim on behalf of H. J. Lazenbury was now withdrawn, as he had been rejected by the Navy, and that on behalf of Fyears was also withdrawn, as he was now over military age. The Tribunal decided to postpone Anthony, Allemande, Biggam, and Copelin to January 1st, and then serve: Tutt to January 30th, and serve; and Harper, Austin, Deller, Roberts, Richardson, Stevens, Warren, and Hidson to March 8th, with the right to renew. All the postponements were subject to the V.T.C. condition.

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Euston Place.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, December 4th.—Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10. Signalling Class. Recruits' Drill, 6.25–8. Lecture, "On Telephones," 7.30.

Tuesday, December 5th.—School of Arms, 6–7. Lecture, 7.15, "The Service of Protection," Company Commander Hynam.

Wednesday, December 6th.—Instructional Class, 6.15. Platoon Drill, Platoon No. 2.

Thursday, December 7th.—Platoon Drill, Platoon No. 7. Ambulance Class by M.O., 6.

Friday, December 8th.—Technical for Platoon No. 10, Regency Street. Squad and Platoon Drill, No. 9. Signalling Class. Recruits' Drill, 6.25–8.25. Lecture, "On Telephones," 7.30.

Saturday, December 9th.—Inspection by General Sir Desmond O'Callaghan, at 3, in Hyde Park.

Sunday, December 10th.—Entrenching at Otford. Parade at Victoria (S.E. & C. Railway Booking-office), 8.45 a.m.

Corps Supper.—A Corps Supper will be held at the Queen's Hotel, Leicester Square, on December 8th, at 7.

(By order) MACLEOD YEARSLLEY, Adjutant.

Institution and Lecture Notes.—University College, London. Prof. J. A. Fleming commenced his fifth lecture on "The Duddell Telephone" on Friday last with a demonstration of the effect of forcing upon the current sent into a 14-mile 14-lb. cable, the current received at the far end. Artificial cables were employed, and it was shown that on switching over from an unloaded to a loaded cable, the current at the sending end diminished, and the received current very greatly increased. The high-frequency alternator used for the experiment did not yield a pure sine wave, but Prof. Fleming showed that the undesired components of the wave could be "filtered out" by connecting resonating circuits in shunt to the terminals, each such circuit containing a capacity and an inductance in series, such that the frequency with which it would resonate equaled $1/2\pi \sqrt{LC}$. By winding coils upon the inductance coils, as in a transformer, pure sinusoidal currents corresponding to the resonating harmonics could be obtained having, for instance, frequencies of 1,000, 3,000, or 5,000 cycles per second respectively. For the study of these high-frequency waves the Duddell oscillograph was not suitable, as its natural frequency of vibration was not sufficiently great—it should be 10 times that of the wave under examination. The Braun kathode-ray oscillograph was free from this objection, but the trace obtained was not sharp enough. However, a rough practical test could be made with a condenser, voltmeter and ammeter; connecting these with the alternator, if no harmonics were present, the current would be $2\pi \times 50 \times 10^{-3} \times 10 \times 10^{-6} \times 2\pi = 6.28$; if, however, harmonics were present, the latter ratio would always be greater than 6.28, possibly two or three times as great. For a true sine wave it was best to use a special machine, such as that designed by Mr. Duddell.

The measurement of the small alternating currents employed in telephony necessitated the construction of special instruments, usually dependent upon thermal effects. The lecturer described such instruments which he had devised, including one using his oscillation valve. For determining phase difference between current and voltage the Francke machine was described, as well as the Drysdale A.C. potentiometer with phase-shifting device. Methods of measuring small capacities were also explained. Remarkingly, in connection with the measurement of s/c, that the Post Office engineers had discovered that gutta-percha conducted alternating currents better than direct current. Prof. Fleming described a special capacity bridge which he and his late assistant, Mr. G. B. Dyke (killed on active service), had developed for the investigation of this effect, and showed the importance of the phenomenon in the cases of dry manila paper, gutta-percha, and vulcanised rubber, all of which varied widely in conductivity for high-frequency alternating currents with the frequency and the temperature. For ordinary g.p. s/c = 100 or 120; for Siemens special g.p. = 20 or 12. The value of $1/c$ could be measured with the Hughes bridge, which the lecturer explained in detail.

Smoke Prevention.—Lecturing at the Leeds Luncheon Club on Monday, last week, on "A Smokeless Leeds, with £500,000 a Year Profit," Dr. S. F. Dufton, H.M. Inspector of Schools in the West Riding, said the normal coal consumption in the city in a year, in the gas works, electricity works, and households—but not including the bulk used in factories and workshops—was nearly 850,000 tons. Of this amount 50,000 tons was burnt "raw" in the furnaces at the municipal electricity works, wasting enormous quantities of valuable by-product, in addition to pouring out volumes of harmful smoke. He urged the distillation of all coal before burning it. Everything at the present time combined to make the immediate adoption of the reform practicable, and it would effect a saving throughout the country of a hundred million pounds a year. For the future no gas or electricity profits should go in reduction of rates, but should all be applied to the reduction of capital charges and reduction to consumers of the cost of light and power, the life-blood of industry.

Junior Institution of Engineers.—On Monday, December 11th, Mr. F. W. Lanchester will deliver his presidential address on "Industrial Engineering: Present Position and Post-War Outlook." The Marquis of G. aham, the retiring President, will take the chair.

Association of Electrical Station Engineers.—The address of this Association has this week been changed to 26, Little Park Gardens, Enfield.

Society of Engineers.—On Monday, December 11th, two papers will be read on the mineral resources of the United Kingdom and of the Empire, by Prof. W. G. Fearnside and Prof. C. G. Cullis respectively.

Science and Industry.—At Leicester, recently, Professor G. Kapp gave a lecture on electrical engineering before the Literary and Philosophical Society, one of a course of three lectures on "Science and Industry" that has been organised by the Society. He stated that in England electrical engineering was not lagging behind other nations, and in some respects was ahead of Germany. He had just examined a new process for the manufacture of nitrates from the air, which gave great promise.

Royal Society of Arts.—On Wednesday last Dr. Dugald Clerk read a paper on the internal combustion engine, in which he reviewed the development of this motor, and showed how prominent a part had been played by British inventors.

Sir Charles Parsons drew attention to the universal use of this type of engine for small powers to-day, and the importance of its educational influence upon the public in mechanics and engineering. He mentioned that Dr. Clerk, in the very near future, would assume a very important Government position in connection with developments in this country.

"Electricity on the Farm" Campaign.—According to the *Electrical World*, a systematic co-operative campaign to place electricity on every farm in the United States is now being launched by the Western Electric Co. In the past much of the farm business has not been transacted through the central station, contractor, or electrical dealer, and it is emphasised that this is an effort to market equipment through recognised electrical channels. At the outset a big advertising campaign is to be undertaken with 21 farm papers reaching 34 million subscribers each month; these are intended to bring requests for a "Farmers' Electrical Handbook," thus furnishing a clue to prospective business, which will be notified to the local trade, and if necessary the company will itself endeavour to get the business. The handbook is both a catalogue and working treatise of the subject. The company, while pushing its farm-lighting set, urges preference for central-station service, if available, and the advisability of consulting the nearest lighting authority in any case. The independent lighting set is rated at 32 volts, but only 110-volt fittings, wiring, &c., are supplied, so that the farm can take the central-station service when available, only the 32-volt appliances needing to be replaced.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—West Ham Corporation has decided that in consideration of the extra responsibility placed upon Mr. HOPKINS, the chief assistant of the tramways, during the change of managers, he be paid a gratuity of £20.

Mr. G. H. DYER, late of London, has been appointed mains assistant at the Dover Corporation electricity works.

General.—The *Commonwealth Engineer* states that Mr. F. COLIDGE, formerly assistant electrical engineer in the Commonwealth Postmaster-General's Department, New South Wales, has been appointed electrical engineer for Victoria, in succession to Mr. A. A. DIRKS, who has become electrical engineer of New South Wales. Mr. F. FAIRLEY, formerly connected with the electrification scheme of the Victorian railways department, has been appointed senior engineer assistant in connection with the electrical department of the Melbourne City Council. Mr. J. Y. NELSON, formerly electrical engineer for New South Wales in the postal service, was presented with a tea and coffee service and silver salver by the staff on the occasion of his retirement after 49 years of service.

Ald. JAMES HEALD, of the firm of Messrs. Calvert & Heald, electrical engineers, &c., has been re-elected Chairman of the Lancaster Corporation Electricity Committee.

Hammersmith B.C. Electricity Committee has appointed Ald. JOHNSON Chairman, and Coun. CHAMBERLAIN Vice-Chairman, of the Committee for the current municipal year.

Roll of Honour.—Sapper W. HEASMAN, R.E., of Maidenhead, has won the Military Cross. He was on the Reserve when war broke out, in the employ of the Telephone Section of the G.P.O. The award was for special and dangerous work in connection with the laying of telephone cables.

We are pleased to record the conferment of the Victoria Cross upon a former employee of the Western Electric Co., Ltd., Woolwich—Private F. J. EDWARDS, of the Middlesex Regiment, who, at a critical moment when his part of the line was held up by machine-gun fire, all the officers had been put out of action, and retirement was imminent, on his own initiative dashed out alone and knocked out the machine gun with bombs. This gallant act, at the greatest personal risk, saved the situation. He joined the Army shortly after the outbreak of war, and is 21 years of age.

Sergeant W. C. STEVENS, Loyal North Lancashire Regiment, who enlisted early in the war whilst with Messrs. Dick, Kerr & Co., Ltd., of Preston, has been killed in action.

Private ERNEST HALL, Scottish Rifles, who is reported killed, after being missing since July 16th last, was an employee of Messrs. Dick, Kerr & Co., Ltd., Preston.

Private A. CAWTHRA, West Riding Regiment, formerly employed in the Bradford Post Office telephone department, has been killed at the front.

Sapper ERNEST HOWLETT, Royal Engineers, reported to be missing, was with Messrs. Siemens, of Stafford.

Temporary-Lieutenant F. A. ROBINSON, who was in the electrical department of the India-Rubber Co., Silvertown, has been awarded the Military Cross for having, as a "Tank" officer, displayed great gallantry. After tremendous fighting, his Tank became "ditched," and he and his crew dug for 14 hours under heavy fire until they eventually got the monster out and returned with it to the assembling point. Lieutenant Robinson had previously done fine work of the same character at another point. On that occasion his Tank was hit by a direct-shell and damaged, but he got his men out safely and

The annual meeting was held on November 22nd at the offices, 123-125, Queen Victoria Street, E.C. Mr. C. J. FORT, who presided, said that the figures in the balance sheet ran into much larger amounts than last year, and he believed that the turnover had never been on such an extensive scale since the company started business. Sundry creditors and credit balances had increased from £90,0 to £125,000. Stocks showed an increase of from £211,000 to £272,000, and amounts due from sundry debtors from £81,000 to £103,000. They had expended about £16,000 on buildings, plant, and machinery, and after providing for depreciation at the usual rates the net increase under those headings amounted to £7,293. The net profit on trading account had increased from £56,000 to £65,000, whilst the general

expenses showed a reduction of £2,700. The profit earned for the year was £24,000, which they trusted they would consider under all the circumstances satisfactory. The engineering side of the works had been somewhat adversely affected by Government work at moderately remunerative prices. The lamp side of the works had been fully employed so far as restricted labour conditions had permitted, and the sale of lamps had been largely increased. It was pointed out last year that the prices of lamps had remained the same as they were previous to the war, and had it not been for the increased cost of labour and raw materials, which might be safely put at between 30 and 40 per cent., the company had done very well indeed in this department, and the profits would have shown a still further improvement. It was only necessary to study the balance sheet a little in order to become aware of the fact that the company was practically in a position to further capital. He had referred to that question at previous meetings, but as the trade increased that shortage of capital naturally became more acute, and the time had now arrived when the board felt that the most serious effort must be made to provide further funds. For this reason, it was much to be regretted that it had been impossible to recommend the payment of a dividend, as, although there was a profit of £24,000, they had had to employ £16,000 of it in additional plant and machinery to cope with the increased business. If, on the other hand, they had further adequate working capital, it would no doubt be possible to distribute a proper portion to the shareholders in the shape of dividends. For that reason they recommended the transference to reserve of £25,000, bringing that up to £100,000, and carrying forward £4,000. The board had been very seriously considering the question of further capital, and had taken an opportunity of consulting some of the largest share and debenture stockholders with reference thereto. They were, of course, aware that there was a sum of £2 per share uncalled upon 99,000 ordinary shares, and the usual course for a company with that amount of uncalled capital would be to call up the necessary amount required. That, however, was denied to them, as the amount in question was pledged to the debenture stockholders as part of their security, and could not be called up without their consent. Undoubtedly that uncalled liability had a very prejudicial effect upon the price of the shares, as otherwise there was, to his mind, no reason whatever why, with the improved prospects of the company and its profit-earning capabilities, they should not stand at a higher price, and that reflected itself in great measure undoubtedly upon the price in the market of the debenture stocks. The board were in a difficult position, standing as they did between the debenture stockholders and the shareholders, who had divergent interests, and any scheme for the raising of further capital had to be framed to meet the views of both parties, which was not easy. However, amongst many suggestions, a scheme had been discussed with leading representatives of both those interests, and he was pleased to be able to inform them that there was now a fair chance of arriving at a solution of the difficulty, and, although he could not pledge himself that it would finally assume the exact form he was about to refer to, he trusted they would be able to achieve something on the following lines: That £100,000 7 per cent. preference shares be issued, participating in further profits up to a further 3 per cent. after the ordinary shareholders had received a dividend, the rate of which had not yet been decided upon. The board felt that in any scheme for the provision of further capital, strenuous endeavours should be made to deal with the liability upon the ordinary shares, and it had been proposed that this should be met in the following way:—They to offer to the existing shareholders the right to subscribe for £1 of preference shares in respect of each ordinary share held by them, and if they accepted that offer the debenture stockholders would be asked simultaneously to agree to the cancellation of the £2 liability in respect of such shares held by those parties who availed themselves of the option; shareholders who did not so avail themselves of this option would be left as they were to-day, with the liability. In effect, it amounted to this, that for the payment of £1 per share, for which a shareholder would receive a participating preference share, he would wipe out the other £1 of liability, and it was thought that a large number of shareholders would avail themselves of that opportunity. As a recompense to the debenture stockholders for this concession, it was suggested that the two classes of debenture stocks should be amalgamated into one class, and that the interest thereon be fixed all round at 5 per cent. per annum; to-day the first debenture stock, amounting to £307,000, bore interest at 4 per cent., and the second debenture stock, amounting to £97,000, at 5 per cent. That would throw an additional burden by way of interest upon the company amounting to £3,000 per annum, but, under the circumstances, he thought it was entirely warranted. Further, it was suggested that after the payment of the preference dividend up to 7 per cent., a percentage of the available profits remaining should go to a sinking fund for redemption of debenture stock, and the balance would be therefore available for dividend upon the ordinary shares. In the opinion of the board, apart from the profits which the proposed new capital should earn, the additional money would enable the company to enter into far more advantageous contracts for the purchase of raw materials and other goods than had been possible for some time past, which naturally would go to increase the profits.

Those were the general lines of the scheme which they had been considering, and he was hopeful that they would be able to carry it, and if the consent of the debenture stockholders could be obtained, he thought they would agree that it was obviously in the interests of the shareholders to support it. They had come to this position in the affairs of the company, that unless means could be found to enable them to go forward, they must inevitably go backward, and he was hopeful that after the cessation of hostilities restrictions would be put upon the free import into this country of electrical goods at the ruinous cut-prices which had hitherto prevailed, and that, with adequate working capital, they would be able to do a largely increased profitable business, particularly on the export side. To-day they could, had they the money, largely increase the sales in Australia, South Africa, and India. They had during the past two years greatly extended their operations in those countries, and were building up a good business there, and it was there they were looking to the employment of part of the additional capital they were endeavouring to obtain. There was one other point to which he desired to refer, and that was with regard to the denomination of the present £5 shares. A £5 share to-day was somewhat unwieldy, and it had been suggested to the board by members of the Stock Exchange that if they were split into shares of £1 each, they would be far more marketable, and with this he (the chairman) entirely agreed, and the board were proposing to deal with this matter. Of course, the partly-paid £5 shares, that was, any shares upon which the liability was not cancelled in the manner he had before referred to, should their scheme go through, would be 12s. paid, with a liability of 8s. thereon.

Mr. ELIJAH-CLARKE seconded the motion.

Mr. RAYMENT said that as an old shareholder, who in the past had frequently criticised the policy of the board, he would like to express his hearty congratulations to the present chairman on the very marked improvement in the company's position. He thought Mr. Ford had more than warranted the confidence of the shareholders, and they were very fortunate in having him at the head of their affairs. As shareholders, however, they were keenly disappointed that it had again been necessary to allocate all the profits to reserve. He did not question the wisdom or the necessity of that course, but when it was remembered that since 1906 nearly £96,000 of profit had been dealt with in that way it made one think that there was not even a remote chance of the ordinary shareholders ever getting a dividend.

The CHAIRMAN, in reply, said that the object of the scheme which he had outlined for obtaining further capital was in order that the profits in future might be divided among the shareholders. It would not be possible to put the profits to reserve and ear-mark them because the debenture holders had got a charge upon the whole of the assets. When he became chairman they had a so-called reserve fund of £40,000, which had been created by showing profits in the past which really never existed; and the whole of that had been written off. They must only look at the reserve which they had really created since then, which to-day stood at £40,000.

The report was then adopted.

Société Française des Câbles Télégraphiques.

The report of the directors states that notwithstanding the increase in the receipts in the trans-Atlantic service in 1914, the results obtained in 1915 exceeded those in the previous year by 5 per cent., despite the absence of normal conditions in the lines, especially in the first half of the year. Several ruptures took place in the trans-Atlantic cables, and the interruption was simultaneous on both conductors for several weeks owing to the difficulty of carrying out repairs, particularly those of breakages localised at depths of 4,700 metres, which had to be postponed until fine weather prevailed. On the other hand, the company had assured the transmission free of charge of the official telegrams of the French and United States Governments, without, however, raising the rates for the paying traffic. In the case of the network in the West Indies the receipts experienced a growth of 28 per cent. over 1914, and the revenue in the republic of Dominica was also considerably higher. The land lines in the latter republic suffered less from interruptions than in 1914 in harmony with the less troubled political situation in that country, whilst the new cable laid between St. Domingo and Porto Rico assured communication between the capital and other countries. Since the establishment of the latter cable, which had permitted of the opening of a new route between St. Domingo and Pto. Plata via Porto Rico, the company's difficulties in Venezuela had ceased, and the situation there had become regular. The working of the cable between Australia and New Caledonia was normal throughout the year, and the receipts increased as compared with 1914, when the cable was interrupted for three months and a half. The subsidies and guarantees received amounted to £25,800, as compared with £25,000 in the preceding year. In 1914 the States of Queensland and New South Wales reduced their subsidy in consequence of the cable between Australia and New Caledonia having been interrupted for a period exceeding 30 days, which was the term fixed by agreement as the maximum duration of any stoppage. Since then, however, and thanks to the intervention of the French Government, those States had admitted that the delay in effecting the repairs was due

to a case of *force majeure*, and had agreed to pay that part of the subsidy which had been withheld. The subsidy of Dutch Guyana continued to be paid, whilst the litigation concerning the subsidies of French Guyana, the Martinique, and the Guadeloupe was now being settled with the Minister for the Colonies. The accounts show net profits amounting to £134,000, and a dividend at the rate of 4 per cent., or 8s. per share, had been declared on the ordinary capital of £537,000, being the same rate as in 1914. It has also been possible to apply £71,000 towards the reduction of interest guarantees on advances made by the Government, which totalled £136,000 at the end of 1914.

Allgemeine Elektricitäts Gesellschaft.

The report of the directors for 1915-16 states that the increase in the share capital which was sanctioned in September, 1915, had been carried out, and the ordinary capital been advanced by £1,450,000 to £9,200,000 by the exchange of new shares of £1,308,750 for shares of £1,738,000 in the Berlin Electricity Works Co., whilst the balance of £146,250 was subscribed in cash, the premium realised having partly served to defray the cost of the issue. The company also in the past year placed its plant, which had been adapted to war purposes, at disposal to a considerable extent for armament works, although the situation still prevented any details from being announced. Nevertheless, the provisional transformation of the production had rendered its necessary already in 1915-16 to take into account the extraordinary expenditure, which was required for the resumption of peace manufactures and fresh competition. As a consequence, the valuation of the plant and stocks, and of property abroad, whether securities, investments, or credit, had been so entered that disadvantages could scarcely arise therefrom. The business in manufactures for peace purposes, although frequently hindered through Government commandeering, had received a new impetus in connection with the war requirements, large orders having been booked specially for the heavy industries. The branch for private installations and connections was active and profitable, but was rendered difficult owing to the lack of labour. The turnover in glow lamps, meters, and heating apparatus at home and abroad exceeded that which obtained in the previous year. Zinc and aluminium windings were introduced for machines and transformers, and suitable substitutes were provided for copper and rubber in the case of insulated wires. The accounts for the past three years show the following figures:—

	1913-14.	1914-15.	1915-16.
Ordinary share capital ...	£ 7,750,000	£ 7,750,000	£ 9,200,000
Loans	—	5,364,000	5,320,000
Gross profits	1,132,000	1,544,000	1,987,000
General expenses	73,000	72,000	91,000
War grants to employees ...	—	230,000	377,000
Depreciation	44,000	44,000	45,000
Net profits and balance forward	944,000	1,064,000	1,359,000
Bonuses	60,000	75,000	100,000
Pension fund	50,000	75,000	100,000
War benevolence	—	—	75,000
Dividend	775,000	852,500	1,017,000
... per cent.	10	11	12

The report proceeds to state that the central station department was able to hand over in working order the Zschornowitz power station to the Elektro-Werke Co. last December, whilst an extension order was received for four turbo-dynamos each of 22,500 kw., together with boilers and other equipment, for the supply of power to the Elektro-Nitrum Co. An order for a turbo-dynamo of 20,000 kw. and converters of 1,800 and 1,500 kw. was booked for the City of Berlin, and one for a turbo-generator of 21,000 kw. for the Silesian Electricity Co. In addition, a contract was obtained from the Rhenish-Westphalian Electricity Works Co. for two complete steam turbine sets and condensers, each for an output of 50,000 kw., as well as for a generator for 60,000 kw., and two transformers for a pressure of 100,000 volts and an output of 60,000 kw., and two turbo-generators and condensers each of 14,000 kw. It is submitted that these orders are of special importance because they indicate that the war has not arrested the further development of the industry on the one hand, and, on the other, that the erection of power stations has been placed on a new footing. Dealing with the railway department, the report mentions that the works for the A.E.G. high-speed railway were advanced, and the tunnel under the Spree was approaching completion. The electricity works closely associated with the company yielded in general better results than in 1914-15; the works at Jassy had been under compulsory management since the declaration of war on Roumania. In the case of the Berlin Electricity Works Co., whose Berlin undertaking was acquired by the Municipal Council in October, 1915, the chief scope of activity was now devoted to the development of the company's other works, including those in the lignite districts of Bitterfeld, where, however, working and production were unfavourably influenced by the conditions of the times.

The accounts purport to show that the credit at the bankers, which totalled £4,531,000 in 1914-15, now amounts to £6,785,000, and the investments are entered at £2,819,000, as compared with £2,843,000 in the previous year; whilst the reserve fund remains at £3,678,000, without any change.

West India and Panama Telegraph Co., Ltd.

SIR A. F. KING presided, on November 15th, at the annual meeting. He said that the cost of repairs to cables was £7,633 in excess of that for the half-year to June, 1915, over £2,300 of the increase being due to new cable being used in repairs, which was not, in itself, a matter for much regret because the system was strengthened to that extent. No opportunity occurred for letting out their repairing ship during the half-year. The profit for the half-year showed an increase of £2,349 over the corresponding half of 1915, and they were able to resume paying a dividend on the ordinary shares. The traffic receipts, so far, during the current half-year compared favourably with those for the December period of last year. The hurricane season in the West Indies, which usually commenced in August, was of special severity this year. In that month Jamaica suffered seriously. Their landlines were blown down in many places, but communications were restored in two or three days. In Dominica telegraphic communication was cut off for several hours, but for the company the most disastrous of the hurricanes struck St. Thomas and the adjacent island of St. Croix, on October 9th, causing great damage in both islands. Their small house and shed at Krum Bay, St. Thomas, were totally destroyed, and their wharf was damaged. The mortgage debentures issued 25 years ago would fall due for payment on December 31st. The issue was only a small one—namely, £80,000—the share capital being £1,275,000. It was their intention shortly to issue a circular inviting the present holders to renew them for a period of ten years. The debentures were a first charge as a floating security upon the whole of the company's property. They would be renewed at the same rate of interest—namely, 5 per cent. per annum—but, in view of the state of the money market, it was felt that the present holders might not be eager to renew them at par, at which price they were issued, and that some inducement in the form of a cash payment must be offered for their renewal. Coupons for a half-year's interest, payable on June 30th and December 31st in each year, would be attached to each bond, and the bonds would be redeemable at the company's option upon six months' notice at £105 per bond. Should all the bonds not be renewed, some would be available not only for any present holders who might wish to increase their holdings, but also for shareholders.

Castner-Kellner Alkali Co., Ltd.

The directors do not feel justified in submitting any accounts for the year to September 30th, owing to the fact that they are not able to estimate the liability for excess profits tax. The amount payable for the previous financial year has not been settled. The profits have exceeded those of the previous year, and the business, though carried on under considerable difficulties, is proceeding satisfactorily. As soon as the amount payable for excess profits has been ascertained the directors will submit the accounts. The auditors have expressed their opinion that the profits are sufficient to warrant the directors recommending that a final dividend of 13 per cent. be declared, which, with the interim dividend of 9 per cent. paid in May, makes 22 per cent. for the year.

East India Tramways Co., Ltd.—The gross receipts for the year ended July last were £97,104, and the working expenses £19,408; net receipts, £77,696. Five per cent. dividend is to be paid on the cumulative preference and ordinary shares, of which an interim dividend of 2½ per cent. was paid May 31st, £2,045; 10 per cent. on the deferred shares, of which 2½ per cent. was paid May 31st, £5,000.

Venezuela Telephone & Electrical Appliances Co., Ltd.—The report for the year ended June 30th shows a profit, including £11,821 brought forward, of £30,076, against £20,401. After providing for debenture interest, &c., and £2,399 for excess profits duty for the past two years, the directors propose to pay a dividend of 30 per cent. on the preference shares (thus discharging arrears to September 30th, 1910), to place £6,000 to reserve for renewals and depreciation, and to carry forward £11,228.—*Financial Times*.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the five weeks ended September 29th, 1916, were 2,699,816, compared with 2,612,755 in the corresponding five weeks of 1915; and during the four weeks ended October 27th, 1916, 2,638,767, compared with 1,889,945 units.

France.—La Société Française de Métallurgie Electrique (Procédés Bourget) is the name of a new undertaking which has lately been formed in Paris (106, Boulevard Haussmann), with a capital of £24,000.

British Electric Traction Co., Ltd.—The directors have declared the dividend on the 6 per cent. cumulative participating preference stock for the half-year ended September 30th.

Canadian General Electric Co., Ltd.—Quarterly dividend of 2½ per cent. for the three months ending 31st proximo, making 8 per cent. for the year on the common stock.

Shawinigan Water & Power Co.—Dividend, 1½ per cent. for the quarter to December 31st on the common shares.

STOCKS AND SHARES.

TUESDAY EVENING.

The position of Stock Exchange markets is governed almost entirely by the news being given by the state of affairs in America. Business here is on foot, caution has been taken by the banks and other financial and ordinary investor and speculator alike to adopt a waiting policy pending something more definite and favourable from the west. Anticipation has been general that there would be good news this week. The City has been full of vague hints that such might be confidently expected. By the bag of two Zeppelins on Tuesday morning, such sports turned foolish again, and the rapid rise in London reversed surprise more than any other feeling.

Prices are mostly dull. There is not much selling; prices have drooped by anticipation. In the foreign division, Mexican issues continue acutely flat. The only market to show any animation and resistance to the general feeling of uncertainty has been that for miscellaneous industrial shares, of which Edison & Swan and British Aluminium ordinary stand out conspicuously.

The Home Railway group is dull and heavy. Talk of Labour unrest in the coal districts has chilled any inclination to take an interest in Home Rails, on the strength of the stocks' carrying five months' dividends. The Underground group is the firmest, but here, both Districts and Metropolitan have gone back substantially, and the buoyancy of Underground Electric Railways of London issues has given way to lower prices as people came in to take their profits.

Nothing fresh is known as to the possibility of fares being raised on the Underground and London General Omnibus systems. The shilling shares have eased off to 6s. 3d., and at 42 the £10 shares show a loss of 2s. 6d. out of the 6s. 3d. that they gained in the previous week. The income bonds remain tolerably steady at 91. Steam stocks have weakened.

The United States are threatened with Labour troubles of their own, but, notwithstanding this, prices of the American and Canadian industrials are mostly better on the week. Canadian Generals continue to improve. The company has declared a final dividend of 2½ per cent., making 8 per cent. for the year. Consolidated Gas, Electric & Power of Baltimore went up 3 points to 133. The shares of steel companies have been breaking new high records.

Mexican industrials, however, remain very flat, although there has been no such repetition of slump as occurred last week, when Mexican Light preferred, for instance, shed 8½ points in a single day. As one of the jobbers in the market observed, this sort of thing could not go on for long, for obvious reasons. British Columbia Electric stocks are steadier, and Brazilian Tractions, after dipping to 4½, recovered to 51, still showing a fall of 1½ on the week.

The Argentine Railway market has been infected with acute depression, which has found indirect reflection in the bonds of the country and in the shares of its industrial concerns. Rather curiously, the 4½ per cent. debenture stock of the Anglo-Argentine Tramways Co. is quoted at 74, while the 5 per cent. debenture stock stands 7 points lower. Of course, the security of the former is decidedly better than that of the latter. There is £1,710,000 of the 4½ per cent. stock and six million pounds of the Fives. At the outbreak of war the respective prices were 98½ and 96. In favour of the 4½ per cent. issue, it ought to be added that the dividend on the company's second preference shares (due last July) was postponed. The Shavining Water & Power Co. has declared its regular quarterly dividend of 1½ per cent. on the common shares, the price of which keeps steady at 140. Victoria Falls preference are a firm spot at 21s. 6d., the 5 per cent. second debentures being 102 and the ordinary shares 11s.

The British Electric Traction Co. has declared a dividend of 6 per cent. on its cumulative participating preference stock for the year ended September 30th last, and the price is a little better at 77½. The ordinary stock, which last June received a dividend of £3 in respect of the previous year, stands at 35; while the debenture stocks are quoted 81 and 60 for the 5 per cent. and the 4½ per cent. second debenture respectively. London & Suburban Traction preference are a little better at 8s. 3d., the ordinary shares being quoted about half-a-crown. The 4½ per cent. first debenture stock changed hands the other day at 66. London United Tramways 4 per cent. debenture stands about 48.

The Telegraph and Telephone list is very steady. Great Northern Telegraphs are 10s. better, but Western Telegraphs are 1 down at 112. The speculation in West India & Panama ordinary turned out to be somewhat of the one-day order, and the shares are 1 16 lower at 22s. 6d. Beyond these movements, the list shows a good deal of firmness. Marconi reacted a trifle, though the market is not by any means a bad one. Argentine have eased off to 10s. 6d.; Canadians remain about 7s. 6d.

Illumination shares—both electric and gas—continue to be heavy. City of London Electric ordinary slipped back to 112. Metropolitan preference at 34 are 1 down. Buyers require to be tempted with cheap prices to induce them to take shares; and the next batch of dividends is awaited, as we

have previously observed, with a certain amount of anxiety. The companies are suffering not only from restriction of lighting, but also from the complaint common to most industries nowadays, to wit, shortage of labour, both as regards the outdoor and the indoor staffs.

Edison & Swan shares have been up to 10s. as a result of the meeting last week. The chairman, Mr. C. J. Ford, dwelt upon the improved results which the company has been able to secure during the past financial year, and indicated that the outlook was distinctly bright. He went into an arrangement for the provision of more money, which would enable the company to take better advantage of the business offered to it. On the speech, the shares rose from 7s. 6d. to 10s., but subsequently eased off to 8s. 9d., leaving them with a rise of 1s. 3d. on the week. The fully-paid shares remain at 12.

British Aluminium ordinary are another good spot at 30s. The rise is no more than a few pence, but there is noticeable activity in the market; and if general conditions were more favourable, the price would probably stand higher. The Castner-Kellner Co. has declared a balance dividend of 13 per cent., making 22 per cent. for the year—an increase of 2 per cent. as compared with the previous 12 months, and the best performance since three years ago. The company pays £32,000 on the quarter of a million shares allotted six months ago to Brunner, Mond & Co., and receives £25,000 in exchange. This, however, is likely to be rectified when Brunner, Mond's final dividend for the year is declared. No change has occurred in Castners. Babcock & Wilcox are steady at 2 15/16, although the market for iron and steel shares has developed a certain amount of irregularity—natural enough in view of the progressive character of the movements that have been taking place lately.

SHARE LIST OF ELECTRICAL COMPANIES.

	HOME ELECTRICITY COMPANIES.		Price Nov. 29, 1916.	Rise or fall this week.	Yield p.c.
	Dividend	1914, 1915.			
Brompton Ordinary	10	10	62	—	47 11 0
Charing Cross Ordinary ..	5	5	39	—	7 8 2
Chel. do. do. 4½ Pref. ..	4½	4½	55	—	6 11 0
Cheltenham do. do. ..	6	4	3	—	6 13 4
City of London	9	8	112	—	6 17 8
do. do. 6 per cent. Pref. ..	6	6	10	—	6 0 0
County of London	7	7	104	—	6 13 4
do. do. 6 per cent. Pref. ..	6	6	10	—	6 0 0
Kensington Ordinary	9	7	59	—	8 4 6
London Electric	4	8	12	—	6 10 6
South London	6	6	104	—	6 15 4
Metropolitan	24	9	23	—	6 6 4
do. do. 4½ per cent. Pref. ..	4½	4½	94	—	7 4 0
St. James' and Pall Mall ..	10	8	62	—	6 8 0
South London	5	5	213	—	6 16 1
South Metropolitan Pref. ..	7	7	145	—	6 7 3
Westminster Ordinary ..	9	7	67½	—	6 13 0

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	6	6	95½	—	6 5 8
do. do. Def.	80½	33½	23½	—	7 10 3
Chile Telephone	8	8	24	—	6 12 8
Cuba Sub. Ord.	6	6	84	—	6 15 6
Eastern Extension	7	8	133	—	6 15 6
Eastern Tel. Ord.	7	8	142½	—	6 12 1
Globe Tel. and T. Ord. ..	6	6	124	—	6 15 1
do. do. Pref.	6	6	104	—	6 16 4
Great Northern Tel.	22	22	98	—	6 10 4
Indo-European	13	13	61	—	6 7 8
Marconi	10	10	24	—	6 9 6
New York Tel. 4½	4½	4½	98	—	6 10 4
Oriental Telephone Ord. ..	10	10	24	—	6 6 6
United R. Plate Tel.	8	8	—	—	6 16 6
West India and Pan.	1	1	142	—	6 11 4
Western Telegraph	7	8	—	—	6 11 4

HOME RAILS.

Central London, Ord. Assented	4	4	25½	—	6 2 2
Metropolitan	12	1	24	—	4 3 4
do. do. District	Nil	Nil	16	—	Nil
Underground Electric Ordinary	Nil	Nil	Nil	—	Nil
do. do. "A"	Nil	Nil	8 3	—	Nil
do. do. Income	6	6	91	—	6 11 10

FOREIGN TRAMS, &c.

Adelaide Sup. 6 per cent. Pref.	6	6	413	—	6 1 6
Anglo-Arg. Trams, First Pref.	6½	6½	94	—	8 9 2
do. do. 2nd Pref.	5½	5½	93	—	7 9 3
do. do. 5 Deb.	5	5	67	—	7 10 10
Brazil Tractions	4	4	113	—	6 17 8
Bombay Electric Pref.	6	6	104	—	7 5 0
British Columbia Elec. Rly. Pfc.	5	5	69	—	Nil
do. do. do. Preferred ..	Nil	Nil	49	—	Nil
do. do. do. Deferred ..	Nil	Nil	47	—	Nil
do. do. do. Deb.	4½	4½	62	—	6 17 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	324	—	Nil
do. do. 6 per cent. Bonds	Nil	Nil	274	—	Nil
Mexican Light Common	Nil	Nil	Nil	—	Nil
do. do. Pref.	Nil	Nil	22	—	Nil
do. do. 1st Bonds	Nil	Nil	324	—	Nil

MANUFACTURING COMPANIES.

Babcock & Wilcox	14	15	215	—	5 2 0
British Aluminium Ord. ..	5	5	30	—	5 6 8
British Insulated Ord. ..	15	15	173	—	7 5 0
British Westinghouse Pref.	7½	7½	24	—	6 3 0
Callenders	15	20	122	—	7 15 4
do. do. 5 Pref.	5	5	44	—	5 17 8
Castner-Kellner	30	29	62	—	5 6 8
Edison & Swan, 2½ paid	Nil	Nil	—	—	Nil
do. do. fully paid	Nil	Nil	12	—	Nil
do. do. 4 per cent. Deb. ..	5	5	62	—	8 0 0
Electric Construction	6	7½	134	—	6 13 4
Gen. Elec. Pref.	6	6	10	—	6 0 0
do. do. Ord.	10	10	14	—	7 2 10
Henley	20	25	16	—	7 15 8
do. do. 4½ Pref.	4½	4½	44	—	6 12 8
India-Rubber	10	10	122	—	7 17 0
Telegraph Con.	30	30	384	—	6 4 7

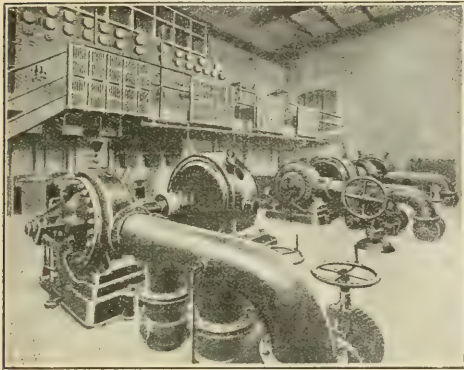
* Dividends paid free of income-tax.

PUMPING PLANT AT PORT ARTHUR, CANADA.

In a paper before the Canadian Society of Civil Engineers, Mr. L. M. JONES recently described the new water supply works of the city of Port Arthur.

The intake consists of duplicate pipes, 24 in. in diameter, extending a distance of 2,350 ft. into the lake, and connected to a pump well at the shore end.

The well is 25 ft. in diameter, and 25 ft. deep.



INTERIOR OF THE PORT ARTHUR PUMPING STATION.

The three main pumping units are Escher-Wyss centrifugal, two-stage, single-suction pumps, having a 12-in. suction branch and a 12-in. delivery branch, the horizontal lines of these branches being at the same elevation. They are designed for 2,000 imperial gallons per minute when pumping against a head of 300 ft., the speed being 1,200 R.P.M., and a guaranteed efficiency of 76 per cent. with a 2 per cent. margin. The impellers, guide apparatus, and all parts coming in contact with the water are of special bronze, a nickel steel shaft covered with bronze, self-lubricating bearings of the ring type, and a patent balancing device are fitted. There is no necessity to disconnect piping to gain access to the internal parts. The pumps operate in parallel or in series, as may be desired, and when working in series will deliver the capacity of one pump at twice the head, or a pressure equal to a head of 600 ft. can be obtained if necessary, or a range between 300 and 600 ft. is available by throttling. They will discharge their rated capacity with a suction lift between 19 and 20 ft., and the power required for the stated condition is 244 B.H.P.

The motors are of the Siemens self-starting synchronous type direct connected to the pump shaft, have a power output of 275 H.P., and are capable of sustaining a 25 per cent. overload for a period of two hours.

Electrical energy is supplied from the Current River station at 2,200 volts and the Hydro-electric station, the latter at 25,000 volts, to a sub-station adjoining the pump-house, where it is stepped down to 2,200 volts.

On the gallery the switchboard and apparatus is located, there being a panel for each motor, exciter motors, exciters, power line from Current River and the transformers, while alongside the board is the panel for controlling the 25,000-volt line. At the rear of the board the switch and bus compartments are constructed of concrete slabs, there being duplicate sets of bus-bars.

When changing from one source of power to the other, the 400-k.v.a. transformers are paralleled with the Current River line, thus enabling the load to be changed without interruption to the service.

In the transformer station is located a bank of three 400-k.v.a. transformers with one spare, making four in all. They are "star" connected on the high-tension side and "delta" in the low-tension side, being oil and water cooled, and mounted on castors. The switching apparatus is placed on a

floor above the transformers, all switches being located in cells made of concrete slabs.

A booster pump, consisting of a motor-driven Allen single-stage pump for 1,000 gallons per minute against a head of 200 ft. is also installed in another part of the system to supply the hill section.

THE PARALLEL OPERATION OF ELECTRIC POWER STATIONS.

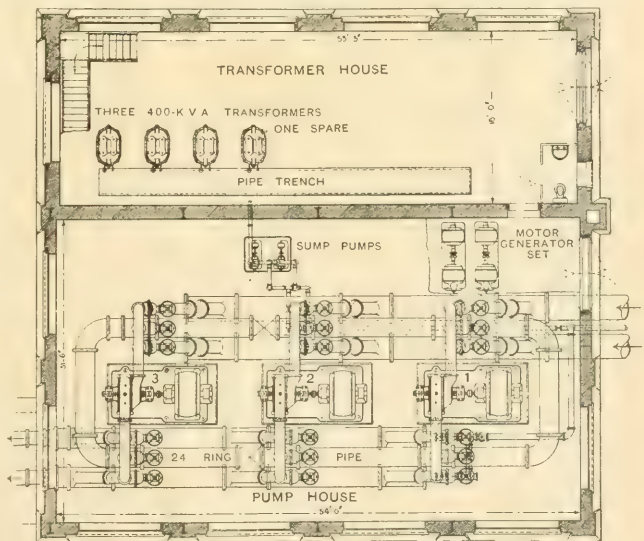
By J. S. PECK, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS.)

It is not proposed in this paper to discuss the commercial questions involved in linking up, but to point out some of the engineering problems and to indicate what types of apparatus are available, and the conditions under which they may be used.

Fortunately the great majority of stations in this country generate 3-phase current at 50 periods, so that the problem of interconnecting is relatively simple; but there are a number of large systems which generate at other frequencies. The problem of linking-up systems of different frequencies is much more complicated than that of linking-up systems of the same frequency, and each particular case requires careful consideration in order to determine the best method to adopt.

When two alternating-current generators having the same number of poles and the same rating are operated in parallel, they must, of course, run at exactly the same speed, and, if they are to divide the load equally, it is essential that the two engines (or turbines) driving them should have the same speed regulation, i.e., the same drop in speed from no load to full load. If one engine should have a regulation of 2 per cent. and the other of 4 per cent., then (assuming the regulation curve to be a straight line) with full load on one generator there would be only half load on the other. Any two machines may be made to divide the load in any desired proportion by proper adjustment of the steam supply, while adjustments of the field rheostats simply cause wattless current to flow between the generators. The effect of this current is to strengthen the field of the under-excited generator



ARRANGEMENT OF PLANT FOR SERIES OR PARALLEL PUMPING, PORT ARTHUR.

and to weaken that of the over-excited generator; thus the voltage across the two remains equal.

The operation of two or more stations in parallel is simply the operation of two or more groups of generators in parallel, and the conditions are similar to those involved in operating two single generators in parallel, except for the fact that the interconnecting line possesses inductance and resistance. For all ordinary cases the resistance and inductance may be neglected.

When the stations to be linked up have the same frequency, voltage, and phase, the only interconnecting link required is a cable with the necessary switches, &c., for connecting together the bus-bars of the two stations. It frequently

happens, however, that the voltages of the two stations are not exactly equal, and it may be required to vary the voltage of either station independently of that of the other. For this reason it is desirable to have some form of voltage regulator in at least one of the stations; otherwise, when voltage adjustments are attempted, heavy wattless currents will flow between the stations and the voltages on the two systems will remain equal, except for the difference due to the drop of pressure in the cable.

The regulator may be either of the step-by-step or of the induction type.

Fig. 1 shows a diagram of connections which may be used when a step-by-step regulator is adopted. A, A, are series transformers for raising or lowering the voltage of the feeders; B, B, are shunt transformers, the secondaries of which are provided with tapplings to give different voltages for applying

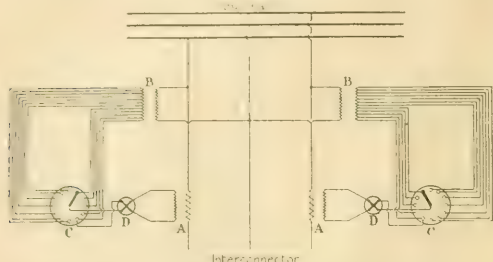


FIG. 1.—DIAGRAM OF CONNECTIONS FOR VOLTAGE REGULATOR IN INTERCONNECTOR BETWEEN TWO 3-PHASE SYSTEMS.

to transformers A, A; C, C, are regulating dials; and D, D, are reversing switches. It will be noticed that only two regulators are required for the three phases.

In order to determine the sizes of cable, transformers, and regulator required to interconnect two systems, it is necessary to know the maximum load which will have to be transmitted between them, and as this is the most important feature in parallel operation it will be considered in some detail.

It will be assumed first that the speed regulation of the two systems is identical, so that each will carry its proper proportion of the total load on both systems. This is a justifiable assumption, since the engine governor can usually be adjusted to give approximately this condition.

and the connecting feeder must carry half the difference in load.

2. This case will be similar to the preceding one, except that instead of the total load being divided equally between the two stations it will be divided in proportion to their capacities. Knowing the load on the bus-bars and on the generators of each system, the load on the interconnector is known at once.

If the load conditions are known, it is a very simple matter to calculate the load on the interconnecting line. If the loads are steady the engine governors may be adjusted by hand to give the minimum or any other desired load on the interconnector, but where violent fluctuations occur manual adjustments of the governor are impossible, and account must be taken of this fact when designing the interconnecting line.

Where the engine governors of two systems are set for different speed regulations, they will divide the total load not in proportion to their generating capacities, but in direct proportion to their ratings and in inverse proportion to their speed regulation, assuming a straight-line speed drop. Thus, if station A has a rated capacity of 10,000 kw. and B 5,000 kw., while A drops 2 per cent. and B 4 per cent. in speed from no load to full load, the two stations will share the total load in the proportion of $(10/5) \times (4/2) = 4$, i.e., A will deliver four times the load of B. If the regulation of A is 4 per cent. and that of B 2 per cent. then the proportion would be $(10/5) \times (2/4) = 1$, i.e., the two stations would deliver equal loads. This would be a very dangerous condition, as B would be heavily overloaded before full load was reached on A. This simply confirms what is well known in operating machines in parallel, namely, that when the regulation cannot be made equal on two machines, the larger one should have the closer regulation.

The same methods may be used where there are several stations in parallel, and as soon as the loads on the different stations have been determined the loads on the different interconnectors may be found.

In the actual parallel operation of alternators in a station, the loads are seldom divided exactly in proportion to the ratings of the different machines, but shift from one set to another with variations in the external load, depending on the governor adjustments. This causes, however, no trouble in the station so long as the sets share their loads properly at the full output of the station, and hand adjustment of the governors is necessary from time to time. In the operation of stations in parallel exactly the same problems are involved, and there should be no more trouble than in operating different generators in the same station in parallel, provided that the interconnecting link is made of sufficient capacity to take care of any discrepancies in load adjustments due to governor peculiarities.

It is becoming standard practice in all large generating sta-



FIG. 2.—DIAGRAM OF CONNECTIONS OF TRANSFORMERS AND REGULATORS IN 4,000-KW. INTERCONNECTOR BETWEEN 2,200-VOLT 2-PHASE SYSTEM AND 11,000-VOLT 3-PHASE SYSTEM IN LONDON.

With two stations A and B, the following cases will be considered:—

1. A and B of equal capacity.
Unequal loads on the two stations.
2. A of greater capacity than B.
Load on B greater than its proportion of the total capacity of the stations.
Load on B less than its proportion of the total capacity of the stations.

1. Since A and B have equal capacities and must run in synchronism they will deliver at all times equal loads. Therefore, if the load on B's bus-bars is greater than that on A's bus-bars, half this difference will be supplied by each station

tions to earth the neutral point of the system. Where the bus-bars of two earthed systems are directly coupled together there may be heavy high-frequency currents flowing through earth between the stations, and these currents may cause trouble in telephone and telegraph circuits. There are several ways of overcoming this difficulty:—

- (a) One station only may be earthed. In this case arrangements could be made so that when the interconnector was opened the unearthened system would be earthed.
- (b) An insulated earth cable could be run from one system to the earth on the other system, i.e., both systems would have a common earthed point.
- (c) Transformers could be inserted in the interconnecting line.

(d) Reactances or resistances could be placed in the earth connection to limit the earth currents to a negligible value.

Where the stations are of the same frequency but of different phase or voltage, it is necessary to introduce transformers into the interconnector. The voltage and phase transformation is made, where such is required, in the same transformers.

Fig. 2 shows the diagram of connections used for the transformers of a 4,000-kw. interconnector between two stations in London, one generating 2,200 volts 2-phase and the other 11,000 volts 3-phase. For varying the voltage between the two stations step-by-step regulators are used. A drum-type oil-immersed regulator is used for changing from tap to tap.

Apart from the introduction of transformers, the operating conditions for stations having different voltages or phases are exactly the same as when the stations have the same voltage and phase, except where it is required to link up a single-phase system with a 2- or 3-phase system. If it is desired to distribute the load equally on all phases of the 3-phase or 2-phase system, rotating apparatus is required. This may take the form of a motor-generator or of what is known as a phase converter.

Several designs of phase converters have been proposed, but they all utilise the well-known fact that if one phase of a 2- or 3-phase machine be supplied with current and the rotor be brought up to speed, then 2-phase or 3-phase current can be supplied from the terminals of the motor.

This type of converting plant is used on the Norfolk and Western Railway in America for converting the single-phase trolley current into 3-phase current for the motors on the locomotives. When running down grade the 3-phase motors regenerate and supply single-phase current to the trolley through the converter. Similar plant is being installed in the sub-stations of a single-phase railway system for converting from 3-phase to single-phase for supplying the trolley circuit.

When two stations of different frequencies are to be linked up it is necessary to use a frequency changer of the rotating type. This will usually take the form of a motor-generator, but in certain cases where continuous current is required it may be advantageous to use a rotary converter for changing from one frequency to continuous current, and another to change from continuous current to the other frequency. Under this condition it is, of course, possible to use both rotary converters for supplying continuous-current load from the two different systems. This condition will be considered later on.

The cost of a motor-generator is comparatively high, and while it is desirable to keep down its size to correspond to the load which it is desired to transmit from one station to the other, its capacity must also be chosen with reference to the load it may have to transmit under abnormal conditions, and the choice of the type of converting plant will be governed largely by this consideration.

The motor-generator for frequency transformation may be either of the following two types:—

1. Synchronous motor and synchronous generator—called "synchronous motor-generator."

2. Induction motor and synchronous generator—called "induction motor-generator."

Each set has certain advantages and disadvantages.

In the case of a synchronous motor-generator, since each machine of the set must run in synchronism with the system to which it is connected, the two systems must run at speeds which are definitely fixed with reference to each other. In other words, the two systems are locked together through the motor-generator, which acts as a perfectly rigid coupling, and it is the strength of this coupling with reference to the loads likely to be thrown on it which requires careful consideration in all cases.

Since the synchronous set locks the two systems in step, the transfer of energy from one system to the other will be governed by the same conditions as when the systems are of the same frequency and paralleled by a direct cable connection. Thus the loads likely to be thrown on the converting set may be calculated in the same way as described above for systems of the same frequency.

Advantages of Synchronous Set.

1. It is reversible and can supply energy in either direction without change from the normal speed ratio.

2. The motoring machine can be run at unity power factor, or even with a leading power factor, and thus assist in improving the power factor of the system. The generating machine may be run with an over-excited field, and so reduce the lagging current carried by other generators on the system.

Disadvantages.

1. The set, acting as a rigid coupling, forces the two systems to run at a fixed speed ratio, and is therefore subject to heavy overloads under certain conditions.

2. Each machine must be synchronised with its own system, an operation requiring some skill, especially with certain ratios between the numbers of poles.

3. Where two motor-generators are operated in parallel special arrangements are required in order to synchronise an unloaded set with one under load.

Where an induction motor and a synchronous generator are used, the induction motor does not run in synchronism with its supply system, but runs slightly below synchronous speed.

The slip varies directly with the load transmitted; furthermore, it may be regulated by adjusting the amount of resistance in series with the secondary member. The induction set may be likened to a slipping coupling between two prime movers, where the amount of slip depends on the load transmitted, so that they are not required to operate at exactly the same speed.

The induction synchronous set is a much more flexible link for coupling-up two power systems than is the synchronous set, and it is possible to use a set of comparatively small capacity for linking-up two large systems, for by making the slip fairly large it becomes almost impossible seriously to overload the set; also it requires a large variation in speeds to give a considerable transfer of energy from one system to the other. On the other hand, the induction machine always takes a wattless current and does not permit any adjustment of power factor on the system to which it is connected.

Advantages of Induction Motor-generator.

1. It is a flexible link and permits a small set to be used between two large systems.

2. It is easier to start and put into operation.

3. By using an adjustable secondary resistance, it is possible manually to control over a considerable range the amount of energy transmitted by the set, though this involves a certain loss in efficiency.

Disadvantages.

1. A comparatively large difference in speed between the two systems is required in order that it may transfer its rated output from one to the other. This large difference in speed often limits the induction set to transmitting in one direction only.

2. The induction machine requires a considerable lagging current, and no power-factor control is possible on this machine without introducing some form of phase advancer.

The great advantages which the synchronous set possesses, of permitting power-factor control and of transmitting energy in either direction without change in speed ratio between the two systems, make it desirable to use the synchronous set in preference to the induction set whenever possible. The great danger in its adoption is the possibility of overloading it and pulling it out of step. Of course, it is possible to protect the machines from excessive overload by means of an overload circuit-breaker; but, when the breaker opens, the machine must be synchronised again, and for a time there is no interconnecting link between the two systems.

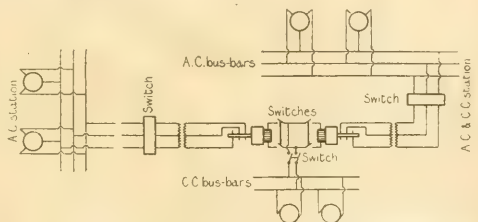


FIG. 3.—A METHOD OF INTERCONNECTING AN A.C. SYSTEM WITH A COMBINED A.C. AND C.C. SYSTEM.

In general, a synchronous set should not be used unless its capacity is reasonably large with reference to the smaller of the two stations which it couples together. Where the stations are large and the changes in load comparatively small and not very sudden, it would probably be satisfactory to use a synchronous set having a rated capacity as low as 20 per cent. of the capacity of the smaller station. Under less favourable conditions it might not be advisable to use a capacity less than 40 to 50 per cent. of that of the smaller station. But where the synchronous set is as small as 20 per cent. of the capacity of the smaller station, overload protection must be provided and occasional shut-downs may be expected.

Interconnecting two systems of different frequency by means of rotary converters, in general, is only commercially feasible where continuous current is required in at least one of the stations. Fig. 3 shows two alternating-current stations of different frequency interconnected in this way. From the continuous-current side of the two rotary converters a connection is taken to the continuous-current bus-bars in one of the stations. With this arrangement it is possible to feed the continuous-current bus-bars from either or both alternating-current stations, or to supply alternating current from the continuous-current bus-bars to either or both stations; also it is possible to supply alternating current from either station to the other.

When rotary converters are used the transfer of energy from one station to the other does not depend upon the speed of the generators, but is controlled by manipulating the voltage of the rotary converters, and means must be provided for accomplishing this result. This may be done by synchronous boosters or by transformer tapplings, but, in general, reactance control will permit sufficient voltage variation to give the desired results.

in conjunction with synchronous condensers might form an advantageous alternative to regulating transformers. Synchronous condensers as a means of regulation dealt with power factor and voltage; it was important to remember that if the voltages at the two ends of a transmission line were adjusted to be constant and equal at any load, they would remain so at all loads, and the power factor would be constant also. Obviously, if station B was being aided, the synchronous converter should be at B, dealing with the idle current near its source; if A was being aided, the synchronous converter should be at A, so that for mutual aid of, say, 5,000 k.v.a. at 0.75 power factor, they would require two machines each of 3,300 k.v.a., a somewhat substantial additional cost to that of interconnecting mains. Their power consumption must also be borne in mind, as though efficient at full load, a synchronous motor had rather high no-load losses; the running arrangements had, therefore, to be studied carefully. As an off-set, however, it must be remembered that the use of synchronous converters would reduce the k.v.a. loading on the generators, thus not only enabling smaller generators to be used for a given kw. output, but reducing the stresses on them in the case of faults; further, such machines helped to balance unequally-loaded phases. Broadly speaking, so far as voltage regulation was concerned the first condition for a satisfactory solution of the problem was a high transmission pressure; when national interconnection came, they might look for a transmission system of, say, 60,000 volts, a power distribution voltage of anything between 10 and 30,000 volts, and the relegation of the 6,000-volt systems to domestic supply. As to power factor, a satisfactory voltage at the consumers' terminals made auto-regulation at each station a necessity. The use of auto-pressure regulators for power factor control presented no practical difficulty, as the relationship between power factor and pressure drop in an inductive line was almost a straight line. On the Yorkshire system, as a case in point, they had two stations 14 miles apart running in parallel, each fitted with auto-pressure control, which effected the desired result for power factor also. Obviously, the interchange of power between any stations should be at as high power factor as possible, so as to reduce transmission losses; with fixed setting of the regulators it was possible to arrange for this within practical limits. In the case mentioned, the normal condition was that little power was interchanged, the interconnectors acting also as distributors. As a large interchange was infrequent, the comparative value of low line losses was small and, therefore, the necessary transfer of power was carried out by power factor alteration at the expense of the wattless k.v.a. on the receiving station; failing the provision of a synchronous converter, this could be dealt with by running a generator as a motor. Finally, in this country the case to be met was that of a number of stations interconnected for the sake of security and load transfer, but under separate control. No system of operation would prove satisfactory which involved communicating instructions to all the stations when a change of load occurred, and the simplest possible alternative was automatic pressure regulation, station output controlled by steam pressure, and either central or sectional regulation of wattless k.v.a. by means of synchronous condensers and boosters.

Mr. PARTIDGE said he had anticipated that the paper would have dealt at greater length on the apparatus which might be used. It was impossible to say what would be the prime mover of the future, but it must be designed for parallel working. As regarded transmission, he saw no difficulty in working up to 50,000 volts with underground cables. The most important question was as to the periodicity to adopt, and this should be settled once for all. It appeared to him that it would be better to adopt something lower than 50; a low periodicity meant less inductance, less chance of coming out of step, the regulation was much better, and capacity currents would be less; pressure rises would also be smaller, and switching would be easier if oil switches were used owing to the zero remaining longer. It was necessary to have plenty of copper in the interconnecting cable. He much preferred the induction regulator for voltage adjustment, and regretted that the paper said so little about phase converters. The induction motor-generator was preferable to the synchronous machine; his experience of a large set for coupling a 3-phase, 25-cycle, 7,000-volt system to a single-phase, 85-cycle, 10,000-volt system was most satisfactory despite heavy disturbances on one or two occasions. He pointed out that while it was easy to synchronise the first induction machine, there was a difficulty with the second incoming machine on account of the difference in slip, and a somewhat similar difficulty arose with the second synchronous motor generator.

Mr. A. M. TAYLOR agreed with Mr. Woodhouse as to linking-up being more complex than appeared on the surface. In Birmingham, the old generating station, run with automatic regulation, was coupled to a new plant without such regulation, and the preliminary difficulties had been overcome, but he thought the author rather under-estimated the difficulty of synchronising two large stations, and that he should have included reactance. The capacity of switchgear was very much governed by it, and it was possible that with two 30,000-kw. stations near and connected that an unsafe amount of plant would come on to one system unless reactance was employed. In regard to the possibility of paralleling stations through static frequency changers, he was quite prepared to design frequency changers of at least 300 kw. capacity. A "bank" of, say, 10 such frequency changers, representing a

total of 3,000 kw., could be suddenly switched in as a big unit. It would not be necessary to synchronise nearly so closely as with synchronous frequency changers, and probably an error of 60 deg. "lag" or "lead," or, at a pinch, even 90 deg., would not be attended with serious trouble. For this reason it might be possible to put in a 3,000-kw. "bank" of static transformers, where a 6,000 or 9,000-kw. set would be necessary with rotating frequency changers. Within certain limits the apparatus would be reversible, possibly to the extent of the capacity of the apparatus. The large "lagging" current, which was the worst feature of the static transformer, could be compensated by phase advancers at the station, as proposed for the induction motor-generator scheme. The static frequency changer took a perfectly balanced current from the three mains, and delivered it to a single-phase system on the higher frequency. All the above remarks related to step-up transformation from 25 periods to 75 (or from 16.6 to 50) periods, but he had also obtained entirely satisfactory experimental results with a step-up from 25 cycles to 50 cycles, for which, however, direct-current excitation would be required. He had experimentally performed the stepping down of the frequency from 75 to 25 (or 50 to 16.6) periods, and probably the same could be done with stepping down from 50 to 25. If, however, the apparatus was found to be sufficiently reversible (so long as the 25-period supply did not entirely give in), there seemed to be no object in employing special transformers to act independently of that supply. He thought that the simplicity of the static frequency changer, and the ease with which it could be switched into circuit under almost all sorts of conditions, and the fact that it practically required no attention when once switched in, being capable of very heavy overloads, and being self-protective against rises of pressure on either side or short circuits rendered it almost ideal for use as a piece of interlinking apparatus.

Sir CHARLES PARSONS, who said he had not intended to speak, referred to the great interest of the paper in view of the necessity of facilitating electricity supply for industrial purposes. He wished the author had said more about American developments, although, probably due to our restricted area, more linking-up was in prospect here. He went on to refer to possible developments in prime movers, pointing out the limitations of the gas engine in this respect.

Mr. BRAZIL said it was important to consider safety as well as efficiency in choosing apparatus for interconnecting sources of electricity supply. He strongly favoured the synchronous motor-generator because of the importance of being able to transmit in both directions. The induction motor-generator would do this under certain conditions, but not unless there was synchronous plant running. Rotary converters were more efficient, but the question of safety came in with them. As regarded earthing the neutral (a) involved using apparatus likely to go wrong, (b) was ideal, but expensive, and (d)—the use of resistances, &c., to limit earth currents—was, he thought, the best arrangement.

Mr. A. P. TROTTER said there were three points of view in regard to earthing: That of the supply engineer, who considered the triple-frequency currents if earthing was carried out at more than one point; that of the Post Office engineers, who had charge of telegraph and telephone circuits; and the question of safety. They must have sufficient current to trip an overload circuit breaker, or, better still, a protective device. The frequencies at present in use in this country were as follows:—

ELECTRICAL SUPPLY UNDERTAKINGS.		
Frequency.	Stations.	Thousands of kw.
25	10	93
40	20	156
50	161	760
60	9	17
83	5	35
100	15	45
33, 68, 75		
77, 80, 90, 93	10	11
ELECTRICAL POWER COMPANIES.		
25	4	78
40	3	317
50	8	117
60	1	36

The commonest frequency in the case of electrical supply undertakings was 50, and the kw. so supplied exceeded twice the whole of the remainder. In the case of power companies, a frequency of 50 was used by eight out of 16, but more power was supplied at 40 than all the rest put together. This was no argument for the extension of a frequency of 40 outside the district known as the North-East Coast; if this were excluded, 50 was the most common. It was undesirable that tees or sub-stations should be connected in linking mains; these should ultimately form a network, and a frequency of 25 seemed suitable. Regulation B.4 of the Extra-high-pressure Regulations of the Board of Trade had, for more than 10 years, restricted frequencies to 25 or 50, except in the North-East Coast district.

Mr. W. M. MORDEY said there was no greater bugbear in power supply work than low power factor, and he had looked for some improvement in this by the use of the static condenser, to the advantages of which, including decreased loss, lower cost, and stationary construction, he had drawn the attention

of the last year—eight years previously. He was much disappointed to find that they had not come into greater use, and suggested that they were worth consideration by engineers.

Mr. E. T. WILLIAMS said a great deal had been said about interconnection, but he agreed that the matter would require careful handling, or it would lead to a waste of money. He felt that they should settle now what should be the standard frequencies. It was easy to imagine a district trunk main system with a standard frequency, to which adjacent stations would be connected, and it was important to fix the frequency and pressure now rather than later.

Mr. J. S. PECK, in replying to some of the points raised, said he felt that Mr. Woodhouse had over-estimated the difficulties of parallel operation; many stations were operating successfully in parallel in ordinary work. In regard to the Manchester district, it had not been considered necessary yet to use more than 6,000 volts for interconnecting service. Low frequency was an advantage as regards transmission, but the difficulty arose in regard to large generating sets which were restricted in speed. It was probable that larger sets would be built for a speed of 3,000 R.P.M. Quite a small current was sufficient to trip the protective gear for earthing. If very large systems were interconnected, it would probably be necessary for the sake of the switchgear to use reactance, and he did not anticipate any great difficulty in parallel working. The difficulties in linking-up were over-estimated.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

UNITED STATES OF AMERICA.—In the United States Revenue Act, which has recently been passed by Congress, provision is made for the creation and establishment of a Commission, to be known as the United States Tariff Commission, which is to be charged with the duty of investigating the administration and fiscal and industrial effects of the U.S. Customs Laws, the relations between the rates of duty on raw materials and finished or partly finished products, the effects of *ad valorem* and specific duties and of compound specific and *ad valorem* duties, all questions relative to the arrangement of schedules and classification of articles in the several schedules of the Customs law, and, in general, to investigate the operation of Customs laws, including their relation to the federal revenues, their effect upon the industries and labour of the country, and to submit reports of its investigations.

The Commission is to have power to investigate the tariff relations between the United States and foreign countries, commercial treaties, preferential provisions, economic alliances, the effect of export bounties and preferential transport rates, the volume of importations compared with domestic production and consumption, and conditions, causes, and effects relating to competition of foreign industries with those of the United States, including dumping and cost of production. The Commission is also to have power to investigate the Paris Economy Pact and similar organisations and arrangements in Europe.

The Revenue Act also contains provisions dealing with "unfair competition," of which the following may be worthy of mention:—

Section 801.—"That it shall be unlawful for any person [in which term are included partnerships, corporations, and associations] importing or assisting in importing any articles from any foreign country into the United States, commonly and systematically to import, sell or cause to be imported or sold such articles within the United States at a price substantially less than the actual market value or wholesale price of such articles, at the time of exportation to the United States, in the principal markets of the country of their production, or of other foreign countries to which they are commonly exported, after adding to such market value or wholesale price freight, duty, and other charges and expenses necessarily incident to the importation and sale thereof in the United States: *Provided*, That such act or acts be done with the intent of destroying or injuring an industry in the United States, or of preventing the establishment of an industry in the United States, or of restraining or monopolising any part of trade and commerce in such articles in the United States."

Section 802.—"That if any article produced in a foreign country is imported into the United States under any agreement, understanding, or condition that the importer thereof or any other person in the United States shall not use, purchase, or deal in, or shall be restricted in his using, purchasing, or dealing in, the articles of any other person, there shall be levied, collected, and paid thereon, in addition to the duty otherwise imposed by law, a special duty equal to double the amount of such duty: *Provided*, That the above shall not be interpreted to prevent the establishing in this country on the part of a foreign producer of an exclusive agency for the sale in the United States of the products of said foreign producer or merchant, nor to prevent such exclusive agent from agreeing not to use, purchase, or deal in the article of any other person, but this proviso shall not be construed to exempt from the provisions of this Section any article imported by

such exclusive agent if such agent is required by the foreign producer or if it is agreed between such agent and such foreign producer that any agreement, understanding or condition set out in this Section shall be imposed by such agent upon the sale or other disposition of such article to any person in the United States."

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 16,215 "Spark plugs for internal-combustion engines." W. A. CLARK, SPRING MFG. CO., H. G. LONGFORD & W. W. LONGFORD. November 13th.
- 16,248 "Spark plugs." Soc. CLERGET, BLIN ET Cie. November 13th. (France, November 13th, 1915.)
- 16,250 "Regulating mechanism for controlling speed of induction motors." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). November 13th.
- 16,272 "Electric regulators, &c." H. LEITNER. November 14th.
- 16,284 "Electrical connections and terminals." H. M. ACKERY. November 14th.
- 16,294 "Reversing switch." IONIAN ELECTRIC CO. & F. BERGMANN. November 14th.
- 16,294 "Packing boxes for electric lamp bulbs." A. ASTLEY. November 14th.
- 16,308 "Secondary electric batteries." T. A. D. LAWTON. November 14th.
- 16,332 "Contact breakers of magnetos." A. COX & ELECTRIC IGNITION CO. November 15th.
- 16,348 "Electric wire gas-lighting appliance." J. H. T. ROBERTS. November 15th.
- 16,359 & 16,360 "Electrical contacts, and mounting or supporting same." A. CRAWFORD, W. P. THOMPSON & CO. November 15th.
- 16,370 "Telegraphy." W. M. BRUCE. November 15th.
- 16,382 "Electric switchgear." H. W. CLOTHIER AND A. REVOLLE & Co. November 15th.
- 16,393 "Electric heaters." T. BURNBY. November 16th.
- 16,395 "Electric furnaces." V. STORIE. November 16th.
- 16,413 "Manufacture of switchboards." W. N. KINGROSE. November 16th.
- 16,423 "Spark plugs." R. HENRY & E. HERRMANN. November 16th. (France, December 2nd, 1915.)
- 16,427 "Electric arc devices and method of operating same." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). November 16th.
- 16,434 "Signalling by electric lamps." W. S. G. BAKER, MCKENZIE, HOLLAND & WESTINGHOUSE POWER SIGNAL CO. November 16th.
- 16,432 "Mercury breaks or interrupters." F. R. BUTT & Co. AND F. R. BUTT & H. F. BIGGS. November 16th.
- 16,453 "Protective devices for electric circuits." W. J. MELLERSH-JACKSON (Bauoh Electric Controller Corporation). November 16th.
- 16,457 "Reflectors for high-speed submarine cable telephony." T. B. DIXON. November 16th. (U.S.A., July 19th, 1915.)
- 16,461 "Attachment for trolley poles of electric cars." W. JAMES. November 17th.
- 16,492 "Spark gaps." L. A. KUZMAN. November 17th.
- 16,512 "Ignition dynamos." C. T. MASON. November 17th. (U.S.A., June 19th, 1915.)
- 16,513 "Ignition dynamos." C. T. MASON. November 17th. (U.S.A., June 19th, 1915.)
- 16,514 "Ignition dynamos." C. T. MASON. November 17th. (U.S.A., June 19th, 1915.)
- 16,515 "Ignition dynamos." C. T. MASON. November 17th. (U.S.A., June 19th, 1915.)
- 16,521 "Spark plugs." H. BIRKBECK (Thierry & Co.). November 17th.
- 16,536 "Miners' electric safety lamps." O. OLDHAM. November 17th.
- 16,540 "Brush-lifting and short-circuiting device on induction motors, &c." BRUSH ELECTRICAL ENGINEERING CO. & T. H. HURST. November 18th.
- 16,542 "Method of generating combustible forces by electrolysis of water for use in internal-combustion engines." G. C. COLOMA & D. MATLAND. November 18th.
- 16,563 "Wireless signalling systems." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). November 18th.
- 16,566 "Apparatus for producing perforated strip by electrical current impulses." H. H. HARRISON AND CREED, BILLE & Co. November 18th.
- 16,567 "Apparatus for producing perforated strip by electrical current impulses." H. H. HARRISON AND CREED, BILLE & Co. November 18th.
- 16,576 "Pocket or portable electric lamps." E. BIGMORE & W. R. CURTIS. November 18th.

PUBLISHED SPECIFICATIONS.

1915.

- 13,952. MEASURING INSTRUMENTS, RELAYS, AND THE LIKE. Marconi's Wireless Telegraph Co. & H. A. Ewen. September 23th. (Cognate applications, 3,233/16 and 3,789/16.)
- 15,092. DIRIGIBLE TORPEDOES. H. A. Von Post. October 25th.
- 15,094. ATTACHMENT FOR MINERS' ELECTRIC SAFETY LAMPS FOR DETECTING FIREDAMP AND OTHER COMBUSTIBLE GASES. T. J. Thomas. October 26th.
- 15,237. WIRELESS SIGNALING SYSTEMS. British Thomson-Houston Co. (General Electric Co., U.S.A.). October 28th.
- 15,261. AUTOMATIC APPARATUS FOR EXTINGUISHING THE LIGHT FROM PORTABLE ELECTRIC LAMPS IN PREDETERMINED DIRECTIONS. L. Gaster & J. S. Dow. October 29th.
- 15,370. ELECTRIC CLOCKS. H. E. Warren. November 1st. (November 30th, 1914.)
- 15,759. CATHODE FOR ELECTROLYTIC CELLS. F. G. Wheeler. (January 25th, 1915.) November 8th.
- 17,752. METHOD AND MEANS OF INDICATING OR RECORDING THE FREQUENCY OF PERIODIC CURRENTS. N. C. F. Jensen. December 20th.

1916.

- The numbers in brackets are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.
- 18. VIBRATORY MESSAGE APPARATUS. E. Peckham. January 3rd, 1916. (101,890.)
- 869. ELECTRICAL RELAY SYSTEMS. Siemens & Halske Akt. Ges. April 10th, 1915. (Patent No. 100,262.)

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1916 EDITION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

FROM our reading of the criticisms and warnings that are being published in some of the distant markets, we judge that it is high time for the British electrical manufacturer to break silence and remove an unfortunate impression that has obtained currency. We refer to the impression of anxious would-be purchasers that we in this country are indifferent regarding the future effect upon our trade of the hold that neutral nations are gaining while we are waging war for all we are worth on the battlefields of Europe. We must make due allowance for the fact that some of the markets that we have in mind are far removed from the great war zone; whatever traders there may read regarding the state of things cannot convey to their minds exactly the same impression as that made upon the minds of those who are right "in the thick of things" at home. We have by the pressure of our blockade cut off their supplies of enemy manufactures; we are only able to handle a small part of the export orders that are available, though that small part, as our foreign trade statistics show, amounts to a very respectable total value every month; our continued pre-occupation with munitions manufacturing as well as the tonnage position and the necessity for Governmental regulation in respect of essential materials, prevents us from doing all that we desire; and these would-be buyers in distant lands are apt, as they contemplate their empty stores or depleted stocks, to charge us with indifference to their needs. They are imbued with a burning zeal for British trade progress, are eager to utilise or sell British products, and only under the sheerest necessity can they compel themselves to avail themselves of supplies that other nations are able to offer. They have, in many cases, tried to persuade clients—public and otherwise—to defer their orders until after the war; but sometimes that cannot be done. We believe that the warnings that they offer regarding the after-the-war effects of the prevailing favourable opportunity of neutrals are sincerely offered, and are evidence of a true patriotism; any irritation or feelings of annoyance, or any suspicions that they entertain regarding apparent indifference, will be better understood if we ungrudgingly recognise that fact. We are waging a war for the freedom of the whole world from the powers of darkness, and our friends know that we are anxious to maintain our exports to assist our operations on the financial side, but they are prevented from "doing their bit" in that important connection, and incidentally, perhaps primarily, they are obliged to offer, or see somebody else offer, neutral substitutes to clients many of whom they have previously supplied with British goods. This aspect of the need for maintaining our export trade is an important one, but our friends abroad must not think that it has been lost sight of, either by the Government or by the industry. The difficulty, when the demand is so heavy upon us for all kinds of material and activity, is to reasonably reconcile all these different requirements, assuring the attainment of efficient national organisation without in the process causing too serious a disorganisation of export industry. What seems to be needed at the present time is some action, whether united or individual is for the trade to say, to impress the foreign markets with the fact that we are not leaving things to take care of themselves until after the war; to assure them that we shall have almost infinite export trade capacity when we can devote our greatly increased energies to it; and that we are, or shall be, able to supply from British factories many lines that before the war they could not obtain here. We do not know how far Teutonic competition will count in foreign electrical trade in days to come, but the neutral nations' position may be strong, though there will be an abundant demand in and from all countries, which we confidently believe will occupy

all the manufacturing nations with electrical and engineering work for some years. But while we believe, taking into account everything as far as we can see it, that our advisers abroad are inclined to take a somewhat exaggerated and pessimistic view of the outlook, we think that it would be as well if organised electrical manufacturers were to weigh up the situation, and see whether they cannot do something impressive, and that immediately, to dispel wrong impressions as to their own goodwill, good intentions, and prospective ability.

If in the early days of the war there was a feeling in some quarters that economic conditions would decide the state of things after the war, and that, therefore, no organised effort was necessary, we can certainly say that no such feeling exists in the electrical trade to-day. The weakness now is rather that we are tempted to conceal what we are doing, what preparations we are making, and to hide our light under a bushel. Surely there is room for an impressive and effective publicity, without playing into the hands of either enemy or neutral traders. We have good reason for knowing that the reader abroad is often a far closer student of his trade journal than are some readers at home. In our own case our pages have dealt practically continuously with such subjects for nearly two and a-half years, and the schemes for the organisation of the engineering and electrical industries have been frequently dealt with. It would appear, however, that while this organisation movement at home is proceeding, there is a need for some speeding-up in the local British organisation efforts suited to each particular market. But it may be that the light is hidden from even us at home.

The Ministry of Munitions and Controlled Firms.

THE recent substantial concessions granted by the Ministry of Munitions to the application made some time ago by the Trade Union officials for considerable advances in wages rates, ranking of women workers at the same rates as would be paid to men for doing the same class of work, and other important points, have resulted in no small amount of criticism from employers in the electrical and allied industries.

To arrive at a fair and impartial judgment of a matter of such far-reaching importance, a great variety of interests and considerations must be carefully reviewed. The heavy increase in the cost of living obviously necessitated an increase in the income of the working man. Whether the increased wages have more than covered, or only partly covered, the increased cost of living, we can only judge from official figures, which, in cases of this nature, do not always present a correct reflex of the situation. In most cases, however, it may be fairly said that the increase in wages has not yet exceeded the increased cost of living.

It is not to be supposed, however, that the one consideration should be expected to regulate the other, since it would be obviously quite impossible to raise or lower the rate of wages with every rise or fall in the cost of living. The demands of the workers during the war period for increased wages to meet the increased cost of living have, we think, with some exceptions, been generously met by employers, in consideration of the fact that, for the most part, the employers have obtained increased prices for their goods.

The point of just grievance among employers is not that the workers' demands for more money have been unreasonable, but that too often the increased wages paid have not resulted in a corresponding increase in output by the workers. Indeed, it has been asserted frequently that the output per man in some controlled firms has actually been less since the increases in wages rates were granted.

Recently several important firms controlled by the Ministry of Munitions received instructions from Whitehall to increase further the rates of pay, include the war bonus, which had been paid as a purely separate item, in the rate of pay, and pay all women considered to be doing a man's job a man's rate of pay, regardless of whether or not the job had ever at any time been done by a man, or whether, as was more frequently the case than not, it had always been done by a woman or a girl. The result of the latter provision is that the employer has been compelled to pay at

one stroke increases of 50 to 60 per cent. for the same class of work as was done previous to the control of the Ministry, or equivalent to about 75 per cent. on pre-war rates.

It has also to be borne in mind that whereas the Ministry of Munitions was, we believe, reluctantly persuaded by the Trade Union officials into granting these concessions, no satisfactory safeguards against bad time-keeping, 'ca' canny, &c., appear to have been secured by the Ministry. To those employers who have felt the bad effect of the disrespect, almost contempt, of some workers for the authority of the Ministry, this further omission to grasp the opportunity to tighten up the loose parts which are so greatly impeding the full effectiveness of the vast war machine is far from reassuring.

The imposition of fines for bad time-keeping, &c., appears to have resulted only in benefiting the funds of the Munitions Tribunals; indeed, we are of the opinion that the questionable system of wholesale fining in munition shops, &c., which has been going on for some time past, is far too prevalent throughout the country.

The result of this somewhat accommodating attitude of the Ministry of Munitions to the Trade Unions will be felt more forcibly after the war, when the Ministry releases its control of the establishments. Then the employers will be faced with the serious question of wages adjustment. In consideration, therefore, of the recent important changes effected by the Ministry of Munitions for its own immediate needs, it becomes a matter of vital importance to employers and all concerned to be assured that the Ministry of Munitions is fully prepared to accept joint responsibility with the employers for the readjustment after the war of the changes made by the Ministry during the period of its control.

To leave the employers and workmen to settle this question among themselves after the war would be tantamount to precipitating the most grave industrial conflicts, and, moreover, it would be equivalent to a serious breach of trust on the part of the Ministry.

Central-Station Service.

No one can call in question the patriotism of the men who, whether as managers or subordinates, are responsible for the maintenance of public electricity supply in this country; many of them have made the great sacrifice which marks the very acme of human devotion, many others are fighting in the trenches—good luck to them!—and their colleagues who are prevented by age or public service from joining them, are working long hours and doing double duty to keep the mains alive. But there are limits even to their elastic capabilities, and now that the "comb" is being applied more vigorously, but not always more wisely, the strain in some cases has approached the breaking-point. The supply of electricity is a highly technical undertaking, which cannot possibly be carried on without an adequate number of fully trained men; for such men substitutes cannot be found, and in their absence there is no alternative but to shut down the plant.

The case of Diesel engine stations is particularly hard; the Diesel engine is of comparatively recent introduction into electricity supply, and the number of men who understand the niceties of its working is extremely limited—moreover, almost all of them are young, and, therefore, greatly to be desired of the military authorities. Already we have heard of one Diesel station losing its chief engineer, and we know of another which is faced with the prospect of an inevitable shut-down if one more of its staff be taken. Surely such men come within the clause of the circular issued to the Tribunals last week, which states that "the exceptions to the 26 years of age instruction include men urgently required for work of essential national importance for whom the demand is greater than the supply"—for the work that these men are doing actually includes the supply of electricity for national purposes of the highest importance, and there is no supply of such men to draw upon at all.

It is not for us, however, to direct the policy of the Government; we only wish to emphasise this simple and incontrovertible fact—that if the Diesel experts are removed from Diesel-engine-driven stations, those stations must inevitably shut down.

SOME CHIEFS—VERB. SAP.

By "TRAMP ROYAL."

It was the way I was addressed that made me take the job. Not a well-paid offer and not attractive work. The moment the chief entered at the interview I was on his side; and I stuck there, going seven years through dismal days amidst figures, and sunny days amidst manholes and lattice masts. There was candour and justice written on the stern face, and the greyish eyes were humanely sympathetic. There was no suggestion of the usual chilling remark warning one that "it will depend upon your own efforts whether we keep you," before one has had a chance to play a single card. I always think that remark could be saved for the day of delinquency. Year in and year out there were many discouragements when the "firm" did foolish things, but the anchor at the head always held fast.

Often in trying times an invisible thread will hold us to the bench, board, or desk, and yet it is but a slight trait of the chief that will, under perhaps more favourable conditions, snap the cord of enthusiasm.

There were other chiefs before and since the erect, gray-haired gentleman just introduced. My first, after shaking the filings of the loco. shop off my feet, was a smart, keen business man, always on the alert, and from whom I received many useful hints of a diplomatic nature. I might have been with him to this day, lulled by the whirr—r of Belliss' and Willans' creations, but for the fact that he went to the rescue of a seaside corporation. The replacement of the "old crocks" by modern machinery made breakdowns an almost unknown quantity, so my grip was packed, and I crossed to the land of sauerkraut and helmets, to study other characters and, incidentally, three-phase mysteries. I had a succession of three chiefs here before the *Moltke* took me to New York; but I won't use up scarce paper in describing their excitable ways and close adherence to rules and regulations. My ears still tingle with "Ach, mein Gott! dass dürfen Sie nicht, weil es nicht regelmässig ist"—and there you are! as Dan Leno so often said.

A big American trust or corporation offers little opportunity for one "to get a line" on his boss. The man who "makes use of you" is but the shadow of a chief. It is he who guides your erring footsteps through the labyrinth of card indexes, files, code lists, and vault records. Hang on to him, and be soon "puts you wise to the right dope." He initiates you into those effort-saving devices that husband the gray matter and prevent the headache of a London office. You learn that strenuousness is not efficiency, and that England is the home of the "hustler," regardless of who coined the word.

Two visits to the Pacific Slope, with a 13 years' interval between, give a mental picture of two chiefs, framed in palms and pepper trees, eucalyptus and mimosa, sunshine and earthquake. Snapshot No. 1 is of Southern California, living with the chief in his ingenious bungalow, on the bluff, overlooking the Pacific Ocean with its gorgeous sunsets. He was a Canadian branded with the Yankee spirit, for he had a keen appreciation of quick methods, jigs, templates, and other "stunts." We had happy evenings together, and he did not wear out his welcome by visiting the work continually. In fact, through that winter I was left for weeks on end to revel in a continuous blaze of sunshine (O ye English winters and defective cables!) what time my little gang wrestled with tees, channels, and trifurcating boxes, or balanced tons of machinery on primitive jacks and "horses," some miles way back from civilisation. We improved the shining hours until the evening train was flagged and bore us home.

The other American, with his gaunt figure, long hair, and keen hatchet face, was of quite another type, and ruled with a shrill voice in the city of the great 1915 Exposition. "He was a wise guy, and some boss, believe me." He permeated the routine of the office with the methods of the old school. One slid along in cycles of *laissez faire*, and being pulled up with a jerk, and team work was out of the question.

Then the war came, and one's own country called.

Two other portraits must be placed in the gallery. We meet many engineers of the type which seems to have been weaned with extract of machinery. The cold, phlegmatic temperament, choking-coil demeanour, and studious appearance are often supplemented by a woeful lack of the understanding of human nature and applied psychology. Just such a man was the chief who managed with annoying persistency to mail me a letter on Fridays, detailing work for the week-end. How his staff blessed him, and how they "played him up" over and over again, need no labouring here. At the close of the contract I returned to the London office, and eventually my enthusiasm oozed out and left an aching void, so for the peace of my conscience I quit.

The tramway manager with the heavy moustache and firm, square jaw was a good leader of men, and knew how to work the gang up to "He's a jolly good fellow": but he had the fear of the Councillors in his soul, and a habit of interfering at breakdowns while the music was played to $x = \frac{1}{2} a/(a + b)$. His sense of humour was the balm that soothed the chafed and jaded spirit.

Chiefs embody every phase and type of human nature, and therefore these few reminiscences make but a fringe.

THE BONDING AND ANCHORING OF ELECTRIC CABLES.

By S. G.

THE bonding and anchoring of electric cables did not, until a few years ago, receive much consideration; but since then the matter has been engaging the special attention of cable engineers, particularly mining engineers.

To the mind of the engineer who deals with "larger things," such as engines, generators, &c., this bonding and anchoring of cables would appear a very trifling matter; but experience on cable work has proved that it is a subject which requires very careful attention, especially when the cost of the cable is taken into consideration.

Many are the designs put forward on paper, but few are adopted. It is not the writer's intention in this article to boom any particular design as being the most practicable, neither is it intended to state which manufacturer brings out the best design. The subject is one on which very little has, up to the present, been published, and the illustrations, with their accompanying comments, are for the benefit of designers, manufacturers, and users alike. The figures, of course, do not represent every possible design, but only a number of selected examples.

It would be well to point out that when getting out designs of this particular class of gear, the designer should always bear in mind that, for "armour grips" especially, *strength* is one of the main requirements to provide for, and, whatever method is adopted, he should make certain that the armouring will be "gripped" properly and a solid job made of it—not only an electrical job, but a good mechanical one, in the very essence of the word—otherwise serious trouble will be the outcome.

With regard to mining work, one often hears the yarn about the collier venting his spite on electrical apparatus and driving his pick into anything electrical that he comes across. This yarn has almost had its day, and is very often "pitched" by persons who like to give one to understand that they are fully acquainted with "underground" conditions of working, yet have never even been in close proximity to a colliery. The writer has known of several instances where this tale has been pushed down the throats of draughtsmen, and would suggest that the actual designers should have opportunities, which are at present mostly denied to them, of going to the job and ascertaining what is required.

The writer's experience in mining work is that the conditions are not quite so black as they are painted; at the same time, he would emphasise the fact that everything

used in the workings must be designed for strength, and only the best materials must be used.

FIG. 1.—Illustrates, perhaps, the oldest method, and one which is used a great deal at present, of bonding the lead sheathing of the cable to the cast-iron box. The lead or copper tape is secured to the box between two brass washers by means of a brass screw. The tape is soldered to the lead sheathing of the cable. This method of bonding is simple and cheap, but care must be taken to solder it properly.

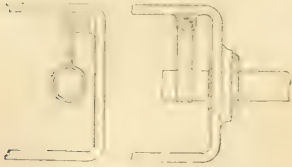


FIG. 1.

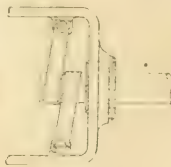


FIG. 2.

FIG. 2.—Illustrates an improvement on fig. 1, the bonding tape being wrapped around the cable and secured at both sides of the box.

FIG. 3.—Illustrates how the lead sheathing of the cable is bonded by means of a cast lead or alloy bush fixed between

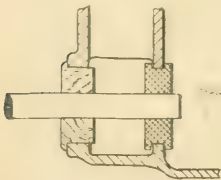


FIG. 3.

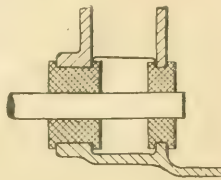


FIG. 4.

the two halves of the box. This method of bonding is also cheap, and is effective provided the lead bush fits the cable properly and the two halves grip the cable tightly when the parts of the box are bolted together.

FIG. 4.—Illustrates an improvement on fig. 3. A cast lead or alloy bush is provided for both the inner and outer wall of the box.

FIG. 5.—Illustrates a very cheap method of bonding. The holes in the glands of the box are a little larger than the lead of the cable, and are made up with lead tape, as in fig. 6.

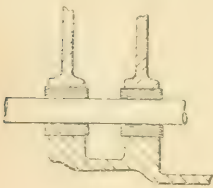


FIG. 5.

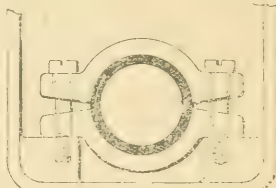


FIG. 6.

FIG. 6.—Illustrates how the lead sheathing of the cable is bonded by means of a pair of malleable or gun-metal castings. The hole in these "grips" or "bonds" is slightly larger in diameter than the lead of the cable. Lead tape about 1/16 in. thick is wrapped around the cable to such a diameter that when the bonds are screwed down to the box the cable is gripped perfectly tightly.

FIG. 7.—Illustrates a type of gland which is usually used



FIG. 7.



FIG. 8.



FIG. 9.

for rubber cables. This gland can be used for lead-sheathed cables if desired, the packing material being lead wool.

FIG. 8.—Illustrates a similar gland to fig. 7, but two glands are used instead of one.

FIG. 9.—Illustrates a similar gland to figs. 7 and 8, an adapter being used.

FIG. 10.—Illustrates how the lead of the cable is plumbed on to a brass wiping gland, the gland in question being secured to the box by means of set-screws.

FIG. 11.—Illustrates a similar gland to fig. 10, with the exception that it is screwed into the box in order to make it watertight.

FIG. 12.—Illustrates a similar gland to fig. 11, but suitable for either steel tape or wire armouring, the bulb on the

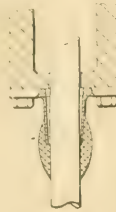


FIG. 10.



FIG. 11.



FIG. 12.

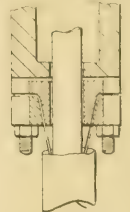


FIG. 13.

gland being an extra precaution for preventing the armouring from being pulled out of position.

FIG. 13.—Illustrates a wire armour grip made of either cast-iron or malleable iron. The wires are gripped between the male and female cones. This method is a very good one provided the cones fit the armour wires properly.

FIG. 14.—Illustrates a similar gland to fig. 13, but the end

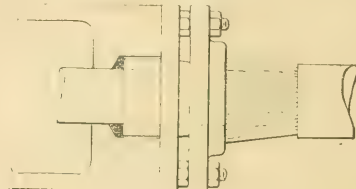


FIG. 14.

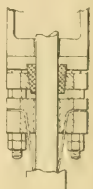


FIG. 15.

of the gland which fits into the box is arranged for a packed joint, spun yarn or other suitable material being used for bitumen cables and lead wool for lead-covered cables. This type of grip is often used in mining work.

FIG. 15.—Illustrates an improvement on fig. 13. The lead sheathing is bonded by means of a lead cone bond, and the armouring is gripped between the male and female cones. If desired, the lead cone grip could be cast solid with the male wire armour grip.

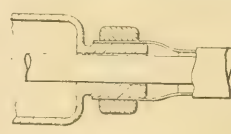


FIG. 16.

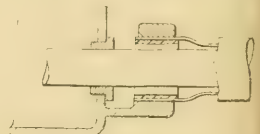


FIG. 17.

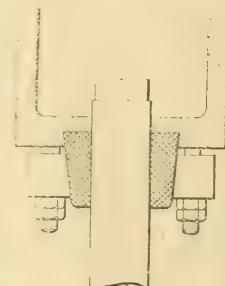


FIG. 18.

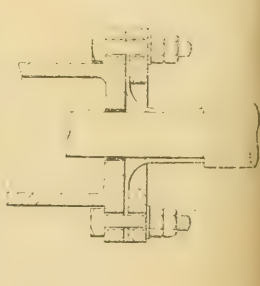


FIG. 19.

FIG. 16.—Illustrates how the armouring is gripped on to a trumpet cast on the end of the box by means of a pair of cast-iron or malleable iron clamps. With this arrangement there is a tendency for the armouring to pull out of place.

FIG. 17.—Illustrates how the armouring is gripped on to a steel ferrule or tube by means of clamps, as in fig. 16.

Fig. 18.—Illustrates how the lead sheathing is bonded to the box by means of a lead cone gripped with a strong cast-iron grip. This is a very effective bond.

Fig. 19.—Illustrates how the armour wires are gripped to the box by means of a cast-iron ring. With this arrangement it is not necessary to remove the outer serving of the cable very far.

Fig. 20.—Illustrates how the end of the cable can be gripped in the case of a cable which has to be suspended at the pit

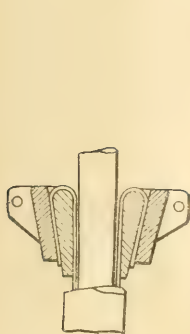


FIG. 20.

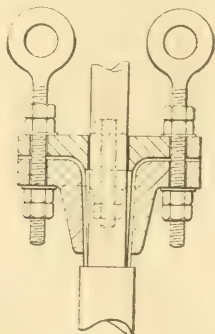


FIG. 21.

head. It will be observed in this design that the cable is suspended by its own armour wires, the wires being bent over the loose cone piece.

Fig. 21.—Illustrates an improvement on fig. 20. The eye-bolts can be fairly long to allow for tightening up.

FUEL ECONOMY.

In the *Sheffield Daily Telegraph* of November 15th the subject of electric power supply to meet the city's enormously increasing demand was discussed with special reference to the question whether the generating station should be situated in Sheffield or in the neighbourhood of the collieries.

Prof. W. G. Pearnsides, of the University of Sheffield, who is engaged on a study of the coal measures of the district, has devoted special attention to this problem, and has suggested two schemes for a central station.

At a meeting of the Sheffield Society of Engineers and Metallurgists, last April, he distributed copies of a map (which we reproduce), showing the location of the collieries, marking especially those possessing by-product coke ovens of a modern type, and suggesting a site between Wombwell and Wath as a very suitable one for a generating station. He now goes further than this, and suggests, for the future, the erection of a great generating station near Doncaster, which would make its electricity from the second-grade portion of the Barnsley coal which is now left unworked in the pits.

In an interview with a representative of the newspaper, the Professor went fully into the matter. "Sheffield," he said, "is the capital of the main fuel-producing area of the North Midlands. It is not in the centre of that area, but on the western edge. The direction in which the coal field is being depleted is from west to east. The zone of maximum production has now got eastwards, about as far as Mexborough, and it is progressing further in that direction year by year.

"To transport fuel by truck, in my opinion, costs more than to carry by cable the electricity which that fuel can be made to produce. The half-crown which is required to bring each ton of coal up from the centre—say, Mexborough—into Sheffield, were better devoted to paying interest on the capital required to build the trunk cable line.

"There are at present two great unutilised sources of fuel which ought to be converted into power. The source with which I dealt in April, the distribution of which is illustrated on the map, is the surplus gas produced by coke ovens. The coke-oven industry is especially active in the district where the Parkgate seam is worked, and there are half a score coke-oven plants,

each representing a group of collieries, situated within a five-mile radius of the 'starred' site between Wombwell and Wath.

"Wherever by-product coke ovens are worked, there is an evolution of gas averaging 12,000 cb. ft. per ton of coal carbonised. That gas is equal in calorific value to the best Sheffield town gas. In ovens of the regenerative type, half of the gas is required to carbonise another ton of coal, and half is surplus.

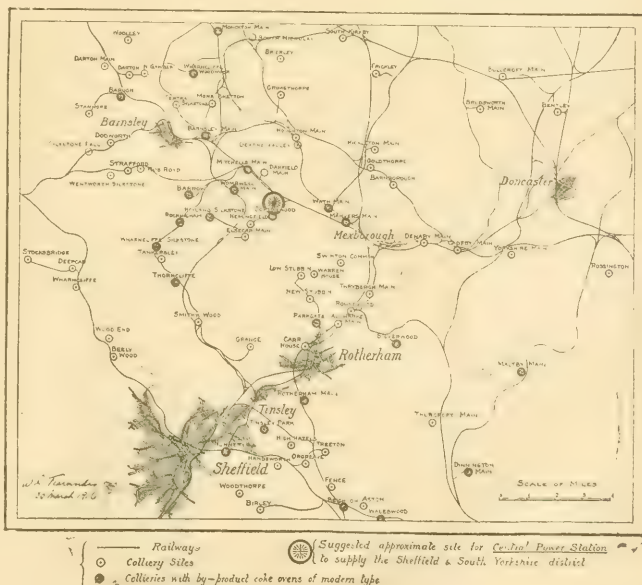
"My suggestion was that this surplus gas should be conveyed in pipes from the ovens to the central power station, where electric power could be produced from it. I estimate that there are more than 20,000 kw. immediately available from that source. I quite recognise, however, that that is not big enough for Sheffield. If linked up with the Yorkshire Power Co. station at Barugh, near Barnsley, the two, together with the present Sheffield supply, might meet immediate needs. But the growth of the use of electricity is enormous. I anticipate that the demand in Sheffield may rise to a quarter of million kw. within the next decade.

"In order further to meet this demand, I suggest the use of the inferior portions of the Barnsley seam, which at its maximum rate of production is worked further to the eastward. Owing to roof requirements, liability to spontaneous combustion, low selling price, and other disabilities, this second-class coal, which overlies the 'hards', often to a thickness of 4 ft. and more, is seldom won, and, under present conditions, broken by the accidents inseparable from deep mining, is allowed to remain and become buried in the goaf.

"A characteristic of this coal is that if it is brought up and piled in a heap at the pit-top, it always heats. If, however, it could be screened and washed, and then put straight into trucks and taken to some big central generating station, where it could be used the same day, it would give almost as great a number of units of heat per ton of coal burnt as will the best fuel that comes to Sheffield.

"There is in this district, easily accessible, enough coal of this class to generate electricity in large stations to the extent of hundreds of thousands of kilowatts. It is not worth while to mine the coal now, because it cannot be got rid of without a great deal of trouble to the selling departments of the mines. Any big quantity of it could only be raised by co-operation between the very large collieries which are working in the area nearer to Doncaster than to Sheffield. The line of maximum production now passes about north and south between Conisborough and Mexborough. The production east of that line is increasing, and will continue to increase. West of that line, production is diminishing, and cannot be increased. Therefore, a central power station to use this supply of fuel should be located not nearer to Sheffield than the line of maximum production which we have mentioned, and the current could be sent, at no great cost per unit, from that station to Sheffield.

"For the generation of electricity in large units by the only method which has yet been proved to be perfectly satisfactory on a large scale—boilers to raise steam which is used through turbo-generators—much water is required. For generating sets making hundreds of thousands of kilowatts, the quantity of water flowing over the Wicker weir in dry weather is insufficient, and it does seem necessary that, for the purpose of condensers, a site down



FUEL RESOURCES IN THE SHEFFIELD DISTRICT.

stream, below the confluence of the Don and the Rother, should be found. The further we go down stream, the more water becomes available, and when units grow, this is a matter which will have to be carefully considered.

Any really efficient scheme for utilising the Barnsley coal would place in the hands of producers which make gas for firing the boiler, this system has a great deal to recommend it from the point of view of national economy. The ammonium sulphate which is recoverable by washing raw gas with acid before it goes to the boiler is sufficient to defray the costs which the utilisation of producers will demand. Gas also is a material which can be fired in the place where it is wanted, which travels in pipes under pressure, and which needs neither a shovel to feed the fire nor a cart to take away the ashes. The time has come for the use of gas and the application of electricity to take its proper share in the economic life of our manufacturing community.

THE INTERNAL-COMBUSTION ENGINE.

By DUGALD CLERK, F.R.S.

(Abstract of paper read before the ROYAL SOCIETY OF ARTS.)

In the development of internal-combustion engines we have borne our full share of pioneer work. The subject is one to which I have devoted much attention for the past 40 years, which have seen a marvellous development of the gas engine, and an extension of the use of different fuels has caused the old title "gas engine" to disappear in favour of the more general term "internal-combustion motor," lately shortened to "combustion motor," which includes all engines known as gas, petrol, and oil motors.

The total power generated by internal combustion in the United Kingdom in 1907 was:—

	Horse-power.
In factories, stationary gas, oil, and petrol engines	680,177
For agriculture, stationary gas, oil, and petrol engines	98,785
For motor-cars and cycles	750,000
	1,528,962

In Germany at the same time the total power generated by internal combustion was:—

	Horse-power.
In factories, stationary gas, oil, and petrol engines	351,000
For motor-cars and cycles	180,000
	531,000

The census of production of the United States of America for 1909 shows that there were in use 1,299,021 H.P. of gas and gasoline engines for the stationary work of manufactures and mines.

Nearly 115,000 motor-cars were produced in that year; this, with the vehicles in use, required engines of a total of about 1.2 million H.P., so that the total combustion power for the United States was certainly not short of 2.5 million H.P.

Allowing for the increase of Britain and Germany from 1907 to 1909, a probable value for the total combustion power of the three nations in 1909 is five million H.P.

In 1909 France had 46,000 motor-cars in use of an average of about 13 H.P., or a total of 598,000 H.P.

The power of stationary combustion engines in France is not available, but the four countries show a total of at least 5½ millions in 1909.

This figure does not include oil and petrol engines used for marine purposes, which probably brings the total up to six millions.

In 1909, then, we find at least six million H.P. of gas, oil, and petrol engines in the world, a truly great development since 1876.

In addition to internal combustion, all these engines have another feature in common—all compress the working fluid before combustion; some compress an inflammable mixture and fire the compressed mixture, producing a mild explosion with a strictly limited possible rise of pressure; some compress air alone and then mix at the temperature of compression the inflammable gas or vapour and ignite as before; and some compress the air charge so highly that on the injection of oil fuel in a state of very fine spray the heat of compression causes the ignition of the spray as it enters the cylinder—such engines do not produce an explosion; the pressure within the cylinder never exceeds the pressure of compression or the pressure of the compressed air sometimes used to pulverise or disperse the liquid oil.

Two mechanical cycles are in general use: in one the motor piston and cylinder alternately act as pump and motor, so that four single strokes are necessary; in the other these operations are performed in two single strokes of a piston; air or the charge, however, has to be pumped and lightly compressed by a separate lighter piston or by the front of the motor piston.

This feature of compression before ignition is necessary in order to provide an economical engine expanding the gases of explosion in the most favourable manner, and at the same time producing large power for small bulk. This mode of operation was described in Wm. Barnett's Patent No. 7,615 of 1838.

M. Alph. Beau de Rochas, a brilliant Frenchman, in a remarkably clever pamphlet published in Paris in 1862, described four conditions as necessary in order to obtain the maximum economy in a compression explosion engine:—

1. The greatest possible cylinder volume with least possible cooling surface;
2. The greatest possible rapidity of expansion;
3. The greatest possible expansion; and
4. The greatest possible pressure at the commencement of the expansion.

Beau de Rochas' proposal had to wait for 14 years before it was put into successful practice by the late Dr. N. A. Otto, of Cologne, in the year 1876, when he produced the first commercially successful gas engine utilising the idea of compression before ignition, first proposed 35 years before by the English engineer Barnett, applied by the means of the cycle of operations due to Beau de Rochas.

Although in 1861, Schmidt in Germany and Million in France described compression engines with separate compressing pumps, no two-stroke engine appeared in public till 1879, when I exhibited my first compression gas engine at the Kilburn Show of the Royal Agricultural Society of England.

At the time when I was experimenting with two-stroke engines in Glasgow, a Northumberland man, the late Mr. James Robson, was busily at work on compression in this district. His first patent is dated 1877, No. 2,334. It describes an engine of the non-compression type; but he produced a two-stroke engine with compression, under patents dated 1879 and 1880. Messrs. Tangye, of Birmingham, produced an engine with Mr. Robson, which was first exhibited in public by them at the end of 1880.

Messrs. Sterne & Co., engineers, Glasgow, built and sold large numbers of Clerk type two-stroke engines, and Messrs. Tangye, of Birmingham, a large number of Robson engines. The test of use and time, however, proved the four-stroke engine to be best adapted for most purposes, and by far the largest numbers of internal-combustion engines in existence operate according to this cycle.

Many of the larger gas engines in Germany and America operate upon the Clerk modification of two-stroke compression engine as adopted by Messrs. Koerting, of Hanover, and their licensees. In the inquiry made in Germany referred to already, it was proved that 260,000 brake H.P. was produced in that country in the year 1907 by four-stroke engines, and 91,000 brake H.P. by two-stroke engines.

A modification of the Robson two-stroke engine was made in England by Mr. Day in 1891, in which a crank case was used as the pumping chamber, and the piston, by means of three cylinder ports, performed all the necessary valve operations. This form of engine is largely adopted in America for launch propulsion; some motor-cars also used it.

Five reports have been published by the British Association summarising investigations on the gas engine.

Germany has also carried out some investigations, and most valuable French work has been also done; some American work has also been performed, but undoubtedly the English work on the nature of gaseous explosions has proved of vital importance to the science of this subject.

While in Germany engineers paid great attention to larger cylinder engines, England was busy developing the smaller types adapted to use heavier oils, such as kerosene and paraffin. The first engine to attain success as a kerosene or paraffin engine was produced by Messrs. Priestman, of Hull, in 1835. Mr. Stuart Akroyd, in his patents of 1886 and 1888, described an engine which, in the hands of Messrs. Hornsby, has taken a most important position.

One set of experiments made by me at Messrs. Tangyes' works in Birmingham possesses special interest. No gas was added to the air until compression was complete. The engine was a flame-injection engine in which explosion was avoided altogether; it ran for six months and many tests were made. Five years later Dr. Diesel, the distinguished German inventor, began work on an engine in which he injected a fine oil spray into highly compressed hot air. The spray at once ignited, and a diagram very similar to the early Clerk diagram was produced, but at a much higher pressure with greater expansion, and therefore much greater economy.

The Diesel type of engine, with its high compression and automatic ignition, used for the first time very heavy oils in a most effective way. Although it has taken an important place, and will continue to occupy an honourable position, its advocates have rather exaggerated its possibilities. For stationary purposes undoubtedly gaseous fuel prepared from coal or carbonaceous matter will maintain the leading position.

Had coal gas been the only fuel possible for the internal-combustion engine, it could not have attained its position of to-day. In providing other gases for this purpose England led the way. Mr. J. E. Dowson constructed a gas producer, using anthracite, which he first exhibited operating a Crossley gas engine in the year 1881 at the York meeting of the British Association.

England, too, led in the use of bituminous fuel producers; the late Dr. Ludwig Mond devoted much effort to the production of large plants capable of gasifying bituminous fuels. In the larger plants devices were included for the chemical recovery of ammonia and the production of sulphate of ammonia, and many large installations of gas engines are now in operation up to about 3,000 H.P. using gas from Mond plant.

An English inventor, the late Mr. B. H. Thwaite, in 1895 made an important experiment in the application of the waste blast-furnace gas to the purpose of power production. His first plants were installed at the Glasgow Iron Works and at Barrow-in-Furness, and the idea was soon taken up at the great Belgian works of Messrs. Cockerill. There the large cylinder gas engine was first developed. The large cylinder movement has undoubtedly prospered more on the Continent and in America than in this country. The extent of the trade, however, is not very great compared to the trade in small cylinder engines.

Of the German inventors, Daimler's merit consisted in his appreciation of the high-speed four-stroke engine of small dimensions, and his little petrol motors were rapidly adopted by Germans, French, and Belgians to the purpose of motor-car propulsion. England, unfortunately, was hampered by an absurd law, which was not repealed until 1896, so that after that date Britain rapidly gained headway in the construction of the very small cylinder petrol engine, and its designers and scientific investigators shared fully in the modern development of the motor-car and the aeroplane. The aeroplane became practicable by the genius of the brothers Wilbur and Orville Wright in the United States in the year 1906. They were the first to successfully apply a petrol engine to a mechanical glider.

CORRESPONDENCE.

Letters received by us after 5 P.M. on TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Economics and Trade.

In your issue of November 17th you referred in your Editorial to Mr. James Swinburne's lecture on "Science and Industry," and expressed surprise at his belief in "the truth and virtue of economic theory." I have read with pleasure from time to time your Editorials on the necessity for a new spirit after the war, but how is this to be realised unless the economic question is squarely faced?

Free Trade, the great fiscal fallacy of last century, is the fetish of a chosen few in our country. The rest of the world, and many of our best here, believe that wealth is due to production, and that to buy from abroad what you could produce at home at the same, or approximately the same, price under similar conditions, means the enriching of a few importers and some manufacturers to the detriment of the country generally.

The Free Traders' explanation of our inability to meet unfair competition is lack of education, but rather does this lack of education explain the foolishness of the electorate in allowing Free Traders to dictate the country's policy.

Producer.

Final-Grade Classes in Electrical Installation Work.

In the middle of our letter in last week's issue your compositor made us say that there were "hundreds of thousands" of individuals waiting for tuition. Our typed letter said "hundreds or thousands."

This unfortunate slip converts our true statement into one of gross exaggeration, and affects the rest of our communication: so we should be obliged if you would insert this correction.

A. P. Lundberg & Sons.

December 1st, 1916, London, N.

[We regret the mistake, a typical "printer's error," but hope that it was obvious to the reader.—EDS. ELEC. REV.]

Paralleling of Electric Power Stations.

I really am at a loss to understand the necessity of papers being read on the enormous difficulties in the way of station engineers who are suggesting linking-up.

Paralleling of power stations has been in vogue in America for many years without any very terrible disasters having occurred. For the last 12 years I have been running power stations in Sheffield paralleled at 2,200 volts, two-phase, and for the last five or six years I have paralleled with these a power station at 11,200 volts, three-phase. The only thing I have found necessary has been to put in a booster which operates either positive or negative on the interconnector between the power stations, and there has never been any trouble whatever.

S. E. Fedden,
General Manager.

Electric Supply Department, Sheffield,
December 2nd, 1916.

Between Two Stools.

"Victimus" is not the only one suffering under "The Defence of the Realm Act." I myself was hauled up before the superintendent of a tramway company, for whom I had worked for 17 years, and told to my face that he took me for a German spy, and that I looked like a German. I retorted that I looked like what I am—a British

North countryman. I produced a copy of my birth certificate, and he said that was, to him, merely a piece of paper. The superintendent of police was satisfied with my credentials, and wrote him to that effect. Several influential gentlemen in the town interviewed him on my behalf, but he would not withdraw his statement. I was discharged without notice. I have now been shift engineer at the municipal electricity works, in the same town, for the last 12 months, badged "On War Service," my employers knowing why I was discharged from the tramway company. It is evident that he (the tramway superintendent) has been made a tool of by some unscrupulous person.

Dunelmian.

Power Station Design.

Referring to your article of November 24th, suggesting the direct supply of coal to stoker hoppers from outside storage, this has long been practised in small and medium-sized boiler houses.

A simple monorail runs around the boiler house, carrying a series of suspended buckets, which are filled either from the coal pile or from outside bunkers, and discharged by gravity to stoker hoppers of the normal size; there is no power cost and no obstruction, and where headroom for overhead coal bunkers is lacking, this monorail system is both cheap and convenient.

The three-boiler plant illustrated in your "Notes" for November 17th, and shown more fully in *Power*, September 19th, 1916, has plenty of space for overhead bunkers holding several hours' supply, and thus giving continuous gravity-feed to normal-sized hoppers of stokers.

Instead of following this highly-desirable practice, the method adopted for this three-boiler plant is to use a bulky travelling crane, transporting back and forwards a single 2 cb. yard coal bucket, which probably holds only about one ton of small coal, and this one bucket has to discharge the coal to three gigantic hoppers, said to hold 55 tons of coal each. These huge hoppers are really bunkers in a very undesirable position, close to the fronts of boilers, with intermittent instead of continuous supply.

Apart from the undesirability of bunkers in such a position, it is clear that the great majority of boilers need front access to the tubes, and could not possibly store coal in bunkers obstructing the tube doors.

Scrutator.

November 30th, 1916.

[The American plant referred to was quoted by us as an example of modern design by such well-known engineers as Messrs. Sargent and Lundy; if the boiler type had been such as to necessitate front access to the tubes, no doubt the crane would have facilitated the dismantling of the hoppers, the arrangement of which was presumably adopted with good reason.—EDS. E.R.]

"Summation-watt" Capacity of Field Rheostats.

I heartily agree with the last paragraph of Mr. Boothman's letter in your current issue, in which he quotes words used by Mr. Carter, that "The use of a formula without care and intelligence is certain to lead, sooner or later, to disaster." My contention all along has been in accordance with this principle.

I note that for a 10-ampere, 20-volt machine the figures given by Mr. Boothman work out right; I quite agree with this, but would point out that such a machine is rather an extreme case. I had in mind, however, a potentiometer resistance used, for example, in conjunction with rotary converters.

I think if Mr. Boothman will check my figures for such a rheostat, he will agree that they are correct.

Charles C. Garrard.

Birmingham, December 2nd, 1916.

Breakdowns of German Plant.

With reference to your leader and the article in the current issue under the above heading, as you invite additional illustrations of the failure of German plant, we have pleasure in giving you the following. This also relates to the Shanghai Municipal Council, but Mr. Aldridge evidently dealt in detail only with the turbo-alternators in making his report:—

In November, 1913, we secured an extensive contract for the installation of the extra-high-tension three-core cables (W.P. 11,000 volts) against very keen German competition. The actual installation of that cable was carried out between April, 1914, and December of that year, and during the progress of the work we had to withdraw and re-lay a considerable quantity of German cable which had given trouble. The principal cause of the trouble was the very inferior method of joining extra-high-tension cables adopted by the Germans, and not owing to the construction of the cables. However, our engineer in charge of the contract, having an opportunity of examining the German cables, was of the opinion that the insulation was greatly inferior to that of British cables, and that the "life" of the German cables was not likely to prove anything near so long as a cable manufactured to the usual British standard. The jointing of the German cables was carried out solely with the object of getting the work through cheaply and quickly. The joints were made with a clamp fitting and grub screws, and the sweating of the joint, which British manufacturers consider to be essential, was entirely absent. The joints were not properly insulated or finished. They were not "staggered," and there was very little clearance between the cores. The German joints were merely encased in a cast-iron box of a very inferior design, which was filled with compound. Consequently the lead sheathing of the

cable was not exposed to the slackness of the compound for holding it in place against the strains of expansion or contraction in the cable itself. The amount of work and skill required for the construction of such a joint as compared with the British-made joint is very small.

The following is a description of the usual method adopted by the British manufacturer.

The conductor is first joined on the telescopic principle, by which the various layers of wires making up the conductor are cut to different lengths. On one length of cable the centre wire is cut shorter than the next layer, the wires in each succeeding layer to the outer layer being longer than the layer underneath them. On the other piece of cable the wires are cut in exactly the opposite manner, so that the centre wire is longer than the layers above it, and each succeeding layer is correspondingly shorter. Thus the conductors fit into each other in a manner resembling a plain and socket. The conductor is then tightly bound with fine wire, and the whole joint made solid with molten metal. After the conductors have been joined they are insulated with special tape to a thickness greater than the original diameter of the insulated cores.

Before commencing to make the joints in the conductors a sufficient amount of the sheathing is cut away to permit of the joints being "staggered"—i.e., made in different positions, so that no joint is directly alongside another. This, of course, entails more work in freeing the insulated conductors, and more material to re-sheath the joint. After the joints have been thoroughly insulated, a lead sleeve, which must be of the correct diameter, and which has been previously slipped over one length of cable, is brought into position and properly joined by a plumber to the original lead sheathing by means of a wiped joint. Insulating compound is then poured into the lead sleeve through a hole left for the purpose the hole being afterwards properly plugged and the joint further protected by means of an iron protecting box. This box is, of course, much bigger than the German box, owing to the much greater length of joint produced by the British method of "staggering" the joint.

We think that you are doing a good service to the British electrical industry by giving wide publicity to the flaws that undoubtedly exist in German plant. The principle of "good enough" is one which the Germans evidently adopt towards their customers, particularly customers abroad, so long as that principle will enable them to cut their prices low enough to get the order, and also make a much larger profit than their scrupulous British competitor. The general run of reputable British firms believe in giving their customers only that which would be good enough for themselves; and when buyers are tempted by an offer of something cheaper from abroad, it would be well for them if they remembered this fact.

W. T. Henley's Telegraph Works Co., Ltd.

W. Bishop, Manager, Sales Department.

London, E.C., December 4th, 1916.

How Electricity is Stolen in Shanghai.

I enclose the following letter, which is rather a gem in its way. It is written by an informant notifying this department that the man referred to in the letter has been stealing electricity for a number of years. Investigations proved that the consumer had, by an ingenious contrivance fixed on the door of his house, so connected the shunt-wire leading to the meter, that when the door was open the shunt would be in circuit and the meter registering, so that whenever the meter inspector called to examine the meter it would appear to be working in order. When, however, the door was shut, the shunt circuit was broken, and so the meter would cease to register. He had carefully concealed the connection where he had broken the shunt-wire behind a partition, and the two ends of the wire were connected on to a spring contact fixed behind the door.

In the past I had considerable difficulty and trouble with the older type of meters with the separate shunt connection, as the Chinese soon learnt that by cutting the shunt wire the meter would cease to register, but for several years now all the meters have had both main leads taken in and out of the meter with the shunt connection made inside the meter, which is sealed, consequently the opportunities for interfering with the registration of the meter have been reduced to a minimum. The case in point to which the enclosed letter refers was effected in an installation where the old type of meter, having an external shunt wire, was installed.

T. H. U. Aldridge,

Engineer-in-Chief and Manager.

Electricity Department, Shanghai.

November 14th, 1916.

COPY.

Shanghai November 4th, 1916.

Mrs. S. M. L. Day.

To whom it may concern.

"Gentlemen,—Being informed truly that a Chinese named F. M. Tsen Wai, who has been using your electricity for last 15 years in his house (F47, Bubbling Road); during that time the lamp of his house, about 14 lamps at 100 c.l. each lamp. They were perfectly whole, steal and the wires hid in the ceiling; afterwards he knew somebody against him, thus made him fear to be caught, so he at once change all the 100 c.l. lamps into 50 c.l., and asked you put a watch, but still the lamps of his bedroom (down stairs east side) without thought pass the watch.

"Every day when night has come the dweller will light the lamp and open the watch cork that was in vain, because he has

put another cork in his sleeping bed (the wire from ceiling) must open steal-cork first then got light. You will find and count his payment fee agree the watch or not. They are 14 lamps of 50 c.l. each, and every lamp lighting at sun sits time to next morning; this is how you may inquire the dwellers.

"I am quite sure, he still in stealing. I hope you will go and catch it as soon as possible.

"I am very true,

"Your faithfully servant,

"RICHOSMANN.

LEGAL.

THE RATING OF ELECTRIC TRAMWAYS.

APPEAL BY THE L.C.C.

(Continued from page 569.)

AT the County of London Quarter Sessions, at Clerkenwell, Mr. A. P. Lawrie, K.C. (Deputy-Chairman), and another magistrate resumed the hearing of the appeal by the London County Council against the quinquennial assessment by the Assessment Committee of the Holborn Union of tramway lines in the Boroughs of Holborn and Finsbury. The thoroughfares in which the lines are situated include Clerkenwell Road, City Road, Gray's Inn Road, Rosebery Avenue, and Old Street.

Mr. Walter Ryde, K.C., and Mr. E. M. Konstam appeared for the County Council, while Mr. Clavell Salter, K.C., M.P., and Mr. W. J. Jeeves represented the Assessment Committee.

The facts showed that the rateable value fixed by the Overseers was £16,932, which was reduced by the Assessment Committee on appeal to £13,818, and the County Council now claimed that it should be further reduced to £6,960. This sum included £810, which had been agreed by the parties as the value of the Holborn electrical sub-station. The gross value had been fixed at £32,055, and the Council claimed that it should be reduced to £25,197.

Evidence was now given by MR. H. VORLEY, accountant for the tramways, who admitted, in cross-examination by MR. CLAVELL SALTER, that in the first six months of the current account year, down to the end of last September, the receipts showed an increase over the six months ended Michaelmas, 1915, of £134,937. The 1915 figures, however, included the strike period, during which the Council lost £100,000 in receipts.

MR. JOSHUA K. BRUCE, deputy chief officer of tramways, said the receipts per car-mile were lower in the Holborn Union than over London generally. The costs outside would probably be lower. Slow speed increased the cost of operating cars, and in consequence of the speed being much lower in the Holborn Union than on the remainder of the system, 17 more cars were required. It was the almost universal experience that as a company or public authority improved a tram route the more money was taken. The longer the route the better value per car-mile.

MR. DONALD DIXON, president of the Rating Surveyors' Association, giving evidence in support of the appeal, said that in the recent quinquennial valuation he advised the Assessment Committees of the Boroughs of Stepney, Bermondsey, Camberwell, Deptford, Greenwich, Lewisham and Woolwich, and agreed the aggregate rateable value of the lines in those boroughs at £51,544. The receipts in those seven boroughs, according to returns given to him by the County Council, were just over a halfpenny per car-mile in excess of the average of the whole system. Witness proceeded on that basis, and he thought that any departure from it would lead to unutterable confusion. In regard to the receipts in the seven boroughs, he allowed a prospective increase of 5 per cent. because of the reduced "bus competition." In his valuation of the lines in the Holborn Union, he took the total car-mileage for 1914-15 at 3,444,331, and the total receipts at £131,712. He added to the receipts a prospective increase of 5 per cent., equal to £6,586, making a total of £138,298. He calculated working expenses—power, traffic, general war bonus, &c., repairs and renewals—at £7453 per car-mile, and deducted £049d. for advertisement receipts, leaving £7404d. per car-mile, which gave a deduction of £106,258. He made other deductions, usual in such a case, and arrived at a rateable value of lines of £4,562. Witness added that on the principle he had adopted there was no danger of a part of the system being rated at a greater value than the whole. Departure from the principle would mean that the Council would be rated at a greater sum for the whole than the valuation of the whole showed.

This concluded the case for the County Council.

On behalf of the Assessment Committee, MR. CLAVELL SALTER submitted that the parochial receipts in the parishes in question must be assumed to be considerably in excess of the average of the system, which was 9.5d. per car-mile. He would call evidence to show that these routes were more lucrative at their London end than at their northern and north-eastern ends. No rating Court was ever excused from making the best estimate it could by reason of the fact that the materials before it were scanty and unsatisfactory. Rating, he believed, meant estimating; the whole basis of the thing was estimate; and he suggested that the Court should make such an addition to the figures arrived at by the County Council as would give what the Court considered to be the actual receipts in each parish.

MR. W. H. EVE, surveyor of Union Court, E.C., gave evidence in support of the assessment, and arrived at a rateable value considerably in excess of that fixed by the Assessment Committee.

He had added 1½d. per car-mile to the average receipts of each route, and applied the amount thus reached to the parishes in question, on the ground that the earnings of the tramways in the Holborn Union were greater than on the routes outside. There were many halfpenny fares in the union on a basis of a higher rate than outside.

THE DEPUTY-CHAIRMAN: I think it is an important point that higher fares are paid where passengers are scarce.

MR. E. M. LACEY, consulting engineer, of Westminster, also gave evidence on behalf of the Assessment Committee. In cross-examination, he said he thought £70 or £80 would be a fair figure to allow for the repair of a car on the conduit system. The Manchester and Salford systems were the nearest parallel in this country to the London cars.

MR. RYDE: Your renewal fund is much below what the Council has actually spent. Here we have miles which have only been down three or four years, and yet we have largely exceeded your estimate.

MR. LACEY: Some years you spend more than in others in renewals. Most of the rails have some years of life yet. The witness added that he did not think there was much difference on the question of lives between him and Mr. Welling, the permanent way engineer of the tramways.

MR. RYDE: Have you fixed your renewal fund on the basis that you can renew steel rails at £7 per ton?

MR. LACEY: £7 a ton was much above the average of the previous seven or eight years, and much above the average the County Council have paid for their rails. I am prepared to admit that steel prices may not go back to the normal for some considerable time after the war; on the other hand, they may. Owing to the better organisation of our works generally throughout the country, we may be able to produce at a cheaper rate in spite of increased wages.

In further cross-examination, **MR. LACEY** said he thought the average life of the rails in the Holborn Union would be about 14 years.

MR. RYDE: Mr. Welling's figure is 10½ years. Do you know that 53 miles out of the 279 miles of track have already been renewed?

MR. LACEY: I don't know whether it is so or not. If one-fifth has been renewed in 11 years, it rather supports my average.

MR. RYDE: You know all the lines were not laid at the same time.

The witness said he had taken the life of the cables as 35 years, though he had not had a cable lasting that length of time in his experience, and probably few people had. He did not know the age of the oldest electrical cable now in existence, but some he laid in 1894 were still in existence.

MR. RYDE: Then that must be a real estimate on your part.

MR. LACEY: It is an estimate based on this: Tramway cable laid, as this is, in ducts, is laid under the best possible conditions. We are in the habit of taking 25 and 30 years for ordinary electric light cables. If it is fair to do that, it is certainly fair to take 35 years for a tramway cable laid under these conditions.

MR. RYDE: Has a cable laid solid a longer life than if laid in ducts?

MR. LACEY: Not necessarily. I should give a cable laid in ducts a longer life.

MR. RYDE: Isn't the installation much more perfect when laid solid?

MR. LACEY: Certainly.

After sitting for a further three days, the Court adjourned the hearing of the case till December 12th.

FRASER & CHALMERS, LTD., v. WHITECROSS CO., LTD.

MR. JUSTICE ROWLATT had before him this adjourned case, which involved a claim by the plaintiffs for £1,186, as the price of a No. 3 Bettington boiler, two pulverisers (one driven electrically and the other by steam turbine), and auxiliary parts sold to the defendants under contracts of 1913 and 1914, and erected at the defendants' wire-drawing works in Lancashire. There was a big counterclaim against Fraser & Chalmers, Ltd., by the defendants for £8,000 by reason of alleged delay and failure by the boiler to produce the guaranteed results. The case was begun on July 3rd and adjourned, the arrangement being that the boiler should be removed pending the resumed hearing, and it was now announced that the boiler had in the interim been sold for £3,000, of which sum £750 was agreed to be the minimum profit of the plaintiffs. The plaintiffs now proceeded to call technical evidence in support of the claim. The case was of a very technical character, but it appeared, broadly, that the plaintiffs supplied the boiler to be used in conjunction with a Green's economiser to evaporate 40,000 lb. of steam per hour, and there were detailed stipulations as to efficiency. There were many accidents and difficulties incidental to the experimenting with the plant, and Fraser & Chalmers said that ultimately the defendants declined to allow them to proceed further in regard to putting the boiler into fit working order, and rejected the plant, and called on the plaintiffs to remove it. The defendants alleged substantially that the boiler never produced the guaranteed results, and was useless for their purposes.

Mr. Colefax, K.C. and **Mr. Moritz** were for the plaintiffs, and **Mr. Leslie Scott, K.C.** and **Mr. Podden** represented the defendants. **MR. CHAPMAN**, of the plaintiff firm, said he had had a great deal of experience with Bettington boilers, and had held a position for the firm at Johannesburg. **Mr. Chapman** subsequently described in detail the experiments with the boiler after its erection at Warrington.

A large body of expert evidence was called on both sides.

Eventually, after a hearing covering several days, **MR. JUSTICE ROWLATT** gave judgment in favour of the plaintiffs. He held that the plaintiffs were entitled to recover as damages the difference between the contract price and the net sum received by them for the sale of the boiler, deducting therefrom the cost of erection, if it fell on them, and there was also a sum of £4 14s. 6d. that was not in dispute. The parties must agree with the figures, and he gave the plaintiffs judgment for the sum determined, with costs.

MUNITIONS CASES.

At a Munitions Tribunal, held at Stockton-on-Tees last Friday (December 1st), two electricians, **John Harkness** and **Hubert Sidgwick**, employed at a local ironworks, were charged with having refused to obey the orders of their foreman. **T. E. Brannigan**, a foreman electrician, said that on November 25th the two defendants refused to go into the sulphuric acid plant, stating that they had received instructions from their society not to do so. He asked them if they would do the work under protest, but Harkness said they had complained on many occasions, and they were willing to take the consequences, as they had their Union behind them. Brannigan, in reply to a Trade Union representative, denied that the men would come into contact with the acid or the fumes. He also denied that he had received complaints from the men about their boots and clothing being burnt by the acid. The defendants said the grounds for their refusal were that they asked for a special allowance for damaged clothes and the dangerous nature of the work as regards health. The Trade Union representative said the men had not received any instructions from the Union to refuse to do the work, and the Tribunal decided that the men had refused to comply with a reasonable order, and would have to pay 15s. each.

At Edinburgh and District Munitions Tribunal a boiler-house fireman employed in Leith Corporation Electricity Supply Works was charged with having, on November 3rd, at 11.30 p.m., left his work in defiance of instructions. It was submitted that the man's action might have resulted in the total or partial stoppage of the steam supply for the generating plant. The man said he left his work because he had too much to do. A fine of £1 was imposed.—*Edinburgh Herald.*

BRITISH POWER, TRACTION, & CO., LTD., v. HODGSON.

MR. JUSTICE PETERSON, in the Chancery Division, had before him, on Monday last, the summons in this action, by which the plaintiffs sought to enforce a finding of the Master that the defendant was liable for a sum of £7,000 odd.

MR. HUGHES, K.C., for the plaintiffs, reminded his Lordship that by a judgment of November 6th it was directed that the liability was incurred by fraud or fraudulent breach of trust, and was, therefore, not liquidated by the defendant's bankruptcy, but directed that the order should not be drawn up, as there was a pending summons to extend the time for applying to vary the Master's certificate. The defendant had decided not to proceed with the summons, and he (counsel) therefore asked that an order should go in accordance with his Lordship's judgment, that the defendant should pay into Court a sum of £7,653, with interest at 4 per cent. from June 25th, 1909, the date of the Master's certificate. He also asked that the defendant should be ordered to pay the costs of the summons.

MR. TOMLIN, K.C., for the defendant, said that the plaintiff company was in liquidation, and the action was really by creditors, and the defendant had issued a summons in the winding-up to set aside the judgment. The defendant was also intending to appeal against his Lordship's judgment on the present summons and he asked for indulgence. It was a matter that had been in suspense for nine years, and he asked for a stay pending the appeal, at any rate. Notice of appeal would be given as soon as the order was drawn up.

MR. JUSTICE PETERSON suggested that some security for payment of the money should be given.

MR. TOMLIN said he was not prepared to give security. All he asked for now was a little time. It was impossible for his client at the moment to put his hand on nearly £8,000.

His Lordship asked whether the defendant was prepared to pay a substantial sum into Court.

MR. TOMLIN said he could not make any offer of the kind, and must place himself in his Lordship's hands without prejudice to any application he might make to the Court of Appeal.

His Lordship said that, under the circumstances, he would give the defendant six weeks. There would be an order upon the defendant to pay the sum found due on the Master's certificate into Court within six weeks, with interest, and an order on the defendant to pay the costs of the summons.

BRITISH THOMSON-HOUSTON CO., LTD., v. DURAM, LTD.

TUNGSTEN WIRE PATENT LITIGATION.

MR. JUSTICE ASHURBY in the Chancery Division commenced on Monday the hearing of an action by the British Thomson-Houston Co., Ltd., against Duram, Ltd., for an injunction to restrain the defendants from infringing the plaintiffs' patent No. 21,513 of 1906, for the invention of a "Process and apparatus for the treatment of metallic tungsten, and for the manufacture of electric lamp filaments therefrom," and also their patent No. 17,322 of 1911, which was granted to John Thomas Henry Dempster for an invention of improvements in methods of wire drawing. It was alleged in the case that the defendants had manufactured wire in accordance with these inventions, and sold three spools of pladuram made according to the same to the General Electric Co., Ltd. Defendants

said the patents were invalid and denied infringement and said the processes and manufacture had, since the patent of 1906, been carried on mainly outside the United Kingdom—namely, by companies in America, Germany and Holland.

Mr. A. J. Walter, K.C., Mr. Colefax, K.C., and Mr. J. H. Gray appeared for the plaintiffs, and Mr. Tom Terrell, K.C., Mr. Kerby, K.C., and Mr. C. Terrell for the defendants.

Mr. WATKINS said the patent of 1906 was generally known as relating to tungsten drawn-wire, and that of 1911 related to improvements in the drawing of the wire. It had been suggested that if tungsten could be drawn into the form of wire it would be of great value, but, until the patent in question in this case was developed, nobody knew how to do it at all. He claimed for the plaintiffs' invention that it treated coherent tungsten by heat during its working process.

Mr. JAMES SWINBURN, the well-known expert, gave evidence. The case is proceeding.

ACCIDENT CLAIM.

At the Manchester Assizes, on November 25th, John Clifford Seddon, electrician, Great Lever Bolton, obtained £318 damages for injuries received in an accident at Worsley, near Manchester, when a steam motor-lorry belonging to William Hesford, carrier, knocked him off his bicycle and broke one of his legs.

WAR ITEMS.

Controlled Establishments.—The number of establishments now controlled by the Ministry of Munitions is 4,512.

Exports to China.—The "London Gazette" for December 1st contains a number of additions to the list of those to whom exports to China and Siam may be consigned.

Lighting Prosecution.—According to the "Westminster Gazette," Mr. J. K. Bridges, the borough electrical engineer, was fined at Eastbourne on December 1st for having a brilliant light at his residence. The Mayor reprimanded the defendant.

Flashlamps and Air Raids.—The public in the Keighley and Bingley district are being warned by the police that the use of electric flashlamps in the streets after it has become known that an air raid is in progress in the country is illegal.

Lost Time.—We read in a Manchester paper that Sir William Clegg, in reviewing the doings of the Sheffield Munitions Tribunal, deplored that during November the number of hours lost by workmen who had been before the Tribunal was 39,925, as compared with 24,412 in October.

Disabled Soldiers and the Post Office.—The Postmaster-General says that the number of disabled soldiers anxious to obtain situations in the Post Office is likely to be greatly in excess of the vacancies, and he is bound to reserve places for Post Office servants now with the Colours.—*The Times*.

To be Wound Up.—The Board of Trade has ordered the following to be wound up:

Vincit Co., Ltd., Apollo Works, 21, South Road, New Southgate, London, N., agents for the sale of carborundum and electric machinery. Controller: C. Eves, 62, New Broad Street, London, E.C.

Canadian Trade.—The "Morning Post" states that the Canadian Government is appointing a Commission to conduct an investigation into the methods of scientific development of Canadian industries after the war. The matter is in the hands of Sir George Foster, the Minister of Trade and Commerce, who has given considerable attention lately to the apparent need of scientific co-operation in many of the principal Canadian industries. The Commission consists of nine members.

Schaffer & Budenberg.—Mr. Barnes having inquired in Parliament whether the firm of Schaffer & Budenberg, with headquarters in Nuremberg and a small works in Manchester, are on the list of Government contractors, and whether the agent, "a full-blooded German," is allowed to go in and out of the Clyde shipyards in pursuit of his business, Mr. Tennant answers: I am informed that the affairs of this firm have been investigated by the Board of Trade, that the shares have been vested in the Public Trustee under the Trading With the Enemy Amendment Act, 1914, and that they are still on the list of Government contractors. The second part of the question probably refers to the Glasgow manager of the firm, who is of German origin, but was naturalised as a British subject nearly 40 years ago.—*Morning Post*.

The Armorduct Manufacturing Co.—In the Parliamentary answers last week, says the *Hardware Trade Journal*, Mr. Pretzman said the business of the Armorduct Manufacturing Co., Ltd., had not been wound up, because the Advisory Committee recommended that, having regard to the character of the work being carried on by the company, that course was inexpedient. Efforts were being made to negotiate a sale by private treaty to some British purchaser who would continue the work satisfactorily, and, pending the result of the steps which were now being taken to find a purchaser of the business, he was not prepared to say what conditions of sale would be imposed. An offer had been made by Mr. Small, but it had not been accepted.

From the *Times* Parliamentary columns we learn that Mr. Pretzman, replying to questions asked by Mr. Nield concerning "the German firm trading as the Armorduct Manufacturing Co." and an offer made by "Mr. Small or Schnahl, the former manager and nominee of the German owners," said:—The supervisor of the Armorduct Manufacturing Co. is at present in communication with several British firms with the view of obtaining offers for the business, and pending the result of the negotiations I am unable to say what consideration will be given to the offer made by Mr. Small. The difficulty in offering the business for sale by auction is that it is necessary that the purchaser should continue the business satisfactorily. The Armorduct Co. is manufacturing articles which are required by the War Office and Ministry of Munitions of War in the national interest, and the supply of which might be diminished by closing the company's business. Mr. Butcher asked that care should be taken that the business should be sold to a British-born subject. Mr. Pretzman said that consideration would be borne in mind. The business would be dealt with under the usual regulations, which provided that any portion of the profits of the undertaking which would accrue to enemies would be vested in the Public Trustee.

Exemption Applications.—The Aldershot Tribunal, on November 29th, reviewed cases of employes of the Traction Co., the Military Representative applying for withdrawal of certificates of conditional exemption. In 10 cases exemption was allowed to stand; in another three months' exemption was substituted; three were granted to January 1st for substitution; and in another case two months were conceded. The company made other appeals, with the result that conditional exemption was allowed to an inspector on the ground of certified occupation; three months to a foreman engine fitter, one month each to two drivers for substitution, and to January 1st to a fitter and two drivers for substitutes to be found.

Southend T.C. appealed for four tram drivers, aged respectively 33, 35, 37, and 40, and a conductor and pointsman (40), it being said that it was impossible to fill the places. Col. Nevitt intimated that he could not consent to the men being marked as in certified occupations. Two of the drivers were thus classed by the Tribunal, and the others were given conditional exemption.

The County Tribunal has given exemption to March 31st to a charge engineer at the city electricity works at Gloucester, passed for general service, and stated to be absolutely indispensable and impossible to be replaced.

At Swinton (Lancs.), an electrician, aged 41, passed for C.I., appealed, and stated that he did work for a munitions firm; two of his men had joined the Army. Two months' exemption was conceded.

Mirfield (Yorks.) Tribunal has given six months' exemption to the manager of a local electric motor works (40).

At Windermere, an appeal for absolute exemption was made by Mr. J. K. Thornborough (34), electrical engineer, who said that the whole of the permanent staff, and the junior partner, had been called to the Colours. The Military Representative consented to three months' temporary exemption, but the appeal was respite for a medical examination.

At Barnsley, on November 30th, the Barnsley & District Electric Traction Co. appealed for a clerk and cashier (29), a fitter (31), an armature winder (24), and a tram driver (25). The latter, the manager said, had left the company's service, and he had returned the man's exemption card. The clerk and cashier and the armature winder were conditionally exempted; and in the case of the fitter, the matter was deferred for two months for the Military Representative to endeavour to find a substitute.

Exemption to the end of the year has been granted to Mr. A. Howard (32), electrician, of Chingford (Essex).

Bromley (Kent) Tribunal has refused exemption to Mr. A. C. Edwards, electrician, of Widmore Parade, who failed to appear in support of his appeal.

At Gillingham (Kent), Mr. A. C. Chalmers, borough electrical engineer, appealed for C. W. Wharby (28), engine fitter's assistant, and three months were granted.

Herts Tribunal has refused exemption to Mr. W. Meager (35), electrical engineer, of Potten End, Berkhamsted, appealed for by Mr. A. E. Barron.

At the request of the Recruiting Officer, the Torquay Tribunal has unstarred Mr. G. A. Binnie, an electrician, passed for general service, and who has been engaged on munition work.

Before the City Tribunal, the Worcester Electric Traction Co. appealed for two switchboard attendants, S. A. Stallard (18) and A. Bullock (38), on the ground that they were in a certified occupation. The Advisory Committee assented to one being exempted, and Bullock was given a conditional certificate and Stallard until December 31st final.

At Oxford, further exemption until a substitute is found was appealed for by Mrs. Elizabeth Storey, electrical engineer, for S. A. Stock (24). Mrs. Storey stated that her husband died six months after the outbreak of war, and that her staff had enlisted with the exception of Stock, who had had five months' exemption. Lieutenant Whatcoat informed the Tribunal that there was not much chance of getting a substitute if Stock was an electrician. Mrs. Storey had had eight months, and it was not fair to ask the Military at the last moment to get a substitute. Stock said that he did not claim to be an engineer, but he could do most electrical work. Lieu-

tenant Whatcoat said the man would be most useful either in munitions or in the Army. The Chairman: The facts are that the lady's husband died after the war and this was the only man left to carry on the business. It was really an employer's application, and was a hard case. Lieutenant Whatcoat said that they were nearly all hard cases now. Unfortunately this man was skilled, and would be useful in either munition works or the Army. Six months were allowed.

At Deal, Messrs. T. L. Tapper, Ltd., appealed for M. C. Stevens (28), electrician, the only skilled man left. The appeal was out of time, but it was urged that as Mr. Tapper had been away on service from the beginning of the war the firm had a reasonable excuse for not applying before. The Tribunal decided that the appeal was too late, and that on its merits they would not entertain it.

The Birkdale (Southport) Electric Supply Co. appealed to the Liverpool Appeal Tribunal against the decision of the Local Tribunal in the case of D. C. Reilly, aged 20, single, and described as a switchboard attendant. The Southport Tribunal had allowed to December 1st only, and the Appeal Tribunal, in extending the time for one month, refused leave for a further appeal.

CONSUMERS' COMPLAINTS.

By A. T. BULLEN.

IN a recent issue of the *Daily Mail*, the writer was surprised to find a letter from a well-known society lady, complaining that, in spite of the "Daylight Saving" Act, her consumption of electricity for lighting had increased—or, perhaps, it would be more correct to say that her bill for electricity consumed had increased—and she invoked the aid of the *Daily Mail*, first, to expose this incredible state of affairs: and, secondly, to search for some cause for the increase.

The only advice that the paper could possibly give, was that the lady in question should forward her complaint to the supply authority concerned, when no doubt an excellent reason could be given for this increased charge: or if, on the other hand, the bill proved to be unfair to the consumer, the matter would speedily be adjusted to the satisfaction of all the parties concerned.

Consumers, however, as a whole, do not appear to have such faith in the officials of the supply corporation or company as seems desirable. One of the first principles of business seems to be to cultivate distrust of everyone with whom you have dealings, and that is why a dissatisfied consumer will complain to anyone and everyone except only those persons appointed specifically for the purpose of giving him the satisfaction he seeks.

Naturally one searches for an explanation for so curious a condition, and wonders if the real reason is that those who have the settling of complaints do not, by their mode of action, ability, and manner of address, inspire confidence. Certain it is that it is quite impossible to deal satisfactorily with any consumer unless he or she is confident that the advice you are giving is sound, and that your knowledge of the subject is complete.

Perhaps more dissatisfaction and distrust is created by advice given by incompetent persons, the results of which have afterwards to be rectified, than by any other cause.

Generally speaking, people do not mind paying for a thing if they know that they are getting the genuine article, but no consumer likes paying for a quantity of electricity until he is quite sure that he has used it. For this reason the minimum charge enforced in some places, quite legitimately and even of necessity, never was, and never will be, popular, and so long as consumers feel that it is possible for an electricity meter to go wrong, or for a meter reader to make a mistake, just so long shall we have complaints.

It is quite possible that the society lady mentioned above had just cause for complaint, but it is equally probable that some satisfactory explanation of the increased charge could have been given had she sent her complaint to the proper quarter. First, it is more than probable that, owing to war conditions and an increased cost of production, the price of electricity had been raised by 20 per cent. Secondly, it is likely that this lady's house is usually closed for the greater part of the summer, but this year being an exceptional year,

may have kept the consumer, or her servants, in residence for a longer period than usual.

Again, there is the possibility of alterations in the existing installation; the substitution of lamps of higher candle power, for instance. The dates between meter readings may not have covered similar periods last year and this year, giving in the first case a relatively short quarter and the second a comparatively much longer quarter. The system of charging may have had an effect, the maximum demand, perhaps, being higher, or there may previously have been in circuit a defective meter, and finally the meter reader may have made the mistake now of over-reading, or, at the corresponding time last year, the error of under-reading, or the meter may have been over-registering.

Surely out of all these possibilities something definite might have been gathered, but it could only be done by an official on the spot, who would have made a personal investigation.

The investigating official, however, must be very tactful in his researches, and must be careful to give only such information as is necessary and advisable. For instance, you might get a complaint over a trifling occurrence which may happen once in a thousand times, but it would be fatal to divulge the exact nature or cause of the failure, for you would immediately be overwhelmed by dozens of others anxiously inquiring lest a similar accident might befall them.

Here is a case in point. A certain consumer who has a thermal maximum-demand indicator on his motor circuit, noticed one day that after the meter reader had tipped his indicator it did not commence again at zero, because at the time of tipping the motor was actually working. He immediately made a complaint to the effect that his indicator was out of order. The cause of the complaint was, of course, obvious, but the investigating official could hardly explain the matter, for he would then have had to make special arrangements for tipping the indicators on every motor circuit in the town. Yet how often would the meter reader drop on a motor which was running at its maximum load?

Here is another instance which also concerns the maximum-demand indicator. In a certain town in the South of England an organist at one church was appointed to another in a different part of the town. The organs in both churches were blown electrically, but the first was on a direct current and the second on an alternating supply. The organist was surprised to find that it cost him much more to blow his new organ than it did the old one. Both circuits had maximum-demand indicators, and the explanation was, of course, the fact that on the A.C. circuit the thermal-demand indicator did not allow for power factor. Consequently the proportion of high-priced units was much more than in the case of the D.C. circuit. Yet it was hardly possible to explain this to the organist.

The remedies adopted in settling some complaints are amusing, yet these amusing methods are usually the outcome of delicate handling and often a keen sense of humour, which, by the way, is a very great asset in any consumers' department. The following is a really good incident. In the early days of the metal-filament lamps many consumers were advised to install small transformers to bring their voltages down to useful proportions. Some supply authorities went a step further than advising, and themselves installed these transformers. This was done in the present instance, but one night for some reason the voltage on one particular circuit was very low, and an old gentleman, who himself knew a little of electrical matters, was distressed to find that his light was poor. After that night he was continually complaining to this effect, and he fixed the responsibility on the transformer which had been installed. Tests were taken on several nights which proved that the voltage at the consumers' terminals was well up to standard, but nothing would convince the consumer that this was so. He was therefore advised to do away with the transformer, but when he realised that this meant purchasing new lamps, he would not think of it. "The transformer," he said, "belonged to the company, and they must supply him with a satisfactory one."

The difficulty was solved by a near neighbour of his removing when the company's inspector adopted the use of

Changing the dissipated consumer's transformer for an internal one which was installed in the new supply house. From the fact that this is a complaint of bad light has been removed from this quarter, and even the chief engineer of the company does not know the ultimate means adopted to satisfy this hitherto dissatisfied consumer.

Most complaints originate out of the charges made for electricity consumed, and most supply authorities now have properly equipped testing departments, under the supervision of a competent and experienced official, in order that the number of defective meters, and consequently the number of complaints, may be kept at a minimum. It is not sufficient, however, for the supervising official to confine his attention to the test-room. He must move among the consumers, and learn the conditions under which each one is using electricity.

In dealing with complaints he must be sympathetic, and ready to hear the consumer's whole story. He cannot settle the facts of the case in possession of only half the facts; but, on the other hand, his sympathy with the consumer must be tempered with common sense, so that he will not raise false hopes, which will be immediately dashed to the ground when his report reaches the chief engineer.

He should have a sound technical knowledge, but he should not air it to the consumer, except in such a manner as is likely to inspire confidence. It is of no value to talk over the head of the consumer; you must rather come down to his level, and try to explain things to him in language he can understand. At the same time, you must let him see that you have the knowledge to apply at the right time and in the proper place.

Remember, it is easy to presume upon the electrical ignorance of the consumer, but it does not pay in the end.

Above all, it is necessary to be fair. If the supply authority is in the wrong, the point should be gracefully conceded, and the matter immediately rectified. Mistakes will always occur—it cannot be helped; but the method of correction of these mistakes may mean much for the future welfare of electrical undertakings.

The officials of a consumers' department are, in one respect, unlike most other men, for they can serve two masters. They owe one duty to their employers, the supply authority; but they owe another duty to the consumers, for they are the guardians of their interests. Let them take care that they are just stewards.

BUSINESS NOTES.

Industrial Developments in Russia.—Some notes on this subject, prepared by the British Vice-Consul at Moscow, appear in the *Board of Trade Journal*. He states that the war has compelled Russia to develop her own chemical industry, and a certain number of works have already been erected while many are projected. The mobilisation of Russian industries in 1915 also affected the glass industry which was called upon to produce for the military authorities goods that were formerly imported from abroad, e.g., mirrors, lenses, and other supplies for optical instruments, thermometer tubing, &c. Fair progress was made in the manufacture of insulating glasses for electrical purposes. There is a great demand for microscopes, scientific apparatus, field glasses, &c. Russian industry in these products is undeveloped as there are no specialists or experienced hands available. Surgical instruments form quite a new industry in Russia, and its development has been greatly handicapped by the shortage of instrument steel and suitable machines and appliances. Cold stores have a great future in Russia, and after the war there should be an excellent demand for refrigerating machinery. There is also expected to be a good opening for peat-pressing machinery. The motor-car business is being developed and large orders have been placed with Russian works to assist to that end. So far the bulk of motor-cars in use in Russia has been imported, imports in 1913-14 being valued at, roughly, £1,300,000.

Electrical Industry in India.—We quote the following editorial comments from a recent issue of *Eastern Industries and Finance*:

"Of all the varied departments of commercial enterprise in India, perhaps the one most in need of immediate overhauling is the electrical industry. British manufacturers of electrical equipment have to realise that if they wish to retain what little hold they have of the Indian market, they must consider their position and prospects. Organisation in the full comprehensiveness of the term is what is needed. Not a mere associative collection of engineers. Organisation which works on the basic principle of mutual

co-operation. Organisation that is real and capable of subordinating private interests to general ends. As far as we are concerned, organisation that is able to evolve an understanding of the needs of India who is today ready to buy what she wants, but not always ready to take just what the manufacturers have to sell. One of the first problems that an association, founded on the above principles, would have to tackle is the question of 'standardisation.' Electrical engineers in India have long watched, not without impatience, the pathetic and half-hearted attempts made in the past to handle this proposition. If a firm grip of the market is to be obtained this indispensable condition must be achieved, for 'standardisation' is the very soul of organisation. If, as is most probable, private and immediate interests have to suffer, then they must go. Nothing should be allowed to stand in the way of the accomplishment of this end, which can only be attained by collective co-operation. There are many other points in this connection that will readily present themselves to those who are interested in the electrical industry, not the least important of which is the question of internal discipline. Pressure should be brought to bear on manufacturers who go out of their way to ignore trade standards, and spend considerable time in evolving means of getting behind regulations, avoiding control, and adopting illegitimate means of getting business. Stern measures must be adopted to force these men into line, for their operations not only have an adverse influence on the market, but tend to stultify the natural development of trade. Although attempts have been made in the past in India to bring electrical engineers and contractors into line, no real progress has been made, and what may be termed cut-throat methods have not infrequently been resorted to. This is good neither for the individual contractor nor for the trade. It is, perhaps, too much to expect celestial conditions to obtain in India, but if some such cohesive measure as that indicated could be adopted by British contractors in India the benefit would soon be apparent. The Americans and the Japanese are watching developments very closely, and although the imports from Japan are very inferior to the electrical exports of the United Kingdom, they are finding markets in India by virtue of the pushfulness and thoroughness of the methods employed by the Japanese agents here. Neither Japan nor the United States can hope to hold all the customers they are now securing, but the British firms will find that it will be an uphill fight before they can effectively oust them from the market. It seems to us that we are too prone to excuse our inactivity by that ready reference to the war and the procrastinating cry: 'Wait till the war is over.' The present upheaval should surely bring us to a reconsideration of this attitude. We have now to realise that old conditions have gone, never to return. What the future holds, none can foresee. We are for the moment concerned with the present, for from our present action future prospects will be determined. In order to keep and increase our hold on the sale of electrical machinery and accessories, we need primarily to focus all our energy on one object, the most powerful factor in our armamentarium of trade resource—organisation."

Catalogues and Lists.—BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., Trafford Park, New Christmas Gift Catalogue, entitled "Domestic Helps." We suppose that, in keeping with the economical spirit of war-time, a far higher percentage than usual of the Christmas and New Year gifts of the coming month will be of a useful character. Everything that is in any way wasteful must be very definitely at a discount in these times. Therefore this catalogue of goods, which make both for economy, efficiency, convenience, and utility, as well as, in some measure, making their response to the desire for novelty, should be very acceptable. It consists of 16 pages of illustrations, prices, and brief particulars of electric cooking appliances, from the small disk stove to the large cooker, hot-bar fires and electric irons, shaving pots, kettles, stoneware utensils, the Westinghouse Utility motor, fans and hair driers, and vacuum cleaners, also electric lamps and table standards.

MESSERS. JENSON & NICHOLSON, LTD., Goswell Works, Stratford, London, E.—New pamphlet giving particulars of "Lacwatt" and "Collac" insulating varnishes, compositions, enamels, and other electrical specialties made at their works at Stratford. The firm have made a special study of the subject of electro-insulation.

THE ELECTRICAL ALLOY CO., Morristown, New Jersey, U.S.A.—Circulars relating to their resistance materials. Monel metal, and spark point nickel.

Trade Announcements.—MESSRS. JAMES GORDON & CO., water-power engineers, having had their offices in Canada House, Kingsway, requisitioned by the War Office, have removed to temporary offices at Queen's House, Kingsway. Their telephone number and telegraphic address remain the same.

The address of MESSRS. HENRY FAJJA & CO., Portland Cement Testing Works and Chemical Laboratories, is 6, Earl Street, Westminster, S.W. Though notice of the change was issued a year ago, letters continue to go to the old address.

Bankruptcy Proceedings.—E. W. BARTON WRIGHT, electrical therapeutic expert, Acton and Oxford Street.—Receiving order made at Brontford, November 24th, on a creditor's petition.

Australian Inquiries.—The Board of Trade Department of Commercial Intelligence reports the following inquiries received:

A firm dealing in electrical goods seeks agencies for British firms for such goods other than wires and cables, telephones, bells, &c., instruments, circuit breakers, accumulators, and switchgear.

A manufacturers' agent wants to represent British makers of electrical fittings and accessories.

Dissolutions and Liquidations.—**IDEAL BATTERY CO.**, manufacturers of dry batteries and electrical appliances, Nursery Road, Mitcham, Surrey. Messrs B. Pearce, A. M. Foster and A. R. Harwood have dissolved partnership. Mr. Harwood attends to debts, &c.

TURNER & BLINGER, 149 Farnham Road, London, E.C. Creditors must send particulars of debts, &c., to the Controller, Mr. J. E. Percival, 6, Old Jewry, E.C., by January 6th.

FELD BROS. & CO. LTD., 25, Grosvenor Road, London, E.C. Creditors must send particulars of debts, &c., to the Controller, Mr. J. E. Percival, as above, by January 6th.

DACUM ACCUMULATOR SYNDICATE, LTD.—This company is winding up voluntarily, with Mr. H. C. Bound, 61 and 62, Lincoln's Inn Fields, London, W.C., as liquidator. A meeting of creditors is called for December 15th.

BACHELET FLYING TRAIN SYNDICATE, LTD., **BACHELET SHIPBUILDING, ENGINEERING, AND ORDINANCE CO. LTD.**, **BACHELET LEVITATED RAILWAY SYNDICATE, LTD.**, and **BACHELET SHUTTLE AND LOOM CO., LTD.**—Creditors of these companies must send particulars of their debts, &c., to the liquidator, Sir W. B. Peat, 11, Ironmonger Lane, E.C., by January 3rd.

QUARTZ-LAMPEN GESELLSCHAFT, M.C.H. (original Quartz Lamp Co.), 62, Red Lion Street, E.C.—Claims must be sent to the Controller (Mr. R. W. Brown, 12, Old Square, Lincoln's Inn, W.C.) by December 16th.

Private Arrangements.—**THE TYLER APPARATUS CO.**, LTD., Banister Road, North Kensington, London, W., electrical engineers, &c.—A circular has been issued to the creditors of the above, dated November 22nd last, by Messrs. Corfield & Crippwell, accountants and auditors, of Balfour House, Finsbury Pavement, E.C., which states that the petition presented by a creditor for the winding up of the company was withdrawn under an Order made by the Judge, and the course is thus clear now for the company to proceed with the reorganisation as suggested. At the meeting of creditors of the company, on November 3rd, 1916, at the Institute of Chartered Accountants, a scheme for the reorganisation of the company's affairs and for the payment of its debts in full, was laid before the creditors and approved. This has been further elaborated and laid before the Court of Chancery in Chambers, and has been allowed by the Court, in so far that the Judge ordered a formal meeting to be called under the terms of the Companies Consolidation Act, 1908, to formally consider and adopt the above scheme, and this was held on Tuesday last.

THE ELECTRICAL STORES will, on December 12th, remove to 35/37 and 39, South Sherwood Street, Nottingham.

Book Notices.—*Air* is the title of the official organ of the Aeronautical Institute of Great Britain, of which the first number has just come to hand; its purpose is to arouse public interest in aerial questions, to stimulate study and research, and to help the development of "British Imperial Aeronautics," without adhesion to any clique or party. It is controlled by a council, with Mr. L. Blin Desbleds as director and hon. secretary, and will appear monthly. The issue contains articles on the Air Board, our pre-war neglect of aerial possibilities, the steel construction of aeroplanes, &c., and details of the membership and constitution of the Aeronautical Institute of Great Britain. We cannot see far into the future; who can say that the Institute may not eventually rival in importance the great engineering institutions of which we are so proud?

"Manual of Electrical Undertakings and Directory," 1916-17. Vol. XX. London: Electrical Press, Ltd. 21s. net.

A.E.G. Electric Co., Ltd.: Sale.—**MESSRS. WHEATLEY KIRK, PRICE & CO.**, by order of the Controller in this case, are offering for sale the stock of electric motors, instruments, fittings and electrical accessories, in one lot by public tender. An announcement appears in our advertisement pages to-day.

For Sale.—**MESSRS. P. HUDDLESTON & CO.** will sell by auction, on Friday, December 15th, at Hammersmith, a quantity of electrical apparatus. Full particulars are given in our advertisement pages to-day.

LIGHTING AND POWER NOTES.

Accrington.—**NEW PLANT.**—Ald. Higham (chairman of the Electricity Committee) recently stated that the Electricity Department had now obtained delivery of the new turbo and alternator, and the only things they were waiting for were the pumps; they hoped to be running by the end of the month. If matters turned out as successfully as was anticipated, they were quite certain to have a diminution of the troubles they had had for several months, due to various conditions.

Argentina.—In September last the Pedro Mendoza central power station, Buenos Aires, of the Compania Italo-Argentina de Electricidad, was formally inaugurated, this completing the present system of the company, which was founded in 1911. The work has been carried out with the industrial and financial assistance of Messrs. Franco Tosi, Pirelli, and Brown Boveri, the capital involved being 50 million francs. The steam plant at the main station consists of four batteries, each consisting of two engines, with economisers, forced-draft plant and steel chimneys. Liquid fuel is principally used, and a large storage is provided by tank wagons of road or railway type. Special turbine pumping plant is installed for the oil fuel. Three 6,000-KW. turbines sets are installed, generating three-phase

current at 6,600-7,000 volts, 50 cycles, and each fitted with a direct-driven exciter. A further installation of turbine plant has been contracted for, bringing up the total plant capacity to about 30,000 kW. From the main station, energy is transmitted to five sub-stations, which distribute direct current within a specified central zone of the city; these sub-stations are equipped with the necessary transforming plant, some 10,500 kW. in capacity, and, in addition, with independent Diesel engine generators—13 in all—consisting of 800-H.P. engines driving 500-KW. generators. For a year and a half this Diesel plant has been supplying consumers pending the completion of the main plant. For sometime 1,600 public arc lamps have been supplied, also about 1,000 arcs in the port, while 12,000 private installations were also being supplied at the end of September. *(Reprinted from The Engineer.)*

Barrow.—The electrical engineer, Mr. H. R. Bownett, has been authorised to assist the Joint Committee in connection with the proposals for interconnection and joint working of electric supply undertakings.

Belfast.—**PROPOSED EXTENSIONS.**—At the monthly meeting of the Corporation the question of extending the electricity plant was considered. The Committee now proposed to place the matter in the hands of experts, and it was decided to obtain the advice of Sir John Snell as to any modifications being made in his report of August, 1914, on the extension question. During the discussion it transpired that recent applications were very nearly refused—so narrow was the margin—and that with the exception of one other town in the United Kingdom, Belfast had the lowest reserve of plant. It was decided to confirm the proposals of the Electricity and Tramways Committee in view of the seriousness of the situation. The proposed new generating station may cost up to £1,000,000.

Birmingham.—**PRICE INCREASE.**—The Electric Supply Committee reports that on March 7th, 1916, it increased the charges to consumers supplied with low-tension electric current, by 15 per cent. to lighting consumers and 20 per cent. to power consumers. The Committee has had before it the returns for the first six months of the present financial year, and it is evident that the expenses will be even heavier proportionately during the forthcoming winter. The high-tension consumers, under the Coal Clause in their agreements, automatically pay an increased rate. The low-tension lighting and power consumers pay a fixed rate, and the Committee considers a further increase should be made in these rates. In conclusion, the Committee stated that it had decided that the increase of 15 per cent. to lighting customers previously sanctioned in March be raised to 30 per cent., and that the 20 per cent. increase for power, heating and cooking made in March, be raised to 30 per cent., and that these additional increases take effect from the December reading of the meters; at the City Council meeting on Tuesday an amendment was carried, increasing the price for power, heating, &c., by 40 per cent. on pre-war prices. The Finance Committee has reported having obtained the sanction of the L.G.B. to a loan of £7,530 for additional cooling towers and pipe line in connection with the alteration of the scheme for the extension of the temporary electricity generating station at Nechells.

Blackpool.—The Finance Committee has agreed to supply electric light for the soldiers' rest clubs and recreation-rooms at a 50 per cent. reduced cost, so long as the consumption does not exceed that of the 1914-15 winter, when concessions of this kind were first granted; any electricity used in excess of this amount will have to be paid for in full.

Bolton.—**LINKING-UP.**—At a meeting of the Electricity Committee, consideration was again given to the report on the interconnection of the Lancashire and Cheshire electricity supply systems, and the principles of the scheme were approved.

Christchurch.—The Bournemouth and Poole Electricity Supply Co. has refused the offer of the B. of G. to pay five per cent. increase on the contract price for current from January 1st, and the offer has been withdrawn. The Guardians take the view that they are liable for the contract price only.

Deal and Walmer.—The B. of T. has granted a year's extension to the Gas and Electricity Co. for laying electric distributing mains in the scheduled area.

Dublin.—The Electricity Committee has issued a report protesting against the methods adopted by the Special Committee of Investigation, which, it says, did not consult the former Committee or the officials, did not permit the officials to be present at its meetings, has not made a report as a Committee on any one of the seven heads of its instructions, and has expressed no opinion of its own on any of these points. The Electricity Committee claims to have overcome the very serious difficulties of the present situation, and to have made arrangements which guarantee the maintenance of the supply in the future, and demands that the Special Committee's report be referred to it for investigation, with the same powers as were conferred upon the latter Committee.

At the monthly meeting of the Corporation, this week, it was decided, on the suggestion of Mr. L. Sherlock, ex-chairman of the Electricity Supply Committee, that consideration of the Electricity Special Inquiry Committee's report, Mr. D'Alton's expert report, the Committee's recommendations, the officials' replying reports, and the supply Committee's report in reply and protest, should stand over pending the submission of a special meeting.

Yearly Statement.—The Electricity Supply Committee's statement of account for the year ended March 31st last shows that the total income from the sales of electricity, meter rentals, public lighting, and miscellaneous sources was £134,555, and the expenditure £77,184, leaving a balance to be carried to

net revenue account of £64,121. The total capital expenditure at the end of the year was £87,450, an increase of £22,594 on the previous year. The total income for the year was £121,883, as against £109,110 in the previous year, and the working costs were £60,461, as against £50,444. The total surplus to be carried to next account is £16,443. A sum of £337 has been transferred to reserve account. The surplus for the year is given at £8,810, as compared with £1,116 in the previous year. The total units sold increased from 9,519,545 in 1915 to 10,338,568. The cost per unit sold increased from 2.26d. to 2.69d. Against this is the fact that the average price obtained increased from 2.56d. to 2.80d. The total maximum supply demanded during the year was 7,288 kW. against 7,486 kW. in 1915. The capacity of the dynamo at the end of the year was 12,000 kW.

The Committee announced that owing to the new restrictions on the purchase of electrical material, it was not in a position just now to deal with applications for new supplies to ordinary consumers.

Dundalk.—**PROPOSED LOAN.**—The Urban Council is applying to the L.G.B. for a loan of £5,000 to enable it to carry out such improvements as will allow the Diesel engines in the electric lighting department to consume *tar* oil instead of petroleum fuel.

Eccles.—**PRICE INCREASE.**—The Electricity Supply Committee has decided to further increase the charges for electricity from January 1st as follows:—Private and public lighting, 15 per cent. to each account, making 25 per cent. in all; general power, heating and cooking, 5 per cent. to each account, making 25 per cent. in all.

Edinburgh.—The Electric Lighting Committee has decided not to insist on the payment of the minimum charge of 10s. by consumers who are on active service. The Committee agreed that before any action was taken in regard to arrears, the circumstances should be referred to the convenor.

Ennis (Co. Clare).—**E.L. SCHEME.**—A public electric lighting scheme has been suggested, and it is thought probable that steps will soon be taken in the matter.

Faversham.—The T.C. has decided not to increase the price of current at present.

Finchley. A resolution from the East Finchley Ratepayers' Association upon the subject of electricity charges has been referred to the Electricity Committee; the Association desires the abolition of the minimum electric light charge, and that the 20 per cent. addition recently made be only upon units consumed. An equitable flat rate, power rate, and street lighting rate, the increase and decrease of each to be governed by the conditions prevailing from time to time, are asked for.

Grantown.—**PRICE INCREASE.**—There was considerable discussion at a meeting of the T.C. on the explanation by Mr. Anderson, electric light contractor, of his action in raising the price of electricity to private consumers by a 1d. per unit. The Council ultimately agreed to recommend private consumers to pay the extra charge.

Halifax.—The Electrical Distribution of Yorkshire, Ltd., having decided to apply for powers to supply electricity within the area of the Luddenden Foot U.D.C., the Tramways and Electricity Committee has empowered the Electricity Sub-Committee to take steps to safeguard the interests of the Corporation. A Sub-Committee has been appointed to confer with the Gas Committee on the question of joint central offices, showrooms, &c., for gas and electricity purposes.

Harrow.—**STREET LIGHTING.**—Through the discontinuance of street lighting, the U.D.C. has saved £520 during the past six months.

Hornsey.—The T.C. has been asked by the Hackney B.C. to contribute towards the cost of defending an action brought by the Gas Light and Coke Co. in respect of a reduced charge made for electrical energy supplied for lighting purposes to customers who are power consumers, it being alleged that the charge constituted an undue preference. The communication was referred to the Electricity Supply and Finance Committees.

Kendal.—The manager of the electricity undertaking has been instructed to procure samples of electrical heating apparatus for advertisement. The charge for electricity for power purposes to consumers of 8,000 units per annum and upwards has been fixed at a flat rate of 1½d. per unit.

Leyton.—For the destruction of works a 30 to 40-H.P. motor is to be purchased, at a cost of from £100 to £120, to drive the air-compressor by electricity when steam is low, instead of burning coal.

London.—**WOOLWICH.**—**PLANT EXTENSIONS.**—Details of a further extension of turbine plant and mains, estimated to cost £21,000, have been approved, and sanction is to be asked for the borrowing of the money. In regard to a former loan of £27,500, it has been agreed to repay this on the instalment system instead of the annuity system. Application is to be made for sanction to a loan of £2,442 for mains extensions, and 55 street lamps are to be fitted with automatic switches, thus economising in labour.

HACKNEY.—The accounts of the Council's electricity undertaking for the year ended March 31st last show a deficit of £7,605. Owing to increased price and poor quality of fuel, the cost of production, increased by £9,022, loan charges also increased by

£1,165, and allowances to employes on active service amounted to £1,986. Owing to the lighting restrictions, the revenue from private lighting dropped £3,878, in addition to £546 from public lighting; the revenue from power showed an increase of £3,739. The sales department made a profit of £772, as compared with £120 in the previous year. The balance standing to reserve amounts to £23,981, after making allowance for last year's deficit.

Plymouth.—**QUARTER'S WORKING.**—The engineer's report of the working of the electricity undertaking for the quarter ended September 30th showed a consumption of 1,302,587 units, producing £10,785, as compared with 1,305,317 units sold and £11,403 in the corresponding period of last year. Added to the income of the June quarter the total amounted to £22,459, as against £22,779 for the corresponding six months of 1915.

Salford.—**LINKING-UP.**—The Electricity Committee approves in principle the scheme outlined in the interim report of the Committee for the interconnection of Lancashire and Cheshire Electricity Supply Systems. Five representatives of the Electricity Committee have been appointed to attend a conference of electricity supply authorities to be convened to consider the matter.

Sevenoaks.—The U.D.C. has given consent to the Electricity Co. to place outside cables for the supply of current to houses in Mount Harry Road.

Sunderland.—**PLANT EXTENSIONS.**—At the annual meeting of the Corporation Electricity and Lighting Committee on Friday last, the chairman said they had passed through a busy year, during which they had added to their list of consumers a number of works and a steel furnace. Permission had been given for the purchase of a new turbine for the Hylton Road extensions, which were estimated to cost £45,000, and the L.G.B. had authorised the borrowing of the money. Tenders were now being advertised for.

Woking.—**FIRE.**—Damage estimated at about £1,000 was done by a fire which occurred on the premises of the Electric Supply Co. at midnight on Sunday. It is believed that the fire originated in the overheating of some stored slack. The damage largely represents burnt cable, which was insured.

Wrexham.—**PRICE INCREASE.**—The charges for energy have been advanced by 10 per cent., as from January 1st, by the T.C.

York.—**LINKING-UP.**—Reporting on this question to the Electricity and Tramways Committee, Mr. J. W. Hame, the city electrical engineer, stated that York was so far from Leeds, Hull, or Harrogate, where supply stations of importance were situated, that the cost of labour involved in carrying out a linking-up scheme would make interconnection impracticable at the present time. The Yorkshire Power Co. was supplying its Selby area, but there would be no advantage in connecting up there yet. The policy they were adopting was to centralise the power production in the city and district.

TRAMWAY and RAILWAY NOTES.

Abingdon.—According to the *Surveyor*, as a result of the action brought by the R.D.C. against the Oxford Tramways Co., the latter has at once changed the route of its buses in the Abingdon district, which now run on the main roads under the care of the Oxford County Council.

Blackburn.—**THROUGH RUNNING.**—As a result of the discussion with the Accrington Corporation Electricity and Tramways Committee on the question of future through running, the two Corporations have decided to enter into an agreement for the future on the basis of an equal car-mileage being run by each Corporation's cars over the other Corporation's lines. The agreement comes into force on January 1st.

Blackpool.—The T.C. has agreed to a recommendation from the Tramways Sub-Committee that the last cars should leave the town centre not later than 10.30 p.m. The aggregate revenue for the year to date on the Blackpool-Fleetwood cars is £42,715, compared with £37,809 a year ago.

Bolton.—The Tramways Committee has decided not to accede to an application by the Amalgamated Association of Tramway Workers for alterations and increases in the wages of various classes of tramway workers.

Burnley.—The Tramways Committee has decided not to entertain the suggestion of the Amalgamated Association of Tramway and Vehicle Workers that tramway traffic should be suspended on Christmas Day, and the wages paid to the employes for the day.

Ilford.—**CABLE BREAKDOWN.**—The tramway manager reported that on October 21st feeder cable No. 4 broke down. It was laid in 1912, nearly four years ago, being supplied by the Standard Cable Co., an entirely German firm. As the cable had to be replaced immediately, a tender was accepted from Messrs. Henley, at £138 for 440 yards of cable, to be delivered within 10 days.

Keighley.—A statement issued to the Corporation last week shows that the tramway receipts from April 1st to November 23rd gave an increase of £445, but there was a decrease on the rail-less trolley vehicles of £378.

Women tramcar drivers are now in training in the town, and have appeared on the streets in company with a male supervisor. The Keighley routes are amongst the easiest to be found anywhere in the country.

Leyton.—**WAGES.**—Increases of wages are to be made to the employés of the tramway department, at an estimated net cost of £1,100 per year. The tramway manager reported difficulty in purchase of rails and tires; the matter has been referred to the Committee's chairman and the tramway manager to deal with.

London.—In a brief *resume* of electric railway work round London, the *Railway Gazette* mentions that the Central London extension to Ealing is well under way, though the Gunnersbury extension is held up. Experimental runs have been made with Bakerloo tube trains on the Watford section of the North-Western line, in connection with the future through service; the difficulty to be met is the question of platform height, owing to the tube train floors being considerably lower than the normal railway coach floors.

Land has been purchased for the Hampstead Railway extension to Hendon, and on the City and South London Tube an experimental section of the larger normal diameter has been inserted. This tube is to be extended from Euston to Camden Town, where a junction will be made with the Hampstead and Highgate Tube Railways.

Amongst the lines held up by the war are the Wimbledon and Sutton Railway, the Piccadilly Railway extension to Gunnersbury and Richmond, in connection with which a new station is to be built beneath Hammersmith Broadway, while the further scheme for providing a deep level line below the District Railway to relieve rush traffic is stated to have not been abandoned altogether.

L.C.C.—The *Surveyor* draws attention to the excellent manner in which the Council's tramway service was maintained during a recent dense fog, adding that it certainly appears that the tramcars scored on this occasion at any rate, not in spite of, but because of, the necessity for their travelling along a fixed line of rails.

Woolwich.—The doubling of the tramway track in Plumstead Road has been urged on the B.C., and it has been suggested that the L.C.C. should carry out the work as a temporary measure, but apparently the local Council refuse consent to the work being done unless certain road widening is also done at the same time.

Manchester.—The Workmen's Special Committee of the Council reported that, having regard to the privileges the Corporation grant to its employés as regards holidays and otherwise, it cannot recommend the Tramways Committee to comply with the application of the Electrical Trades' Union for treble pay in respect of Christmas Day and Good Friday for electricians and wiremen in its employ who work on those days.

Mexico.—According to the *Merion Review*, a novel feature of the excellent electric car system of Mexico City and its suburbs is the provision made for carrying freight of all kinds, including live animals, on the same cars with passengers. Each train is made up of two large cars—the one in front being for first-class passengers and the one in the rear for second-class, the fare in the first being exactly double that in the latter. One end of the second-class car is partitioned off for freight, and here one can see chickens, goats, turkeys, pigs, calves and other live stock, vegetables, flowers, fruit, wood, and all manner of rural products, all of which are conveyed to the heart of the city from distances of 5 to 10 miles and more in the country. This is a very profitable portion of the company's business.

The electric car lines of Mexico City have been placed in first-class order again, having been seriously crippled during the Zapatista occupation in the early part of 1915, and it having been difficult to secure the necessary machinery and supplies owing to the situation in Europe. This has been remedied, however, and now the service is being re-established upon the former very efficient basis. Prior to the revolution the local transportation system of Mexico City and its suburbs was noted as one of the best and most extensive in the world.

Nelson.—Arrangements have been made between the Nelson and Colne Corporations for a curtailed tramway service. During the winter months it has been decided to discontinue the last hour service, except on Saturdays.

Rossendale.—**ARBITRATION.**—The inquiry regarding the rearrangement of fares and stages, as between the Rawtenstall and Bacup authorities, which has been conducted by Mr. J. M. McElroy, of Manchester, on behalf of the B. of T., was concluded last week.

Salford.—**ELECTRIC VEHICLE.**—The Electricity Committee has ordered an "Orwell" tipping wagon, at a cost of £795, the amount to be taken from the renewals fund.

Stockton.—**PROPOSED TRAMWAY PURCHASE.**—With regard to the proposed purchase of the tramway system in the borough, a letter has been received by the T.C. from the Middlesbrough Corporation, stating that that body had appointed a Committee to consider the question of the purchase of its local tramway system, and suggesting a conference between the two authorities, together with a representative from Thornaby. The Stockton T.C. has appointed a deputation accordingly to meet the Middlesbrough Committee.

Walsall.—The Corporation Tramways Committee recently decided to run a restricted service on Christmas Day; the employés have been agitating for the discontinuance of the service on that day, and threaten not to operate the cars.

TELEGRAPH and TELEPHONE NOTES.

France.—The telegraph and telephone tariffs have been raised by levying a tax of 2½d. per telegram up to 50 words, in addition to the normal charge of 3d. a word, and increasing the annual payment for a private telephone from £16 to £20.

India.—Between April, 1912, and March, 1915, the telegraphic network of British India increased by 12,833 km. of line and 56,183 km. of wire, the totals being 135,489 and 531,353 km. respectively. The number of offices open to public service increased by 7,710 to 8,438, and the number of telegrams handled from 1381 to 1492 millions (internal), but the international traffic, which rose to 166 millions in 1913-14, fell to 127 millions in 1914-15. The revenue from the telegraphic service rose from 1768 million francs in 1912-13 to 2079 millions in 1914-15. The number of telephone exchanges at the end of 1914 was 186, with 15,476 connections. *Journal Telegraphique.*

Mauretania.—Two wireless stations have been opened at Atar and Chinguetti, in communication with the station at Port Etienne. *Journal Telegraphique.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—**SYDNEY.**—January 22nd. Electrical plant (converter, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.*

QUEENSLAND.—December 12th. P.M.G.'s Department. Caps and lamps for switchboard, covered wire, benders, sleeves, and tapes. See "Official Notices" December 1st.

January 1st. P.M.G.'s Department. Cords, switchboard, parts and accessories, measuring instruments and telegraph instruments. See "Official Notices" December 1st.

Aylesbury.—December 16th. U.D.C. Electricity Department. Paraffin oil for one year (800 gallons); Diesel lubricating oil for one year (500 gallons). See "Official Notices" to-day.

Bridgend.—December 15th. Hospital Committee. Electrical wiring at the Isolation Hospital, Cefn Hirgoed. Mr. D. R. Jones, Clerk, 10, Wyndham Street.

Cape Town.—January 5th. Electric motors and starting panels, for the Corporation Electricity Department. Dock Road. Cape Town.*

Durban.—January 3rd. Corporation. One 3,000-kw. steam turbine, alternator, and condensing plant. Specification No. S. 238; drawing No. P. 597, both at the office of the Borough Electrical Engineer, Municipal Buildings. Deposit £2 2s.

Johannesburg.—December 20th. Corporation. Automatic pressure regulators for the A.C. turbo-generators at the power station.*

January 3rd. Corporation. Iron axles and bushes.*

London.—**ENFIELD.**—Electric light installation, Ponder's End Congregational Church. Rev. J. H. Bennett, pastor.

December 16th. H.M. Office of Works. Materials for electric bell wiring. See "Official Notices" to-day.

L.C.C.—December 19th. 325 tons of rolled-steel bars for magnetic brake shoes. Chief Officer, L.C.C. Tramways, 62, Finsbury Pavement.

New Zealand.—**DUNEDIN.**—January 24th. Motor-generator, accessories and spares. City Electrical Engineer, Market Street, Dunedin.*

TAURANGA. February 12th. Borough Council. Supply of six three-phase transformers, 11,000-400 volts. Messrs. H. W. Clime and Sons, Consulting Engineers, Raetihi.—*N.Z. Shipping and Commerce.*

Salford.—December 13th. Two electric passenger lifts (push-button system) at Union Infirmary, Hope, Pendleton, for the Salford B. of G. Specifications, &c. from Mr. E. H. Inchley, Clerk to B. of G., Poor Law Offices, Eccles New Road.

Spain.—The municipal authorities of Soria, in the province of that name, have lately invited tenders for the concession for the electric lighting of the town during a period of four years. The electric lighting contract for the town of Alcoy (Province of Alicante) has also lately been up for tender; no period was, however, in this case mentioned.

Sunderland.—D. C. 1200. Steam turbine, alternator, and generator. 1200 H.P. 1200 K.V.A. capacity works. Specification for the same. 1200 H.P. 1200 K.V.A. capacity works. Mr. A. S. Blackman, 1200 H.P. 1200 K.V.A. capacity works. 1200 H.P. 1200 K.V.A. capacity works.

Warrington.—D. C. 1200. Electricity and Tramways Committee. Twelve months' supply of earthenware conduit. 1200 H.P. 1200 K.V.A. capacity works. 1200 H.P. 1200 K.V.A. capacity works.

December 12th. 7,000 tons of slack coal for the electricity works. 1200 H.P. 1200 K.V.A. capacity works. 1200 H.P. 1200 K.V.A. capacity works.

Specification for the "Steam Turbine" can be seen at the Board of Trade Commercial Intelligence Department in London.

CLOSED.

Blackpool.—Motor-generator for testing purposes, for the Electricity Department. Electric & Ordnance Accessories Co., Ltd.

Luton.—T.C. Electricity Department. Accepted tenders: 1200 H.P. 1200 K.V.A. capacity works. 1200 H.P. 1200 K.V.A. capacity works.

December 12th. 7,000 tons of slack coal for the electricity works. 1200 H.P. 1200 K.V.A. capacity works. 1200 H.P. 1200 K.V.A. capacity works.

Manchester.—Electricity Committee:—Low-pressure pipes and supports.—Aiton & Co., Ltd. Lea recorder.—Lea Recorder Co., Ltd. High and low-pressure pipework.—Stewarts & Lloyds, Ltd. Valves.—Blakeborough & Sons. Cables.—Pirelli-General Cable Co.; Western Electric Co.; B.I. & Helsby Cable, Ltd.; W. T. Glover & Co., Ltd.

Reigate. B. of G. Electric cable for the laundry at 1200 H.P. 1200 K.V.A. capacity works. 1200 H.P. 1200 K.V.A. capacity works.

Salford.—Tramways Committee:—Installation of electric lighting, 1200 H.P. 1200 K.V.A. capacity works. 1200 H.P. 1200 K.V.A. capacity works.

Electricity Committee:—Installation of electric lighting at the electricity station. 1200 H.P. 1200 K.V.A. capacity works. 1200 H.P. 1200 K.V.A. capacity works.

Woolwich. B.C. Accepted tender:—Rees Rotarbo Manufacturing Co., Ltd. 6,000-gal. pump for cleaning the boilers at Globe Lamin Works, 1200 H.P. 1200 K.V.A. capacity works.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, December 8th. At 8 p.m. Paper on "Paraffin and the Internal-Combustion Motor," by Mr. S. C. Sanders.

Saturday, December 9th. At 2.30 p.m. Visit of inspection of the mechanical plant for lighting, ventilating, cooking, and heating services at the Holborn Restaurant, Kingsway, W.C.

Monday, December 11th. At 8 p.m. At the Institution of Electrical Engineers, Victoria Embankment, W.C. Presidential address, "Industrial Engineering: Present Position and Post-War Outlook," by Mr. F. W. Lancaster.

Chief Technical Assistants' Association.—Saturday, December 9th. At 3 p.m. At the Tavistock Hotel, Covent Garden. Discussion on "Coal and Ash-Handling Plant."

Society of Engineers.—Monday, December 11th. At 3 p.m. At Burlington House, Piccadilly. Papers on "The Sources of the Minerals required by the Iron and Steel Industries of the U.K.," by Prof. W. G. Feamsides; "The Mineral Resources of the British Empire as regards the Production of Non-ferrous Industrial Metals," by Prof. C. Gilbert Cullis.

Royal Society of Arts.—Monday, December 11th. At 5 p.m. At John Street, Adelphi. Howard Lecture, "Coal and its Economic Utilisation," by Prof. J. S. S. Brane.

Wednesday, December 13th. At 4.30 p.m. At John Street, Adelphi. Paper on "The Development of Imperial Resources," by Mr. H. Wilson Fox.

Association of Supervising Electricians.—Tuesday, December 12th. At 7.15 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Electric Lighting," by Mr. S. G. Martlew.

Liverpool Engineering Society.—Wednesday, December 13th. At the Royal Institution, Colquhoun Street. Paper on "Works Costing Systems," by Mr. H. Shepherd.

Association of Engineers-in-Charge.—Wednesday, December 13th. At 8 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Solid Fuels," by Mr. S. G. Martlew.

Institution of Electrical Engineers.—Thursday, December 14th. At 8 p.m. At Victoria Embankment. Paper on "Colonial Telegraphs and Telephones," by Mr. R. W. Weightman.

Western Local Section.—Monday, December 11th. At 5 p.m. At the South Wales Institute of Engineers, Park Place, Cardiff. Kelvin Lecture, "Some Aspects of Lord Kelvin's Life and Work," by Dr. Russell.

(Manchester Local Section).—Tuesday, December 12th. At 7.30 p.m. At the Engineers' Club, Illustrated Lecture, "Some Aspects of Industrial Engineering," by Mr. S. G. Martlew.

Scottish Local Section.—Tuesday, December 12th. At 7.30 p.m. At the Engineers' Club, Glasgow. Paper on "The Parallel Operation of Electric Locomotives," by Mr. J. M. Park.

Greenock Electrical Society.—Thursday, December 14th. At 7.45 p.m. At 22, West Stewart Street. Paper on "The Art of Wiring," by Mr. J. Nichol.

Institution of Mechanical Engineers.—Friday, December 15th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, Westminster, S.W. Paper on "Variable-speed Gears for Motor Road Vehicles," by Mr. R. L. D. Jones.

Illuminating Engineering Society.—Friday, December 15th. At 5 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. "Suggestions for the Use of Electric Light in the Home," by Mr. L. Gaster.

Association of Mining Electrical Engineers West of Scotland Branch.—Saturday, December 16th. At 1.30 p.m. At the Royal Technical College, Glasgow. Social evening.

NOTES.

The Motor-Ship "Glenamoy."—This ship, recently completed by Messrs. Harland & Wolff, is equipped with two six-cylinder Burmeister & Wain Diesel engines, giving a total of 3,600 H.P.; a large electrical plant is provided, all the auxiliaries being electrically operated, and including 19 electrical winches of 7 or 4 tons capacity, electric steering gear and electric cooking.

United Kingdom Manufacturers Represented in U.S.A.—H. M. Consul-General in New York (Mr. C. Olive Bayley) requests United Kingdom manufacturers who have branches, agents or other representatives in the United States to forward to him the addresses of such representatives, as these will be of great assistance to him in dealing with the frequent inquiries he receives from American merchants. *Board of Trade Journal.*

Essay Competition.—The Dorset Field Club is offering the "Ceil" Medal and prize of £10, to be awarded next May, for the best paper on "The More Recent Applications of Electricity in the Present War: Especially in the Treatment of Diseases and Wounds Arising Therefrom." An announcement appears in our advertisement pages to-day.

The "Dacia" Torpedoed. A Press dispatch from Lisbon states that the British ship *Dacia* has been torpedoed and sunk. Her tonnage was 1,473 net and 1,856 gross. She was built in 1898, and was owned by the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd. German submarines have raided Funchal, Madeira, their bombardment being specially directed against the English submarine cable station.

Central Station Men and Military Service.—At a meeting of the Heston and Isleworth U.D.C., on Tuesday evening, Mr. Palmer said that one of the local Tribunals had publicly attacked the Council's electricity department for refusing to release some of its men of military age and fitness. The Electricity Committee had tried hard to get men to replace them, without success, at which he did not wonder, seeing how valuable the services of electricians were just now.

Mr. Bonnett said they had 13 men fit for the Army, and the Council ought to release them. The engineer got them badged, but he did not know that the Council had ever sanctioned such a proceeding. The Council was being attacked on all sides for keeping its employees from doing their duty to the country, and it was nothing but a scandal.

Mr. Heath said that he was astounded to hear there were so many men still retained, for he had always been fighting to get them into the Army. The engineer had never received sanction to keep the men out of the Army. They were all married, and their ages were from 25 to 39, and it was quite possible to substitute them by women. They knew that women were attending to switchboards and doing lots of duties that men used to do. He would move that the names of the men be sent to the Ministry of Munitions and the military representative, who would soon see which of the men could be retained.

Lieut. Chapman pointed out that meter reading and switchboard work could be done by women. As the street lamps were out, there was no need for a public lighting attendant.

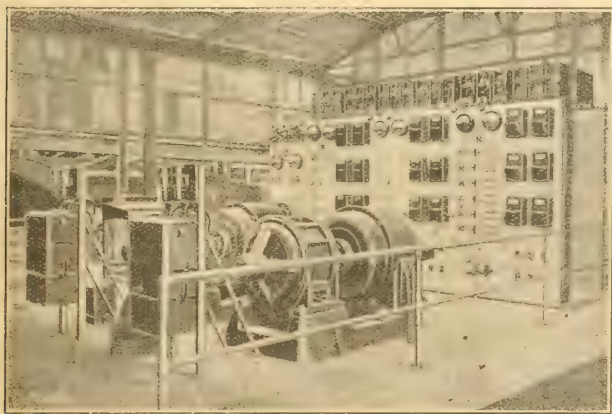
Mr. Meyers, chairman of the Committee, assured the Council that the engineer had done all in his power to find substitutes for the men. They were willing to go, but there must be others to take their places. The Council could not get the roadmen or scavengers to do their work, which was technical, and required a great deal of knowledge. The engineer had to keep the works going to meet contracts and supply the public demands; but if the Council would exonerate him from blame, he would discharge the men the very next day. The engineers were running day and night, and the men worked in three shifts of four each, and though members had boasted they could save four of these men, never a one of them had shown how it could be done. They must have technical men to send out at any moment to see to faults or to attend to sudden calls, and in a district where there was much work depending on both the day and night load, the staff must be kept up.

The discussion then dropped. The Local Government Board has forwarded to municipalities throughout the country a memorandum prepared by the Home Office and Board of Trade dealing with the substitution of women for men in municipal services, particularly in electricity undertakings.

It is stated that at the request of the military authorities the Ministry of Munitions has reviewed the certificates held in connection with war-service badges by employees at the Bath Electric Light Works and as a result has disbadged three men.

American Capital in Norway.—American capital is employed in building a factory for the production of calcium carbide at Sande in the district of Stavanger, where there are falls suitable for the generation of large amounts of electrical power. Other electrochemical products are to be turned out by this factory for shipment to New York and sale in the American market. First shipments should be ready early in 1918, as the contract calls for the finishing of the plant by January 1st of that year. The new company is registered in Canada, and is called the Electric Furnace Products Co., Ltd. Edgar F. Price, an officer of the Union Carbide Co. of New York, is president of the organisation. The power for the factory is to be supplied by the Sande Falls Co., a Norwegian corporation financed by Norwegian capital. A lease of 40 to 50 years for the use of the power has been taken from this corporation by the Canadian Co., and the Norwegian corporation already has more than 250 men at work. There are three sources for the power now, to be used, each of which will come from a 1,000-ft. head. In all they will generate a total of 40,000 H.P. Later the tail water will be carried in a tunnel nearly 5 miles through the mountains to a place where it will fall into the salt water of the fjord. This will generate another 40,000 or 45,000 H.P. Although this end of the fjord is about 70 miles from the sea, the water is so deep that large ocean steamers can come direct to the company's docks and take the goods for shipment to the United States. The Sande plant will be one of the largest in Norway. (*International World*.)

Vehicle Charging in Sydney, N.S.W.—The number of electric vehicles in Australia at the present time is not very large, but continual progress is being made. In Sydney a garage has been established by the City Council at Palmer Street, and the charging station (our view of which is reproduced from the *Commonwealth Engineer*) is the first of its kind in Australia. The plant consists of two motor-generator sets together with a charging switchboard. Included in the vehicles that are regularly charged and maintained at the station are two 5-ton, two 2-ton, two 30-cwt., two 15-cwt.



VEHICLE BATTERY-CHARGING STATION OF THE SYDNEY COUNCIL, N.S.W.

one 1-ton, one 10-cwt., and ten electric broughams; a number of others are also on order. The brougham and runabout are stated to be popular in Sydney; and an exceedingly light runabout has recently been introduced—the Milburn light vehicle, which has travelled a distance of 70 miles on one charge. The City Council's charging station possesses all the necessary facilities for the care and maintenance of electric vehicles.

Carbon Electrodes in Germany.—One of the results of war conditions in Germany has been the standardisation of carbons for electric furnaces. According to the new rules, round carbons for steel furnaces are to be made in sizes varying in thickness from 100 mm. upwards, by steps of 25 mm., to 250 mm. diameter and by steps of 50 mm. for larger sizes, the tolerance varying from 3 mm. to 6 mm., according to size. For rectangular electrodes used with other kinds of furnaces the standard size has been fixed at 500 mm. square. The standard length may ultimately be raised to 24 in., but for the time being is fixed at 2 m. All lengths, however, may be varied in multiples of 20 mm., and the tolerance is to be 20 mm. A table has been published giving the standard dimensions to be adopted for upper holders with cylindrical threads screwed into the carbons. (*Iron and Coal Trades Review*.)

Hydro-Electric Works in France.—During the past 20 years many efforts have been made in the French Chamber of Deputies with the object of securing the passage of a Legislative measure which would ensure the methodical utilisation of the hydraulic forces of the country in connection with the production of electricity. All these schemes, however, have failed to mature, chiefly in consequence of the difficulty of finding a just interpretation of the right of granting concessions by the State. When the question concerned waterways under the control of the Government no disagreement arose, but when the interests of private owners were affected the harmony suddenly disappeared. The war,

however, has demonstrated the necessity for utilising to a much greater extent the extensive water powers with which the country has been richly endowed by nature. Just as the French cannot possess too many guns and too much ammunition for the successful prosecution of the war, so can they not have too many water powers in use for the production of electrical energy, because the country is poor in coal resources as compared with its industrial progress. Prior to the war France was compelled to import 20,000,000 tons of coal and coke per annum, and when peace is restored, and even if the German coal basin of the Saar, with its annual output of 15,000,000 tons of coal should be annexed, it is considered that the industrial expansion would still render it essential for the French to obtain from 10,000,000 tons to 15,000,000 tons of coal per year from abroad, unless the existing water powers are drawn upon in a considerably greater measure than is the case at present.

According to a report prepared a few years ago by M. Pinot, general secretary of the Comité des Forces Hydro-Electriques, the water powers capable of being utilised in France represent 5,850,000 H.P. This power compares with 7,500,000 H.P. in the case of Norway, 6,750,000 H.P. in Sweden, 6,460,000 H.P. in Austria-Hungary, 5,500,000 H.P. in Italy, 1,500,000 H.P. each in Spain and Switzerland, 1,425,000 H.P. in Germany, and about 1,000,000 H.P. in England. Yet, with such considerable resources at disposal, it was shown by M. Ader that only 10 per cent. had been brought into useful service by 1911. Since that time good progress has been made, particularly during the course of the present war, and further works are still being carried out. It is estimated that a total of £60,000,000 has been invested in hydro-electric works throughout the country. Nevertheless, it is believed that falls representing a further 1,500,000 H.P. could be profitably used, and that the State should intervene and render assistance in the development of the resources.

A Bill has now been introduced in the French Chamber by four private members, with the object of attempting to reach a solution of the problem. The Bill proposes a form of nationalisation of electrical energy in the sense that the right of granting concessions should be vested in the State. The undertakings are classified as works of 500 kw. which do not sell energy, and works of from 500 kw. to 10,000 kw. The former would be subject to State sanction, and powers in regard to waterways not owned by the State would be granted for a period of 50 years, and be capable of extension for a similar term. In the case of large works the concessions would only be given to limited companies after inquiry by the Minister of Public Works, in conjunction with the Ministries of Agriculture and Home Affairs, and provision is made whereby concessionaires would be able to overcome obstacles improperly placed in the way of their undertaking. It is suggested that the State should participate in the profits realised by the first-mentioned class of works without intervening in the management; whilst two representatives of the State would be appointed to the administrative council of the large works. The Bill further exempts existing works, having no title previous to the edict of 1566, from the proposed law for a period of 75 years, and until then no extensions would be possible without authority or submission to the law. The owners of those works possessing the title in question would not be liable to the law unless their undertakings were redeemed by the State; but they would have to pay a tax in order to establish equilibrium with the other works. Excepting the latter class, all the works would revert to the State on the expiration of the concessions, which could be expropriated by the State after the ordinary period of 30 years. It is finally suggested that a Government Committee for hydraulic powers should be created, and formed of officials for one-half of the members, and of representatives of the electrical manufacturing, electrochemical and electrometallurgical industries, and of agriculture for the other half, to work in conjunction with the Ministry for Public Works.

Leeds Engineers' Wages.—An award made by the Committee on Production in connection with an application for an advance of wages made by the Leeds and District Engineering and Allied Trades Joint Committee to the Leeds and District Employers' Association, provides for the time rates of the men concerned, other than the ironfounders, being advanced 3s. a week. The advances are to be regarded as war wages, and recognised as due to and dependent on the existence of the abnormal conditions now prevailing in consequence of the war. (*Leeds Mercury*.)

Aluminium as War Material.—The Ministry of Munitions has issued an Order including various classes of aluminium and alloys of aluminium as war material, and cancelling the previous Order dated July 21st last. The classes and descriptions are as follows:—Aluminium and alloys of aluminium, unwrought and partly wrought, including ingots, notched bars, slabs, billets, bars, rods, tubes, wire, strand, cable, plates, sheets, circles, strip; aluminium scrap and swarf, aluminium alloy scrap and swarf, remelted aluminium scrap and remelted aluminium alloy scrap and swarf; granulated aluminium, aluminium powder "bronze," "flake," and "fitter." (*Ministry Press*.)

A Birmingham Engineering Federation.—A federation has been formed in Birmingham of all the craft Unions engaged in the engineering industry in the local area. The federation represents over 10,000 skilled workmen. *Daily Telegraph.*

Institution and Lecture Notes.—**University College, London.** In the last of his course of lectures on "Long-Distance Telegraphy," Prof. Fleming discussed the subject of radio-telephony. After briefly explaining the main principles of wireless telegraphy, he explained the necessity for using a system of continuous undamped waves for telephony, and described various methods of obtaining such waves. The first of these was the high-frequency induction alternator of Alexanderson, which, by means of high-speed revolution and a large number of poles, produced alternating currents of the necessary frequency—up to 100,000 cycles per second. This machine was made to generate 50 or 100 KW., but was very costly. In the Goldschmidt frequency-raising machine high-frequency oscillations were produced by internal electromagnetic reactions, the unwanted frequencies being filtered out with resonant circuits, and the antenna being tuned to accord with the highest frequency attained. Machines such as these were unsuitable for use on board ship, owing to gyrostatic action and to the excessive wave-length. The Poulsen arc high-frequency generator, with copper-carbon electrodes in a non-oxidising atmosphere, and a simpler arc generator devised by the lecturer, using copper-carbon electrodes in chambers sealed with oil, the vapour of which takes the place of hydrogen, were described, and an interesting experiment with a long helix, showing the production of stationary waves, and proving that the discharges were intermittent, was performed. In Dr. Fleming's opinion, however, although the arc generator is generally used by experimenters, it is not sufficiently developed for practical use; the more he worked with it the less he liked it.

The problem of impressing the voice waves on the antenna current was next discussed, the chief difficulty being shown to reside in the limitations of the carbon microphone transmitter, which can carry only a small current. With a liquid microphone Prof. Vanni had succeeded in telephoning a distance of 600 miles. The Alexanderson magnetic amplifier, in which the saturation of iron was utilised to magnify the microphone effect, was described, and, in Dr. Fleming's opinion, showed much promise. The instrument used in most of the successful experiments, however, was a modification of his own oscillation valve, which he first studied in 1889, and which, he observed in 1904, could be used as a rectifier of alternating currents. By a recent legal decision in the United States this device had been held to contain the essential features of later oscillation valves, and it could be used not only as a receiving valve, but also as a generator of continuous undamped oscillations on either a small or a large scale. Finally, the principle of the Brown telephone relays was explained, with illustrations.

Institution of Mechanical Engineers.—The report of a Committee appointed in 1914 on hardness tests for hardened journals and pins has just been issued; it deals mainly with a series of experiments made at the National Physical Laboratory by Dr. T. E. Stanton and Mr. R. G. Batson with machines arranged to produce wear of the surface under rolling and sliding abrasion. The tests showed that for a given material the resistance to rolling abrasion was roughly proportional to the Brinell ball hardness number. With sliding abrasion, however, it was found that the Brinell hardness numbers of a miscellaneous selection of steels were not a safe guide in predicting their relative resistances to wear.

Diesel Engine Users' Association.—At the November meeting of the Association several new members were elected, and a long list of consulting engineers, manufacturing firms, and others interested in Diesel-engine work, but not qualified for full membership, were accepted as "Subscribers" to the Association. The new class of "Subscribers" are entitled to receive copies of the reports of *Proceedings* and other information and particulars circulated by the Association.

The president (Mr. Geoffrey Porter) announced that the Committee's report on "Air Compressor Explosions and Troubles," with recommendations on the subject, had been finally revised, and that it would be printed and circulated to the members and subscribers.

The hon. secretary gave particulars concerning several types of distance thermometers for use on air compressors, which he had collected from instrument makers, with information concerning cost of installation, &c.

Mr. George B. Vickers read a paper on "Piston and Small-End Lubrication in Diesel Engines," of which an abstract appears elsewhere in this issue.

Royal Society of Arts.—The Juvenile Lectures will be delivered by Mr. A. A. Campbell Swinton, F.R.S., on "Electricity and Its Applications." The lectures, which will be fully illustrated with experiments, will be given on Wednesdays, January 3rd and 10th, at 3 p.m.

Bradford Engineering Society.—At a meeting of the Society last week, Mr. W. Howard Brown lectured on "The Principles of Continuous-Current Motor Starters."

Royal Institution.—The illustrated Christmas course of Juvenile Lectures will be delivered this year by Prof. Arthur Keith, M.D., F.R.S., his title being "The Human Machine which All Must Work." The subjects are as follows:—"Living Engines," December 28th; "Living Levers," December 30th; "Living Pumps," January 2nd; "Living Bellows," January 4th; "Living Workshops," January 6th; "Living Central Exchanges and Wires," January 9th. The lecture hour is 3 o'clock. The following are among the lecture arrangements before Easter: Prof. C. S. Sherrington, six lectures on "The Old Brain"; Prof.

W. E. Dally, two lectures on "The Structure of Metals"; Prof. F. G. Donnan, three lectures on "The Mechanism of Chemical Change"; Prof. J. A. Fleming, two lectures on "Modern Improvements in Telegraphy and Telephony"; (1) Telegraphy; (2) Telephony." The Friday evening meetings will commence on January 19th, when Prof. Sir James Dewar will deliver a discourse on "Soap Bubbles of Long Duration."

Educational.—A Committee has been appointed by the Treasury to report upon the system of examination for Class I of the Home Civil Service, and to submit a revised scheme to suit the requirements of the India, Foreign, and Colonial Offices, as well as the Home Service. Sir Alfred Ewing and Sir H. A. Miers, both scientific men of the highest eminence, are members of the Committee, their colleagues being Mr. H. A. L. Fisher and Prof. W. G. Adams, representing classical studies, and Mr. Stanley Leathes, First Civil Service Commissioner, as chairman.

SWANSEA COLLEGE.—At a meeting held to promote the claims of Swansea Technical College to be raised to University status (which application is being considered by the Royal Commission on Welsh University Education), subscriptions to the endowment fund were announced amounting to £71,000.

CITY AND GUILDS OF LONDON INSTITUTE. The report of the Department of Technology for the session 1915-16 shows that the number of students in attendance was 35,203, compared with 55,996 in 1913-14, and the number of candidates for examination was 8,508, compared with 23,119, the number of passes being 5,239, compared with 14,570. Many students after commencing work were unable to complete their course and come up for examination, and many registered classes had to be discontinued owing to the falling-off in the number of students in attendance. At centres in one district an air raid, on May 2nd, necessitated the suspension of the examinations, and the rising in Ireland hindered the holding of the examinations at the regular dates. For the first time on record the examinations were held on foreign soil, 12 candidates being examined in Telegraphy and three in Telephony at Havre. A candidate in Telegraphy was examined on board H.M.S. *Queen Mary*. For the special examination in Magnetism and Electricity which the Institute holds by arrangement with the Postmaster-General, only 385 candidates presented themselves, as against 664 last year. Some suggestions and criticisms having been made in regard to the syllabus in Electric Wiremen's Work, a conference was arranged between Mr. W. R. Rawlings and Mr. W. Ellerd Styles, representing the Electrical Contractors' Association, and Prof. T. Mather, F.R.S., and Mr. Hawkins, representing the Institute, as the outcome of which a revised syllabus, under the modified title of "Electrical Installation Work," has been adopted, and now appears in the programme for the next session. Emphasising the importance which technical instruction of artisans will have in the near future, the report says:—

"A vague opinion that all is not well with the technical training of our working population is, no doubt, widely held, but much more is necessary, and the time for mere discussion of the problem is past. Speaking generally, employers must change their attitude towards technical training, so that those who foster the education of their younger employes should become the great majority instead of the minority, and so that attendance at continuation schools and day schools, or if this be too much to expect, at least at evening technical classes, should become the rule. Nothing short of a strong national movement in this direction can prove adequate to meet the requirements of the case. What has been said above is sufficient to show that there is need for reform in the primary school, in the secondary school, in the technical school, and in the University, not with a view to turning men into machines, but to provide them with the raw material of knowledge, which they need for intellectual development."

Fatalities.—Coroner H. Rutherford held an inquiry at Coxlodge, Northumberland, on the 5th inst., into the circumstances attending the death of George Soulsby, aged 20, a fitter's apprentice, who was employed by the Burradon and Coxlodge Coal Co., at Hazelrigg Colliery. The evidence of M. Dickinson, the engine-man, went to the effect that on Sunday morning, the 3rd inst., Soulsby went into the engine house, and witness imagined that he was looking round to see that all was right. Witness went out for a couple of minutes, and on his return found Soulsby lying on the floor on his back. The use of artificial respiration was unavailing. On examining the place witness found that Soulsby had been interfering with the electric controller. He had opened the box and come into contact with the current. M. Richardson, the engine-wright, stated that he instructed Soulsby to "blow out" the motor, but he did not intend that the youth should have cleaned the contacts, because he knew Soulsby would not have time, although he was quite capable of doing it. A verdict was returned that Soulsby had been accidentally killed while attempting to open the electric controller before cutting off the main switch.

Appointment Vacant.—Tramway traffic superintendent for the Pontypridd U.D.C. (£150). See our advertisement pages to-day.

Trade with Italy.—The representative of a firm in Rome is at present in London with a view to getting into touch with United Kingdom manufacturers of the undermentioned goods, and arranging to represent them on the Italian market:—Electrical fittings, hardware and tools, &c. Particulars from the Secretary, Statistical and Information Department, London Chamber of Commerce, 97, Cannon Street, E.C. *Board of Trade Journal.*

A New Triangulation Signal Lamp.—Though the general principle employed in geodetic surveys is the same as in the survey of a railroad, a farm, &c., the great distance between the points, varying between 10 and 100 miles, or over, requires not only the use of specially large and refined instruments, but also a special means of making the point visible to the observer. This is now done in day time by reflecting sunlight to the observer from a mirror placed accurately over the point, and at night by means of a specially constructed acetylene lamp. Distances of the magnitude mentioned can be penetrated by either means only under favourable weather conditions, and many days during a season are lost even when the atmosphere is only slightly clouded by smoke, fog, &c.

The storage cell was studied by the United States Coast and Geodetic Survey with the view of using electricity as a source of light. Its cost and weight, and the difficulties connected with its maintenance, were found to be too great. Electric generators with the necessary prime motor, were found to be too heavy for transporting to difficult stations.

The result of a series of tests of dry cells, which are readily divisible into loads suitable for climbing different ascents, however, warranted the design and construction of a new type of lamp, the use of which will increase the number of observing nights per month by at least 25 per cent.

The main part, an ordinary automobile head light, is suitably mounted for directing in horizontal and vertical planes: the lamp is provided with an ammeter, a small rheostat, and a switch. The whole, packed in a strong case, weighs 23½ lb.

In order to obtain most nearly the maximum intensity of the light, it was necessary that the lamp should be provided with a filament concentrated to a degree not found in those on the market. A lamp manufacturer was induced to make the necessary designs and experimental tests, and submitted a number for trial.

The use of the dry cell was found practicable, and not too costly, on the assumption that the proposed lamp was to be kept burning throughout the night. The trial of the newly-designed lamp, by comparison with the present acetylene lamp, however, proved the former so much superior, that it was decided to have the lights shown only on signal, flashed with one of the new lamps by the observer, for the few minutes each time it is observed upon. This reduces very materially the consumption of current and battery cost. The lamp, after being provided with two additional bulbs, one for medium and one for short distances, was tested by the Bureau of Standards, with the following results:—

Apparent candle-power, at a distance of 100 ft.	
Lamp with specially concentrated filament, gas filled, 6 volts, 2.5 amperes	250,000
Automobile lamp, 6 volts, 1.8 amperes	50,000
Flash-light lamp, 2.7 volts, .34 ampere	6,000

The candle-power of the acetylene lamp now used in the triangulation carried on by the Survey, measured under the same conditions, is 1,500.—E. G. FISCHER, in *Science*.

Glass Manufacture.—A department of glass technology at the University of Sheffield has been organised with the financial support of the Advisory Committee of the Privy Council for Industrial Research, of the Ministry of Munitions, and of the glass manufacturers of South Yorkshire. An actual glass factory will be established, in which operations will be done on a large, semi-commercial scale. The model factory will be equipped with pot furnaces and a small tank furnace and a series of experimental furnaces, including a number of electrically-heated ones and some heated by gas. *The Times*.

The Coal Trouble in Australia.—A Reuter dispatch from Melbourne, dated December 2nd, stated that manufacturers throughout Australia were to be supplied with motive power, as from Monday last, thus enabling the factories to re-open, conditionally on their closing down for 10 days for the Christmas and New Year holidays. The full train and tramcar services were being restored.

Electrical Trades Union.—The address of the secretary of the London Station Engineers' branch is 7, Levensale Road, Forest Hill, S.E.

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place.—Orders for the week by Lieut.-Col. C. B. Clay, V.D. Commanding.

Monday, December 11th.—Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10. Signalling Class. Recruits' Drill, 6.25—8. Lecture, "On Telephones," 7.30.

Tuesday, December 12th.—School of Arms, 6.7. Lecture, 7.15, "The Service of Protection," Company Commander Hynam.

Wednesday, December 13th.—Instructional Class, 6.15. Platoon Drill, Platoon No. 1.

Thursday, December 14th.—Platoon Drill, Platoon Nos. 5 and 6. Ambulance Class by M.O., 6 o'clock.

Friday, December 15th.—Technical for Platoon No. 10, Regency Street. Squad and Platoon Drill, No. 9. Signalling Class. Recruits' Drill, 6.25—8.25. Lecture, "On Telephones," 7.30.

Saturday, December 16th.—N.C.O.'s Class, 2.30. Company Commander Hynam.

Sunday, December 17th.—Entrenching at Otford. Parade at Victoria (S.E. & C. Railway Booking-office), 8.45 a.m.

(By order) MACLEOD YEARSLEY, *Adjutant*.

New Finnish Hydro-Electric Company.—Application has been made to the Ministry of Trade and Industry for the approval of the statutes of a new company formed in order to construct and exploit electrotechnical works at Imatra-Volchoff under the name of "Vodopad." The founders are two share companies: the Petrograd Electricity Transmission Co. and the Finland Power Co. The object of the new company is to exploit the Imatra and Volchoff waterfalls, and to transmit the power generated to Petrograd, to be distributed to local factories and for illuminating the capital. The founders are asking power to expropriate land, and permission, with an original capital of 8,000,000 roubles, to issue Government-guaranteed bonds to the extent of nine times the capital named—that is, 72,000,000 roubles—to bearer. The project has been carefully examined by a special Conference, and has now been sent to the Finland Senate for a decision.

British-made Tungsten.—The shortage of tungsten following the outbreak of war—owing to our former dependence on Germany for supplies—rendered it essential to produce the metal in this country, for use in the manufacture of high-speed steel, and a Committee of steel manufacturers representing some 30 firms erected a factory in Lancashire for the purpose early in 1915. Since July last year the work has been carried on continuously day and night, and an average output of 3 tons a day has been obtained. The tungsten powder has averaged 98½ per cent. pure, and much of it over 99 per cent., compared with about 97½ per cent. for the German product. The company, which is known as High-Speed Steel Alloys, Ltd., has purchased a wolfram mine in Burma, and is improving its plant to deal with all kinds of low-grade ores. So there is no fear of a shortage of metal filaments!

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station Officials.—Mr. L. A. THAIN, charge engineer at the Bridlington Corporation electricity works, has resigned, having secured an appointment at Swansea.

A proposal by the Barrow Corporation Electricity Committee that the salary of Mr. H. R. BURNETT, borough electrical engineer, be increased from £550 to £600 per annum as from January 1st last, has been referred to the General Purposes Committee of the Town Council for consideration.

The Aberdeen Electricity Committee has agreed to an advance of £25 in the salary of the chief clerk at the electricity works. The wages of many employes at the works are to be advanced as from the date of their applications in October.

The Erith U.D.C. has advanced the salary of Mr. J. C. WILLIAMS, the engineer and manager, by £50 per annum; that of Mr. I. H. SAYNOR, departmental electrical engineer, by £25; that of the chief clerk (Mr. H. A. MUNDAY), by £16; and other officials by £10 and under.

General.—Mr. WM. STAPLETON, assistant electrician at the power house, Clonmel Asylum, has been appointed to the charge of the Fethard (Co. Tipperary) electric lighting plant.

The *Manchester Daily Dispatch* states that Mr. F. A. CARMICHAEL has been appointed Chief Superintendent of Telegraphs in Manchester, and Mr. J. WADSWORTH superintendent. Mr. G. BIDDOLPH has been promoted to the position of Assistant Superintendent, Class I.

London Gazette Notice.—Territorial Force: Royal Engineers. Tyne Electrical Engineers. Staff-Sergeant G. T. B. SCULLARD and Staff-Sergeant F. THOMPSON to be Second-Lieutenants (on probation).

Mr. ALAN WILLIAMS, M.I.E.E., has been appointed temporary Lieutenant, R.N.V.R., for special electrical engineering duties.

Coun. W. H. DAWSON has been appointed Chairman of the Woolwich B.C. Electricity Committee.

Mr. G. W. EYRE has been reappointed Chairman, and Mr. A. G. CROWLEY Vice-Chairman, of the Plymouth Corporation Electricity and Street Lighting Committee.

Coun. DAGNALL has been elected Chairman, and Ald. WALKER Deputy-Chairman, of the Manchester Corporation Electricity Committee; and Ald. BOWES Chairman, and Ald. CHAPMAN Deputy-Chairman, of the Tramways Committee.

Coun. MAYNE has been re-elected Chairman of the Newcastle Corporation Tramways Committee, and Coun. A. MUNRO SUTHERLAND Vice-Chairman.

Mr. H. SELLERS has been appointed Chairman of the Keighley Electricity Committee, and Mr. J. MUILEN Chairman of the Tramways Committee.

Ald. J. P. SMITH has been appointed Chairman and Col. WADHAM Vice-Chairman of the Barrow Electricity Committee.

Roll of Honor.—Lance-Corporal CHARLES RAMSEY, Royal Engineers, who at the time of enlisting was an electrical engineer with the Palmer Iron and Steel Shipbuilding Co., Jarrow, has been awarded the Military Medal for bravery on the field.

Private JOHN NUGENT, R.M.L.I., killed on active service, was a fitter at the British Westinghouse Works, Trafford Park.

Mr. C. W. PARISH presided at the meeting held on November 28th. He first referred to the death of Mr. G. Keith, the chairman and managing director. For the past two years he had had to refer to a serious falling off in the Amazon rubber crop. In the past twelve months there had been a slight improvement, the rubber production being increased by 1,365 tons, and great fluctuations in the price had tended to increase the company's business. The traffic receipts increased by £9,749, due to an improvement in business during the last half of the financial year and to an increase of 10 per cent. in local rates which automatically came into force on April 1st, 1916, owing to the fall in traffic during 1915. Expenses at stations decreased by £1,201, partly due to the lower rates of exchange, and maintenance of cables decreased by £1,929. The gross profit was £29,880, as against £22,994. Mr. Nosworthy, who had been elected to fill the vacancy caused by the death of Mr. Keith, and had been appointed managing director and knew everything about the company's business and cables by reason of his control of the system on the Amazon, seconded the adoption of the report. In the course of his speech, as reported in the *Financial Times*, he recalled that the first cable worked a very short time before parts of it became interrupted; half its length had to be relaid about 18 months afterwards, and the new cable also was subject to repeated interruption. The experience thus gained had enabled them to overcome many difficulties, and to-day a very good service was maintained. The service was much improved by the duplication in 1906 of the uppermost section, some 70 miles long, which was most subject to interruption. Experience showed that the one means of maintaining a satisfactory service was to have two cables the whole way between Para and Manaus, and in 1907 he was instructed to make surveys to find, if possible, a new route entirely apart from the main river, or as nearly so as could be. Two years were spent on the survey, and a suitable route was found. The new cable had a length of 1,094 miles, of which only 146 miles were in the main river, the remainder being in lakes and small rivers where there was shallow water, perfect bottom, and next to no current, and some 25 miles of underground cable was laid.

mostly through virgin forest. Many of the streams were never used, except perhaps by canoes, and had become completely blocked by floating islands, through which they had to cut their way. Since its completion this cable had been interrupted 28 times. Of this total, five were due to damage by natives and five occurred in the cable of the 1906 upper section duplication, part of which was incorporated in the main duplication. Consequently in six years there had been only 18 breaks in the 1910 duplication, which was an exceedingly small average, so that the route selected might be considered successful. It was very rare for through communication to be interrupted. As to their prospects, he thought the worst was passed. The price of rubber, present and prospective, was remunerative. The States Governments were encouraging agriculture, and Brazil generally appeared to be making some recovery from its financial crisis.

Electrical Securities Trust, Ltd.—The report for the year to November 14th states that the results for the period, after charging all expenses and the interest due and accrued on the debentures, amounting to £2,376, show a loss of £564. No credit has been taken in the accounts for interests or dividends which may have accrued and which have not been paid within the period of the accounts. The directors regret that they have been unable to dispose of any of the investments held by the Trust during the past year, but out of cash in hand the trustees, on December 23rd, 1915, made a further distribution of 5 per cent. on the debentures.—*Financial Times*.

Companies to be Struck Off.—The following companies are to be struck off the Register unless cause to the contrary is shown within three months:—

Electric Stores, Ltd.
H. Manne-romulo Western, Engineering & Electric Co., Ltd.
New Electric Rail & Light Co., Ltd.
Panama Electric Light, Power & Traction Co., Ltd.
Telephone Installment System Co., Ltd.

United Wire Works, Ltd.—The report for the year to September 30th states that, after providing for depreciation, bad debts, and excess profits duty, the profit is £13,702. Dividend, 7½ per cent. on the ordinary shares, free of tax; £1,500 to general reserve fund, leaving £3,302 to carry forward.

Callenders' Share & Investment Co., Ltd.—The accounts for the year show, after providing for debenture stock interest, &c., and including £3,010 brought forward, £11,292 available, as compared with £10,876. A further dividend of 2½ per cent. is recommended, making 5 per cent. for the year, transferring £500 to reserve, and carrying forward £4,175.

Adelaide Electric Supply Co., Ltd.—Final dividend of 5 per cent., making 10 per cent. for the year, together with a bonus of 2 per cent., both free of income-tax, on the ordinary shares for the year ended August 31st.

Dartmoor Electric Supply Co., Ltd.—Notice appears in the *London Gazette* of December 1st respecting the reduction of capital of this company from £4,000 to £2,000.

Brazilian Traction, Light & Power Co.—The directors have declared a quarterly dividend of 1½ per cent. on the fully-paid cumulative preference shares.

United Electric Tramways of Monte Video, Ltd.—Interim dividend on the pref. shares for the half-year ended September, 1916, at the rate of 6 per cent. per annum, less tax at 5s. in the £. No interim dividend on the ordinary shares for the half-year.

Power Gas Corporation, Ltd.—Profit for the year ended September 30th, 1916, £21,192, plus £9,105 brought forward. Dividend, 6 per cent. on the ordinary shares, less income-tax. £11,120 is to be carried forward, out of which excess profits duty, if any, will be met.

Chloride Electrical Storage Co., Ltd.—Interim dividend, 1s. per share, free of tax, on the ordinary shares.

Melbourne Electric Supply Co., Ltd.—Final dividend of 5 per cent., making 10 per cent. for the year, free of income-tax, on the consolidated ordinary stock.

Western Telegraph Co., Ltd.—First quarterly dividend, 3s. per share, free of tax, for the year ending June, 1917, being at the rate of 6 per cent. per annum.

STOCKS AND SHARES.

THURSDAY EVENING.

The political crisis has had a slightly depressing effect upon prices in the Stock Exchange, although, as business men, members of the House would welcome any sort of change that is likely to expedite the conduct of the war and hasten its termination. The most immediate influence is still the position of affairs in Greece and Roumania. Having regard to the uncertainty which still exists at the time of writing in both theatres, it is not very surprising that there should be a pronounced disinclination on the part of the public in the direction of investment and speculation alike.

This disposition is accentuated by the usual December desire to indulge in mild window-dressing, which leads capi-

talists, large and small, to postpone investment of surplus funds until the year is turned. This time they have the additional excuse that they are waiting for the advent of the new war loan. The sarcasm that the Government is likely to defer the next loan till such time as the news is much more than it is now, carries more acid than point, because, although it is unfortunately true that the Government missed its market badly in the autumn, it is equally true that to float a big loan during the last weeks of the year would be to crab pretty much its chances of success.

The Home Railway market continues in a sagging condition, and day by day the prices of the Steam stocks dwindle. This tendency has spread to the Undergrounds, where prices are scarcely so firm as they appear. Recent buyers of the £10 shares of the Underground Electric Railways are doing their best to snatch what profit remains to them; and the price, which was 2½ to ten days ago, is now more a tenth under 2, while in the shilling shares, which now stand at 6s., there is very little doing. The advance in wages conceded to the miners, and the threat that even this is not sufficient to satisfy the demand of those gentlemen, is the latest restraint laid upon hopefulness in the department.

The electric lighting market is quiet. What little pressure to sell was noticeable last week has been relaxed to some extent, and the assumption is that holders of illumination securities are looking with subdued expectation upon the campaign which is being carried out with a view to increasing the lights of London. Having regard to the alarming number of street accidents, the strong probability that the Zeppelin raiders are not likely to repeat their costly visits for some time, and the sentimental feeling that there is something undignified in London's still sheltering under its pall of darkness, it is hoped that the authorities may see their way to modify the stringent regulations at present in force. Westminsters are 1/16 down; so are South Londons. City of London ordinary are offered about 11½. But on the whole, the approach of the end of the year is an inducement to proprietors to retain their shares rather than to try to sell them at low prices so shortly before the next batch of dividend announcements.

Last week's meeting of Reuters shareholders confirmed the sale of the company's shares at £11 per share, which is just double the price at which Reuters were standing not so very long ago. The lowest touched this year was £4, and last year the price fell to 3. The last dividend paid by the company was 8s. a share, in May, 1914; so that, taking everything into account, it seems to us that the shareholders may heartily congratulate themselves upon having such an excellent price offered them. When the last 10 per cent. dividend was paid, in 1912, a certain amount of criticism was launched at a distribution of profits which looked rather extravagant at the time. However, this is now a matter of history; and proprietors are lucky to get out so comfortably.

Brazilian Traction again broke severely upon a fall in the Brazilian rate of exchange to a small fraction below 1s. The price touched 45½, showing a drop of 5 points in less than a week. Support forthcame at this level, and a recovery ensued to 47, which still leaves Traction's substantially lower on balance. The preferred have fallen 3 to 86. Rio exchange firmed up to 1s., but most of the things connected with Brazil are dull and depressed.

Other issues in the Latin-Canadian group are mostly better. An extraordinary rise in the price of Otis Steel carried the shares to 100, as compared with the low-water mark of 25 this year and 10 in 1915. The rise is associated with rumours to the effect that the company is to be taken over by one of the big corporations in America. Consolidated Gas & Electric of Baltimore shares have risen to 134, and from the look of the market it would seem to be wrong to sell them now. No recovery has occurred in British Columbia Electric stocks, and the Mexican group remains very flat. Government, railway, and industrial issues all being unfavourably affected. Mexican Light & Power preferred shares are 5 points down. The telegraph market is heavy. Westerns receded to 14, and the Eastern group is dull with a 2-point fall in Eastern Telegraph ordinary. The strength of industrials in New York helps to maintain the prices of the Anglo-American division. Marconis moved narrowly between 2½ and 3, the flicker of excitement which put the price up to 3½ last month having died out. Great Northern Telegraphs lost their rise of a week ago. Globe Preference eased off to 10½. Telegraph Constructions show a loss of 10s. at 38.

The feature of the miscellaneous group is a rise of 7s. 6d. in the price of India-Rubber shares, taking them to 13½, at which the return on the money is still over 7½ per cent., with dividends paid free of income-tax. General Electric ordinary fell 5s. to 133. Callenders are good at 13. British Aluminums are active, although there was a little profit-taking in the neighbourhood of 30s. The prior lien bonds of the British Westinghouse Co. drooped a trifle to 100, but the preference shares remain firm at 97½. Castner-Kellners keep strong on the increase in the dividend; and Edison and Swan shares, after their activity about 8s. 6d., have settled down to a quiet time again.

Armament shares are easier, the report of the Armstrong Co. apparently causing a little dissatisfaction, in spite of the big figures which it disclosed. In the rubber market, a rise to 3s. per lb. in the price of the raw material had virtually no effect upon the quotations of shares, so slack has business become. Further improvements in the price of copper break-

ing all records for recent years, had little influence, in consequence of the feeling that the metal market is being manipulated from America, which is taking the fullest advantage of the needs of the Allies in the matter of munitions.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend	Price Dec. 5, 1916.	Rise or fall this week.	Yield p.c.
Bepton Ordinary	10 10	62	—	27 11 0
Charing Cross Ordinary ..	5 6	82	—	7 8 2
do. do. 4½ Pref. ..	4½ 4½	87½	—	6 11 0
Chelsea	5 4	113	—	6 18 4
City of London	9 8	113	—	6 17 8
do. do. 6 per cent. Pref. ..	6 6	10	—	6 0 0
County of London	7 7	103	—	6 13 4
do. do. 6 per cent. Pref. ..	6 6	10	—	6 0 0
Kensington Ordinary	9 7	68	—	4 1 6
London Electric	4 8	12	—	6 10 6
do. do. 6 per cent. Pref. ..	6 6	4	—	6 15 4
Metropolitan	3½ 3½	28	—	6 6 4
do. do. 4½ per cent. Pref. ..	4½ 4½	34	—	7 4 0
St. James' and Pall Mall ..	10 8	64	—	6 8 0
South London	6 6	28	—	6 17 6
West Metropolitan Pref. ..	7 7	13½	—	6 7 3
Westminster Ordinary	9 7	64	—	6 16 8

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref. ..	6 6	384	—	6 5 8
do. do. Def. ..	80½ 80½	222	—	7 10 3
Chile Telephone	8 8	7½	—	6 12 8
Cuba Sub. Ord.	6 6	82	—	6 8 6
Eastern Extension	7 8	140½	—	6 16 6
Eastern Tel. Ord.	6 7	124	—	6 14 0
Globe Tel. and T. Ord. ..	6 6	104	—	5 18 5
do. do. Pref. ..	22 22	37½	—	6 17 4
Great Northern Tel. ..	13 13	51	—	6 7 8
Marconi	10 10	24	—	8 9 6
New York Tel. 4½ ..	4½ 4½	161	+3	4 9 0
Oriental Telephone Ord. ..	10 10	24	—	4 6 6
United R. Plate Tel. ..	8 8	62	—	5 16 6
West India and Pan. ..	1 6d.	1½xd	—	2 4 0
Western Telegraph	7 8	14	—	6 14 4

HOME RAILS.

Central London, Ord. Assented	4 4	65½	—	6 2 2
Metropolitan	1½ 1½	28½	—	4 6 0
do. do. District ..	Nil Nil	16	—	Nil
Underground Electric Ordinary	Nil Nil	11½	—	Nil
do. do. "A" ..	Nil Nil	6½	—	Nil
do. do. Income ..	6 6	91	—	6 11 10

FOREIGN TRAMS, &c.

Adelaide Sup. 6 per cent. Pref.	6 6	41½	—	6 1 6
Anglo-Arg. Trams, First Pref.	5½ 5½	82	—	8 9 2
do. do. 2nd Pref. ..	5½ 5½	23	—	6 17 4
do. do. 5 Deb. ..	5 5	67	—	7 9 3
Brazil Tractions	4 4	47	—	8 10 2
Bombay Electric Pref. ..	6 6	106	—	6 17 3
British Columbia Elec. Rly. Pice	6 6	69	—	7 5 0
do. do. Preferred ..	Nil Nil	49	—	Nil
do. do. Deferred ..	4½ 4½	62	—	6 17 4
Mexico Trams 5 per cent. Bonds	Nil Nil	34½	—	Nil
do. do. 6 per cent. Bonds ..	Nil Nil	27½	—	Nil
Mexican Light Common ..	Nil Nil	13½	—	Nil
do. do. Pref. ..	Nil Nil	17½	—	Nil
do. do. 1st Bonds ..	Nil Nil	32½	—	Nil

MANUFACTURING COMPANIES.

Babcock & Wilcox	14 14	21½	—	5 2 0
British Aluminium Ord. ..	5 5	80½	—	6 6 8
British Insulated Ord. ..	15 17½	113	—	7 5 10
British Westinghouse Pref. ..	7½ 7½	24½	—	6 8 0
Callenders	15 20	21	+½	7 13 10
do. 8 Pref. ..	5 5	44	—	5 17 8
Casner-Kellner	20 22	88	—	6 6 8
Edison & Swan, £3 paid	Nil Nil	—	—	Nil
do. do. fully paid ..	Nil Nil	14	—	Nil
do. do. 4 per cent. Deb. ..	5 5	62½	—	8 0 0
Electric Construction	6 7½	15	—	6 13 4
Gen. Elec. Pref.	6 6	10	—	6 0 0
do. do. Ord.	10 10	13½	—	7 5 6
Henley	20 25	16	—	7 16 3
do. 4½ Pref.	4½ 4½	4	—	6 12 6
India-Rubber	10 10	13½	—	7 12 4
Telegraph Con.	20 20	38	—	6 5 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, December 6th.

	Latest Price.	Fortnight's Inc. or Dec.
CHEMICALS, &c.		
a Acid, Oxalic	per lb. 178	..
a Ammoniacal sal.	per ton 475	..
a Ammonia, Murate (large crystal)	.. 454	..
a Bisulphide of Carbon .. ..	.. 423	..
a Borax .. ..	.. 424	..
a Copper Sulphate .. ..	.. 463	..
a Potash, Chlorate	per lb. 2/—	..
a Perchlorate .. ..	.. 2/—	..
a Shellac	per cwt. 124½	..
a Sulphate of Magnesia .. ..	.. 416	..
a Sulphur, Sulfimed Flowers ..	.. 418	..
a Lump .. ..	.. 418	..
a Soda, Chlorate	per lb. 1 7/—	..
a Crystals	per ton 120/—	..
a Sodium Bichromate, cakes ..	per lb. ..	..
METALS, &c.		
c Brass (rolled metal 2 to 12" base)	per lb. 1/6½ to 1/5½	1d. inc.
c " Tubes (solid drawn) .. ..	.. 1/6½ to 1/5½	1d. inc.
c " Wire, bays .. ..	.. 1/6½ to 1/5½	1d. inc.
c Copper Tubes (solid drawn) ..	.. 1/10½ to 1/11	1d. inc.
c " Bars (best selected) .. ..	.. 2189	211 inc.
c " Sheet .. ..	.. 2189	211 inc.
c " Rod .. ..	.. 2189	211 inc.
d " (Electrolytic) Bars .. ..	.. 2170	210 inc.
d " " Sheets .. ..	.. 2189	210 inc.
d " " Rods .. ..	.. 2179	210 inc.
d " " H.C. Wire	per lb. 1/9	1d. inc.
f Ebonite Rod .. ..	.. 3/—	..
f " Sheet .. ..	.. 2/6	..
f German Silver Wire .. ..	.. 2/6	..
h Gutta-percha, fine .. ..	.. 6/10	..
i India-rubber, Para, fine .. ..	.. 3/5	..
i Iron Pig (Cleveland warrants) ..	per ton Nom.	..
i " Wire, galv. No. 8, P.O. galv. ..	.. 4/10	..
j Lead, English Pig .. ..	.. 232 5	..
j Mercury	per bot. £18 12 6 to £18 15	£1 inc.
j Mica (in original cases) small ..	per lb. 8d. to 8/—	..
e " " medium .. ..	.. 8/6 to 8/—	..
e " " large .. ..	.. 7/6 to 14/— & up.	..
d Silicon Bronze Wire	per lb. 1/11½	1d. inc.
r Steel, Magnet, in bars	per ton 435	..
g " Wire, English .. ..	.. £100 to £131	£4 dec.
n " Wire, Nos. 1 to 16	per lb. 2/11	..

Quotations supplied by—

a G. Boor & Co.	g James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Tilt & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	j Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	k P. Ormiston & Sons
Telegraph Works Co., Ltd.	r W. F. Dennis & Co.

U.S.A. Turbine Business.—Since the beginning of 1916 the demand for steam turbines has far outstripped anything in the past. A compilation made by the *Electrical World* from data furnished by the steam-turbine manufacturers discloses the fact that the volume of steam-turbine business already handled since the beginning of the current year exceeds 2,000,000 kw. in rated capacity. At this rate the total 1916 business should reach 3,000,000 kw. in turbine capacity.

At present the best deliveries that it is possible to obtain are eight months for some of the smaller sizes for pump and industrial use, a year to a year and a half on large industrial and ordinary central-station sizes, and two years for the very large sizes. Orders now on hand are sufficient to keep the entire manufacturing facilities in operation for considerably more than a year.

It has been roughly estimated that approximately 65 per cent. of the present business is for central-station equipment, 25 per cent. for industrial plants, including marine installations, averaging 300-500 kw., and 10 per cent. for pumping stations averaging 50 H.P.

Many large units have been ordered since the beginning of the year, the tendency being towards machines of very large capacity. Notable in this respect have been orders for a 73,000-H.P. and a 60,000-H.P. unit, and an order for two cross-compound units of a total rating of 95,000 kw.

Both labour and material have been hard to obtain in satisfactory quantity and price, and both have greatly increased in price during the year. Turbine prices have, therefore, necessarily advanced.

Russia.—THE 1886 COMPANY LIQUIDATION PUZZLE.—According to the *Norvige Fremya*, in the opinion of V. P. Litvinoff, who has returned to Moscow from Petrograd after consulting there on the liquidation of the 1886 company, the question has been definitely decided. It is said that if hitherto the liquidation has not been proceeded with, it is because of the great importance of the concern and its close connection with work being done for the national defence, so that great care must be taken in handling the question of liquidation. The details of a scheme are now being worked out. It is denied that there are inter-departmental divisions of opinion as to how the liquidation should be effected, and it is clearly stated that the liquidation of the 1886 company is a matter of the near future.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

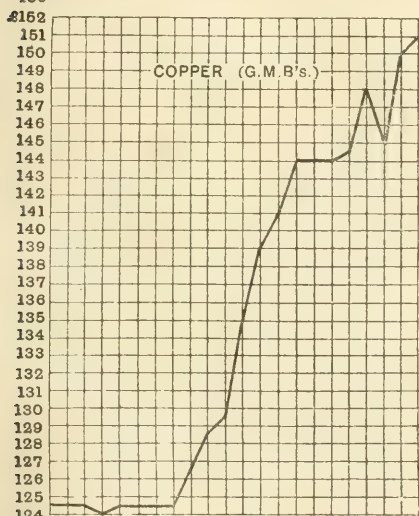
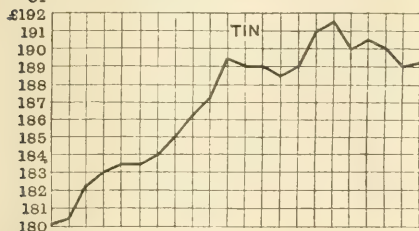
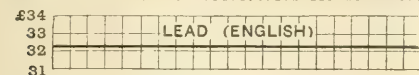
Locality.	Month ended (4 wks.)	Receipts for the month.	No. of weeks.	Total to date.	Route miles open.	
		£	£	£	£	
Bristol (Trams) ..	Nov. 24	18,941	— 277	47 231,047	+ 9,613	30-5
Cork	" 13	1,361	+ 161	47 24,091	+ 452	9-89
Dublin	" 24	2,420	+ 1,767	47 286,584	+ 715	54-4
Hastings	" 24	3,144	+ 203	47 49,258	+ 3,174	19-3
Lancashire United ..	" 22	7,009	+ 812	47 86,392	+ 4,76	42
Llandudno-Co. Bay ..	" 21	854	+ 93	51 18,710	+ 1,221	5-6
Tyneside	" 25	21,439	+ 452	47 2,401,981	+ 4,896	..
Auckland	Oct. 20	21,428	+ 597	16 84,288	+ 1,160	26-79
Calcutta	Nov. 25	18,932	+ 2,191	39 23,267	+ 11,437	..
Kalgaorlie, W.A. ..	Sept. 2, 1916	2,762	—	..	..	20-5
Madras	Nov. 15	2,106	+ 143	45 41,367	+ 3,145	..
Montevideo	Nov. 28, 1916	—	3	..	..	..
Dublin-Lucan Rly. ..	Nov. 24	496	+ 59	21 3,566	+ 291	7

* Two weeks.

METAL MARKET.

Fluctuations in November.

Nov. 1 2 3 6 7 8 9 10 13 14 15 16 17 20 21 22 23 24 27 28 29 30



Electricity Supply in Germany.

—In *l'Industrie Electrique* is given a summary of a scheme put forward by Prof. Klingenberg, President of the German Society of Electrical Engineers, for the development on the largest scale of the production and use of electrical energy and for the discouragement of the use of gas, by existing in order to further the adoption of electricity power. He proposes to build a number of large, wattless generating stations, which would distribute energy to existing stations at a pressure of 100,000 volts, these becoming, therefore, sub-stations: competition between the new and the old stations, however, must be avoided, as the latter represented in 1913 a capital of not less than 100 millions sterling. The State works would cost about 40 millions, and their output in 1926 would reach 400 million kw, while the net annual profit would rise to about 1·6 million pounds. The State would derive a revenue of more than 4·4 millions sterling from taxes imposed upon electric lighting, gas, hydraulic power, and coal, these taxes being specially calculated to encourage the use of electricity and to discourage the use of rival sources of motive power. The author estimates that after paying capital charges and taxes, there would still remain nearly two-thirds of the gross profit, which he believes would exceed 14 millions sterling per annum.

Inefficiency of Labour in the U.S.A.—According to the *Electrical World*, although wages in the electrical manufacturing industry are about 25 per cent. higher than before the war, about 20 per cent. less work is obtained per man, or for the same cost only 61·2 per cent. as much work is done. This is the result of an extraordinary demand for labour, leading to constant changes of situation on the part of the workmen, as well as to the employment of inexperienced and partially trained hands. Manufacturers who had had the foresight to establish pension and bonus systems have been more fortunate in keeping their shops full than their competitors. A company which requires 250 men for full output has employed 2,250 men during the past 10 months, yet it recently had only 220 men at work.

THE FARADAY SOCIETY.

GENERAL DISCUSSION ON REFRACTORY MATERIALS.

THE Faraday Society opened its session on November 8th with a remarkable symposium and general discussion on "Refractory Materials." The President, SIR ROBERT HADFIELD, F.R.S., who presided over the meeting, said its justification was the vital importance of refractories to so many national industries and the little attention the subject had received in recent years, as a result of which the scientific foundation required for healthy development was lacking. This view is evidently general, for the meeting attracted a very large audience from all parts of the country, representative of every interest concerned, whether geologists, makers of firebricks, iron and steel metallurgists, gas engineers or chemists. A comprehensive collection of exhibits, native and colonial minerals, and home-made refractory products, such as bricks, crucibles, furnace tubes, and laboratory ware, added to the attractions of the meeting, the sustained interest of which may be gauged by the fact of its extending over two sessions, from 10.30 to 11.30 p.m. It will be impossible here to do more than indicate in a very general way the nature of the discussion, for the number of contributions to it, in the form of papers, speeches, and written communications, exceeded 30, and the material when printed will fill a fair-sized volume.

The keynote of the meeting was co-ordination, both as regards workers and as regards knowledge; closer co-operation between the collector of raw material, the maker, and the user on the one hand, closer co-ordination between science and practice, between the research laboratory and the brick-maker and steel-maker on the other. The beginning of such co-ordination was made some years ago when a Joint Committee, Refractory Materials was formed by the Institution of Gas Engineers and the Society of British Gas Industries. Dr. H. C. COLMAN, Chairman of this Committee, gave a short account of its work, which has consisted in drawing up most useful specifications relating to fire-resisting goods used in gas works, and also in carrying out investigations likely to help in improving the materials in the market. But the reference has been too limited to be of general value, and the means for carrying out research have been far too small for the end in view, although what has been done, under the skilled direction of Dr. J. W. Mellor, of Stoke-on-Trent, is known the world over for its accuracy, thoroughness, and value. There is hope now that in both these directions the meeting will have given a great impulse to more rapid progress.

Most useful, because most fundamental, was the information given by Mr. J. ALLEN HOWE on the recent work of the Geological Survey in refractory materials, by Dr. A. Strahan, the Director of the Survey, and by Mr. T. Crook, of the Imperial Institute. These speakers made it clear that not only is this country well provided with most of the ordinary raw materials—silica, fireclay, refractory sands, and dolomite—required by the furnace-brick maker, but that the Empire, although perhaps not entirely self-contained, is well provided with resources in the less common refractories, such as graphite, chromite, magnesite, bauxite, and zircon. All this information—accompanied by exhibited specimens—was both helpful and timely, and the promised reports of the Geological Survey, containing not only details of the locality and nature of the deposits that have been surveyed, but also the results of the chemical, petrological, mineralogical, and textural examinations that have been made of 1,500 or more samples collected, will be awaited by firebrick, crucible, and retort makers with keen interest.

The group of papers with which the symposium opened dealt largely with the question of the nature and composition of firebricks and the relation between refractoriness on the one side and texture and chemical content on the other. Three aspects of this side of the subject were discussed: First, the importance of analysis; secondly, the necessity for a 'mechanical' analysis, that is, dividing up the material into its physical constituent parts before proceeding to chemical analysis; and thirdly, the value of an examination into the texture of firebricks, either microscopically or in other ways. With regard to the first, mention must be made of the most useful series of tables, giving complete analyses of most of the refractories in common use, which Sir Robert Hadfield appended to his opening address. On the second point, we would only mention Dr. R. LESSING's very lucid explanation of how he electrolyses refractory mixtures into their component parts in a simple apparatus by means of a gentle current of water. Mr. A. B. SEARLE (Sheffield) emphasised the secondary importance of chemical analysis to physical and microscopical tests. Dr. J. W. MELLOR spoke chiefly on the texture of firebricks. He showed how this can be controlled by the manufacturer, and what texture should be arrived at for the different purposes in view. To exhibit the various types of texture, he showed a set of firebricks cut transversely, and with their exposed faces polished. Prof. W. G. FEARNSIDES, of the University of Sheffield, in an extremely interesting speech, described how he "slices" bricks for microscopical examination of texture, and how much can be learned from such study, whether before the brick has been used or after it has completed its life's run in the lining of a furnace. Mr. COSMO JOHNS (Sheffield), in the

... of exceptional importance, also spoke on this question, particularly as it bears on the silica bricks used by the steel maker, urging the study of the effect of texture by varying grain-size, and correlating it with refractoriness and other properties. He also discussed the changes bricks undergo under furnace conditions.

Several speakers dealt with the classification of refractory materials. Mr. C. P. PAGE in particular discussed this from the point of view of their behaviour under furnace conditions. The usual classification into acid, basic, and neutral materials is convenient, but arbitrary and inaccurate. The refractory has two conditions to contend against, heat and chemical action, and refractoriness towards the one has no relation to that against the other. So-called acid refractories are used where it is a case of refractoriness towards heat because they are plentiful and cheap; basic and neutral materials are less widely distributed, and are often difficult of application. Classification was also one of the themes of the very interesting speech of Dr. P. G. H. BOSWELL, of the Geological Department, Imperial College of Science and Technology, particularly with regard to refractory sands, our resources in which were indicated by him. It appears that the high silica sands (carrying over 99 per cent. SiO_2) and the aluminous sands (70-80 per cent. SiO_2 , up to 15 per cent. Al_2O_3), although largely imported from abroad, are yet plentiful and accessible in this country. But for the green sands, or moulding sands, used for casting steel, we must still rely on overseas supplies—largely because we do not at present know the exact properties of this material, a subject on which Dr. Boswell himself is, fortunately, working.

The point of view of the manufacturer was ably put by Mr. ALBERT CLIFF, of Stamford, and, by correspondence, by Mr. W. DONALD (Glasgow), Mr. T. ALLEN (Dudley), and Mr. F. DEANSFIELD (Oldham). Mr. Cliff made various suggestions as to the directions in which improvements in manufacture were possible. One was in the working-up of old material. Some of the present shortage of supply he was overcoming by fastening non-corrodible working surfaces, such as chromite or magnesite, on to ordinary firebricks. Finally, he made an eloquent appeal for co-ordination between the chemists and the manufacturers, and to the men of science to come down to the works districts and talk freely to the young people, and so accelerate a rise of specialised intelligence. Both Prof. Fearnside and Mr. Cosmo Johns told of the valuable information locked up in works in conjunction with the foremen. The men of science should go through the works and translate this knowledge into their own more universal language. Mr. Donald told how he was endeavouring to approximate the pure Greek magnesite to Austrian magnesite by adding a small percentage of Fe_2O_3 ; he also criticised the present use of dolomite in conjunction with magnesite in basic steel furnaces, and he attributed to this cause much of the trouble in these furnaces. Incidentally, he mentioned the possibilities of Serbia, with its minerals and plentiful water-power, as an electrometallurgical centre. Mr. T. Allen spoke of the inconclusive character of laboratory tests, but unfortunately, works tests often took years to realise. Mr. Deansfield raised an important problem in the conservation of national resources in drawing attention to the enormous loss of refractory clays lying under coal seams due to the winning of the coal only. Some interesting points of practice were given by Mr. ALLEVY REYNOLDS in his communication. Mr. Reynolds, as did Dr. Mellor before him, threw scorn on the possession of so-called "trade secrets," which impeded progress and, in the end, were most harmful to any industry. The plea for co-ordination was also strongly urged by Mr. W. J. JONES, of the Ministry of Munitions, and Mr. A. A. McDUGALL DUCKHAM, of the same Ministry, emphasised how much the output of munitions depended on refractories.

Finally, several papers and speakers touched on certain specific researches in which they were engaged, and which promised valuable results in improving the properties of old materials and in giving to the metallurgist new materials as a weapon for attacking the new problems that he was having to face. For example, Dr. W. ROSENHAIN, of the National Physical Laboratory, spoke about the possibilities of highly purified zirconia. Bricks made of this material were being used for optical purposes, and they did not grit until well over 2,000 deg. C. Dr. J. A. HARKER mentioned that zirconia, if fine enough, would stand being plunged into water at a white-heat temperature. Dr. R. S. HUTTON (Sheffield) and Mr. E. KILBURN SCOTT told of the value of completely shrunken magnesite; the shrinking, which had to be done at a very high temperature, could now be economically effected in the electric furnace. The properties and uses, especially for electric tube furnaces, of that very useful refractory alundum, were described by Mr. C. R. DARLING. Dr. W. H. HATFIELD (Sheffield) pointed out how research in many directions was hampered by our not having sufficiently accurate instruments to register high temperatures. Dr. W. C. HANCOCK, who is working in conjunction with Prof. Bone at South Kensington on coke-oven firebricks, spoke of the application of certain organic dyes to etch refractory materials as a means of investigating their structure.

We can refer to one other portion of the discussion only, and that is the paper of Mr. EZER GRIFFITHS, of the National Physical Laboratory, who has devised a new and most carefully thought-out method for measuring the thermal conductivity of bricks and tiles of commercial sizes. The great diffi-

culty was the attainment of a uniform temperature over the hot face of the irregular sample, and this was overcome by the use of a shallow bath of molten metal heated electrically. A special thermometer for exploring the temperature had also to be devised, and with these precautions extremely accurate results for a very difficult measurement have been attained. The values of the thermal conductivity and its variation with temperature as given in the paper suggested to several present the desirability of saving much waste heat in furnaces by lagging them with a highly-insulating substance, just as steam pipes are lagged. It appears that Hutton and Beard suggested this, also, strangely enough, in a paper read to the Faraday Society as far back as 1905, and yet the idea has not been adopted. It may be hoped that this interesting meeting—one visitor said, over his cup of tea at 11.30 p.m., that it was the most interesting scientific meeting he ever had attended—will be fruitful in this matter also, as it assuredly will be fruitful in many other directions in a field covering industrial products of such vital importance to the nation.

PISTON AND SMALL-END LUBRICATION IN DIESEL ENGINES.

By GEORGE B. VICKERS.

(Abstract of paper read before the DIESEL ENGINE USERS' ASSOCIATION.)

For the lubrication of Diesel engines pure mineral or hydrocarbon oils are undoubtedly the best; they contain a much smaller percentage of acid than animal or vegetable oils. The best test of lubricating oil is on the air compressor. If the oil causes pitting on the compressor valves and shows an acid scouring action on the valves in the air bottle heads, the engineer may expect the main cylinder liner wear to be excessive. Average liner wear is .010 in. to .012 in. per 1,000 hours' run, when the engine is heavily taxed. For pistons, an oil with a moderate viscosity of, say, 130 to 180 at 140 deg. F., gives good results, whilst an oil with a good viscosity of, say, 400 to 500 at 140 deg. F., is best for small end lubrication.

For enclosed-type engines thicker oil is required than with the open type, as the temperature inside the crank case is much higher than on open-type engines. In experiments on enclosed engines made by Messrs. Hick, Hargreaves & Co., Ltd., difficulty was experienced in using thin oil which had a viscosity of 110 at 140 deg. F. Thicker oil was used, having a viscosity of 140 at 140 deg. F., in place of the thin oil, and the fuel consumption, which previously had never been lower than .45 lb. per b.h.p.-hour, was reduced to .419 lb., effecting a saving of 15s. in a six-hour trial run.

On average engines the quantity of lubricating oil used is kept as low as possible by using new oil on the small ends only, and filtered oil on the other parts. This filtered oil has advantages, as after running and filtering, the bituminous matter in the oil is eliminated. Filtered oil should not be used too often on the pistons, as its viscosity gets too low for this work. The original method of lubricating the piston by a single stem leading to a belt encircling the liner, and from thence through small holes in the liner, is a poor method. The belt should be flushed out with paraffin every time that the pistons are withdrawn, or perhaps even once a week.

The usual method of piston lubrication is through four or six stems or quills leading through the water jacket to the liner, and connected by a common feed pipe, past a back-pressure valve, to the single lubricating pump. Many engineers now insist on having a separate feed to each quill, i.e., they have a 6- or 8-feed lubricator fitted for each cylinder. This is undoubtedly the better plan. The pumps for piston lubrication are in the majority of cases driven from the cam shaft, and so are placed much higher than the quill line. The result is that, after a short stoppage, the feed piping has been drained, and the piston does not receive any lubrication for a few minutes after starting. A better plan is to have the lubricators fixed well below the lubricating belt line and worked off the indicator gear or the vertical shaft, thus ensuring that the pipes are always charged. The check valve in the lubricator pipe should be well designed, and periodically examined to ensure that there is no bituminous matter holding the valve up and interfering with the supply.

The method of securing the quill is sometimes the cause of trouble. Some makers prepare a tapered hole in the liner, and the quill has a rounded nose and is screwed home tight through a tapped hole in the water jacket. When the parts get warm and expand, these quills have been found to act as struts, and have caused piston seizures. An improved method is to have the quill screwed into the liner, a plain hole in the water jacket, and an external joint.

Some makers have not adopted quills in the liner, but have relied on the splash system. This system is really only suitable for small engines, and its chief drawbacks are that lubrication cannot be regulated, is most uncertain, and there is a tendency to wastage.

Phosphor-bronze bearings are usually adopted for the top

end bearings. The wear on phosphor-bronze bearings is seldom more than .001 in. per annum, whilst white metal bearings, according to the quality, may show more wear than this in one week. When a phosphor-bronze split bush is used, the average clearance is .003 in. vertically and .006 in. at each side. If the bush is solid, more clearance is required, usually .006 in. to .008 in. vertically and .008 in. at the sides. The gudgeon pins should be fully case-hardened, at the ends as well as on the bearing surface.

A good long skirt is advisable to act as a guide and to reduce the pressure per unit area due to thrust. The length of guiding surface on the piston should be 1.4 to 1.6 times its diameter for low-speed engines, but may be reduced to 1.2 times the diameter for high-speed engines. The scraper method for lubricating the top end bearings, depending on collecting the oil remaining on the liner walls after the rings have scraped the bulk off, seems a very haphazard method, but it is quite effective for pistons up to 24 in. in diameter.

In the banjo system, the oil is led into a banjo on the side of the crank, and the centrifugal force causes the oil to flow into a small receiver and pass up the pipe leading to the top end. Without a knowledge of the effectiveness of this system, any engineer would be justified in expecting that at least a special quality of oil, of the "monkey" brand, which would climb up the pipe, would be necessary for this system.

The most general method of lubrication is to have one or two slots in the piston which pass over the leads from the oil supply pipes and holes leading from the bottom of the slots through the piston to the centre hole in the gudgeon pin. Several holes lead from this centre hole in the pin to the bearing surface. It is preferable to have two slots in the piston, one midway between the crankshaft centre line and the cross centre line on the front side of the piston, and one directly opposite, so that whichever side of the liner the piston is thrust against, one of the slots is able to scrape the maximum quantity of oil from the liner. The slot is best when V-shape in section, and the top and bottom should be under-cut at about 45 deg., the scraping edges being left moderately sharp; a sluice should also be cut to connect the top of the slot to the circular scraper groove cut in the piston to take advantage of the oil scraped off the walls by this groove. The hole in the centre of the pin should be at least 14 in. dia. for a 6-in. pin, as it acts as a reservoir for the oil. Two holes at least should be drilled from the top of the pin to the centre, one close to each end of the bearing surface at 30 deg. to vertical centre line. These holes should lead into longitudinal grooves on the top surface of the pin, with well-rounded edges to assist the oil to escape.

On medium- and high-speed engines a complete system of forced lubrication solves lubrication difficulties. Of course, this means having the engine fully enclosed. The practice of fitting a lubricating pipe leading from the bottom to the top end is to be deprecated; it is much better to have the oil passage up the centre of the connecting rod. When a priming system of lubrication is not provided, a small ball valve fitted in a cage in the hole at the bottom end of the connecting-rod acts as a retaining valve when the engine is shut down and prevents the oil from draining away from the top end.

Forced lubrication has disadvantages. Unless manufacturers have taken special precautions, it is probable that the piston will receive too much lubrication. The oil is thrown from the bottom-end bearings on to the liner walls, and when the piston is on its suction stroke, the slight pressure in the crank chamber tends to force the oil past the relaxed rings, the result being that the lubricating oil is burnt and very peaky indicators cards are obtained, showing a maximum pressure frequently 100 to 150 lb. above compression pressure. The high consumption of lubricating oil has retarded the progress of the enclosed type of engine. We have overcome the difficulties, first by guarding the bottom-end bearings to avoid splash on to the liners; secondly, by preventing the oil from creeping from the top-end bearing along the gudgeon pin keyway on to the piston surface; thirdly, by providing scraper grooves on the piston with return ducts to the inside; fourthly, by dissipating the vapour in the crank chamber, this vapour tending to get past the rings on the suction stroke.

The common method of withdrawing the oil vapour is to take the air compressor suction, or the main cylinder suction, from the chamber. This causes dirty valves, is wasteful, and has proved to be dangerous. We find that the vapour is most effectively withdrawn by a belt-driven extraction fan, and we lead the gases to a baffle box where they are condensed, thus recovering the oil which, by other methods, is burnt. The vapour is mainly caused by the oil being splashed on the inside of the piston crown, and if the crown has an oil guard fitted the vapour is considerably reduced.

A discussion followed, and Mr. W. FENNEL referred to the increased sulphur contents of certain fuel oils which were now being used; it was found that these reacted on the lubricating oil, especially if this was compounded with vegetable oils, causing a sticky deposit, analogous to vulcanised bitumen, which destroyed the lubricating properties of the oil. Compounded oils should not be used for cylinder lubrication, but only pure mineral oil. He expressed the opinion that the most successful Diesel engine of the future would have a cross-head. He also strongly advocated separate lubricators for each point to be lubricated.

In his reply, Mr. VICKERS agreed that sulphur would certainly have a bad effect on most compounded oils, but said that it would have no effect on a pure mineral oil.

SCIENTIFIC AND INDUSTRIAL RESEARCH.

ON Friday last, at the Institution of Civil Engineers, Lord CREWE received a deputation from the Conjoint Board of Scientific Societies with regard to the financial provision for research and allied purposes. He was accompanied by members of the Committee of the Privy Council for Scientific and Industrial Research and the Advisory Council, while the deputation numbered over 120 gentlemen, including many of the most noted representatives of the scientific and industrial worlds.

As President of the Royal Society, Sir J. J. THOMSON, in an opening speech, stated that the object of the deputation was to urge the necessity of increased grants for scientific and industrial research, on the utilitarian ground that it would be an excellent investment. Such grants should not be withheld from pure scientific investigations; many discoveries most important to the world had been made in the course of researches of the most abstract character—such as the X-rays, for example, which had proved of incalculable value to the nation during the war in surgical work, but were really a by-product of research, and would never have been discovered by beginning at the other end and seeking for means to facilitate surgical operations. It was useless to grant sums of money to individuals, who would feel bound to turn out some practical result or other every year, instead of patiently pursuing an apparently unremunerative investigation without regard to appearances; the money should be allotted to the universities. The cost of pure scientific research, however, was trivial compared with that of industrial research on the full-size scale. The finances of the National Physical Laboratory were also in a very unsatisfactory condition, and it could not pay such salaries to its junior trained assistants as would enable it to retain their services.

Sir M. FITZMAURICE said that the research scheme put forward by the Advisory Council was essential to the industries of the country, and should have far-reaching effects. He had never presided over a more enthusiastic committee than the Standing Committee on Engineering; but to get the scheme into a healthy working condition money was indispensable, and that without delay.

Prof. H. B. BAKER, advocating the prosecution of chemical industrial research, pointed out that sulphuric acid, a fundamental necessity to industry, was still made by a process invented by a quack doctor at the end of the eighteenth century. Surely improved methods could be found, and there were numerous minor problems awaiting solution. Not only was research required with specific aims in view, but also pure scientific research. Since the war began academic and manufacturing chemists had come together, and their collaboration would lead to enormous advances.

Replying to the deputation, Lord CREWE said that a great part of the work in question was of immediate value in connection with the war, and after the war; the fruition of the schemes for scientific and industrial research was dependent upon the attainment of a full and complete victory. The Government had decided to establish a separate Department of Scientific and Industrial Research for Great Britain and Ireland under the Lord President of the Council, with the President of the Board of Education as vice-president. They had also decided, subject to the consent of Parliament, to place a large sum of money at the disposal of the new department, to be used as a fund for the conduct of research for the benefit of the national industries on a co-operative basis. The Board of Inland Revenue had decided, with the approval of the Chancellor of the Exchequer, that no objection should be offered by their surveyors of taxes to the allowance as a "working expense" for income-tax purposes, of contributions by traders to industrial associations which might be formed for the sole purpose of scientific research for the benefit of the various trades; and the allowance would be equally applicable as regarded traders' contributions specifically ear-marked to the sole purpose of the research section of an adapted existing association. In both cases the allowance would be subject to certain conditions, e.g., the association or the research section to be under Government supervision, and the trader's contribution to be an out-and-out payment, made from his trade profits, and giving him no proprietary interest in the property of the association, &c. In order to enable the Department to hold the new fund and any other money or property for research purposes, a Royal Charter had been granted to the official members of the Committee of the Privy Council for Scientific and Industrial Research under the title of the "Imperial Trust for the Encouragement of Scientific and Industrial Research." A substantial gift had already been made to the Trust by two members of the Institution of Mechanical Engineers for the conduct of a research in mechanical engineering to be approved by the Department, in the hope that this example would be followed by other members of the Institution. The Government had been impressed by the need of further assistance to research. Systematic co-operation between the leaders of industry and the Advisory Council was necessary. As it was impossible to make a close estimate of the annual cost of the work, which might vary widely, the Chancellor of the Exchequer was prepared to devote to it a very large sum, estimated to cover the needs of the next five years, on a scale which would enable them to spend four or five times as much on industrial research alone as the whole scheme had pre-

very early received. It was of no use to deal with individual firms or persons, he hoped to see the creation of new trade associations on a large scale, or the formation of branches of existing associations to deal with these purposes, with separate accounts. These associations should be controlled by small committees composed of representatives not only of industry and science, but also of the skilled workers. With regard to technical training, the present regulations under which technical schools received public money were not up-to-date; local authorities and governors of schools would be consulted, and more help would be given from the national funds. Substantial additions would be made to the annual grants to train technical teachers and provide scholarships to universities. Besides the lump sum above-mentioned, an annual vote would be provided to cover the expenses of the Department, to assist researchers and societies that were carrying out researches, and non-remunerative research. The country owed a great debt to the National Physical Laboratory and its director, Dr. Glazebrook, and its future would be the subject of anxious consideration on the part of the Advisory Council. The Coal Conservation Committee was working in close touch with the Advisory Council, and a series of researches was to be put in hand, to establish on a scientific basis systematic economy in the use of fuel. A chemical survey would be made of all the coal measures of the United Kingdom, and the qualities of the different kinds of coal would be investigated.

Notice has been given in the *London Gazette* of the creation by Royal Charter of the Official Members for the time being of the Committee of the Privy Council for Scientific and Industrial Research a Body Corporate for the purposes of the said Committee, under the title of "The Imperial Trust for the Encouragement of Scientific and Industrial Research."

Mr. H. Frank Heath, C.B., has been appointed Permanent Secretary of the new Department, to whom all correspondence should be addressed until December 31st next, at the Offices of the Board of Education, Whitehall. On and after January 1st, 1917, all correspondence should be addressed to The Secretary, Department of Scientific and Industrial Research, Great George Street, Westminster, S.W.

THE NATIONAL PHYSICAL LABORATORY.

IN an address delivered to the BIRMINGHAM AND MIDLAND INSTITUTE, on Monday last, Dr. R. T. GLAZEBROOK, F.R.S., Director of the National Physical Laboratory, showed how the Laboratory had assisted in the progress of the past 10 or 15 years, and how by its development we should gain a powerful instrument to aid us in the future.

The object of its foundation was "to bring scientific knowledge to bear practically upon our everyday industrial and commercial life." In this process three distinct stages might be observed. We needed:—

1. The work of the man of science in his research laboratory.

2. The investigations which go on in an industrial research laboratory, developing new processes or introducing new products.

3. The works laboratory proper controlling the quality of raw materials, finished products and processes.

In the first place, we must have scientific knowledge. To be successful that knowledge must be pursued for its own sake. Each of the modern practical applications of science had its foundations in purely scientific work, and we must have the student of pure research, the genius who goes on his way discovering new truths, irrespective of consequences, laying bare more and more of nature's secrets and unravelling her mysteries. In England we had never lacked such men, our roll of great discoverers had been a glorious one. The endowment of pure science was essential; without it the attempt to apply science to industry failed.

Turning to the third need—the works laboratory proper—this was necessary, if for no other reason, to maintain the standard of output, to secure that the proper grade of material was supplied to the works, to check the instruments in use, and to test the product in its various stages of manufacture. The days were gone when successful manufacture could be carried on entirely by rule of thumb, trusting to the skill of trained workmen. New processes and new products could be investigated in the works laboratory, and these investigations and tests must go on in the works themselves under the eyes of men familiar with the process of manufacture in its every stage.

Between these two—the man of science researching in his university or college, and the works chemist toiling in his shop—there was a gap. Some means were needed to make the discoveries of science available to the manufacturer, to secure to him the advantages which came from the growth of knowledge to keep him in the forefront of his trade. This was the function of a laboratory of industrial research, and among such laboratories the National Physical Laboratory should hold a prominent place. The laboratory had another function to fulfil: it was a great standardising and testing institution. Industrial research involved a laboratory very different from the usual works laboratory, and also investigations of a different type from those employed in a purely industrial laboratory. It meant a large, elaborately equipped and heavily staffed laboratory engaged largely on work which for many years would be unremunerative, and which for a

considerable time after its foundation would obtain no results which could be applied by the manufacturer. This work clearly needed a special house; it could not be done in the laboratory of a technical institute. The main work in such a laboratory as that of a technical institute must be educational. The research laboratory was necessary if progress was to be made.

For the industrial research laboratory the plant, &c., must be so planned that it was possible to carry out the necessary operations on a scale comparable with that required in works, and, moreover, the man who carried through the investigation must be not only acquainted with the latest scientific advances in his subject, but must know what was possible in works, and must mould his solution of the problem to harmonise with these possibilities. The undertaking was often more complex than that of the pure scientist. It was one which needed a special laboratory, a special equipment. Thus, the task of an institution like the National Physical Laboratory differed from that of either a university or technical college laboratory or a works laboratory. The senior members of the staff joined avowedly with the purpose of applying science to industry; they were prepared to make it their life-work. The juniors retained their posts for some time; thus all acquired a store of experience of the highest value, with a unique knowledge of the technical aspects of industry which it was difficult to gain in another way. The Laboratory had, he trusted acquired the confidence of the technical industrial world, and problems were brought before the staff with the knowledge that they would be handled in a confidential manner by men trained to deal with them.

If they were to have a National Industrial Research Laboratory, who was to pay for it? The obvious answer was the nation, but this in some quarters at once raised a difficulty. It was claimed that the results of any successful research brought profits in the first instance to some particular class, and that class ought to pay. If a manufacturer came with a conundrum which he desired to have answered for his own private benefit, he must pay; but if a competent committee controlling an industrial research laboratory concluded that a research was of importance and likely to lead to knowledge of benefit to the whole industry with which it was concerned, Dr. Glazebrook held that the cost of such a research should be met out of national funds.

The needs of the nation at the present time were too serious, the danger of delay too pressing, and the State might well devote large sums to industrial research without minute inquiry as to whether the research was going to benefit Messrs. A.B. specially and what share, therefore, of the expense Messrs. A.B. must be asked to guarantee. In America the Bureau of Standards, in Germany the Reichsanstalt and the Material-Prüfungs-Amt worked thus for the national good, and this should be the task of our English Industrial Research Laboratory.

Dr. Glazebrook then gave an account of the N.P.L. and its work during the past 15 years, and outlined the task that lay before it in the future. He said that there must be more than one such laboratory; in many cases an industry could be best served by a laboratory near its principal centre. Large firms, again, might each prefer to have their own trade secrets, but a private laboratory on a really sufficient scale was expensive, and for the smaller firms, at least, the only way to secure the full advantage of scientific advance was by co-operation—co-operation in the laboratory, co-operation, with specialisation in production, in the works themselves.

Increased funds must be provided, and it was only through the aid of the manufacturers, and of those who from experience had profited by the work of the Laboratory, that the authorities could be induced to do all that was needed to establish the Laboratory in a secure position.

On Friday last, Lord Crewe, President of the Privy Council Committee, had announced that a large sum was to be at the disposal of the Committee during the next five years, and outlined the scheme for its expenditure. The Lord President spoke in generous terms of the work of the Laboratory in the past, and indicated a sphere of wider usefulness under less difficult conditions in the future.

In many cases, no doubt, the researches contemplated must go on in special laboratories arranged and equipped for the purpose—laboratories closely connected with the industry it was desired to help, situated at the great manufacturing centres; but there were many other researches of wide interest and great importance for which a central laboratory was the proper house, a laboratory fitted and equipped in an ample manner, with a trained and competent staff animated with a love for science, and yet with a keen appreciation of the practical side of the question discussed and a real desire to help our country by the application of science to industry.

The body controlling industrial science research must have access to a laboratory in which might be studied the many problems which did not require for their elucidation appliances of the more specialised "works" character or opportunities only to be found in particular localities; where a staff was available, able and experienced, ready to attack under the advice of men skilled in industry the technical difficulties met in applying new discoveries on a manufacturing scale or to develop ideas which promised future success.

Such a rôle the National Physical Laboratory should be prepared to play; such was the future which he trusted might be in store for it.

TELEPHONE TROUBLES.

We have just been re-reading a small booklet issued by the Telephone Department, which gives suggestions to the public as to how they can assist in facilitating the working of the telephone.

We think it will be generally admitted that the working of the system is still far from smooth, but if the suggestions contained in this little booklet were followed there can be no doubt that great improvement would result. A great many of them are summed up in the injunction to be courteous to the operator. The booklet adds: "She has a difficult, nerve-racking job, and, apart from chivalry, your consideration will improve her work."

In calling for a number, many people forget that they ought to give the name of the Exchange first and the number afterwards. Subscribers are also advised to be sparing in the use of the word "Hullo." It is certainly a little over-worked by most telephone users.

It is pointed out that the times of greatest pressure on the telephone are from 10 to 11.30, from 2 to 3.30, and from 4.30 to 5.30. If these periods are avoided a subscriber is more likely to get through quickly than if he selects the busiest time of day.

A paragraph headed "Etiquette" says that the *ringer-up should never keep the rung-up waiting*. The "Hold-the-line" nuisance is perennial and exasperating.

The booklet concludes with particulars of the facilities for dispatching telegrams by telephone, and calls public attention to the fact that if the fire brigade, police or ambulance, or salvage are required in a hurry there is no need to look up a number, but all that is necessary is to ask the exchange for "fire," "police," "ambulance," or "salvage" as the case may be.

The greatest curse in connection with the use of the telephone by the public is, however, not sufficiently dwelt upon in this booklet, and that is the habit which many firms, especially the larger ones, have of entrusting their telephone business to the smallest and cheekiest boy on the premises. To ring up some of the larger firms in London means the loss of one's temper, the loss of half-an-hour, and the loss of all respect for the telephone organisation of the firms in question.

In answer to the call, the impudent small boy aforesaid begins by saying "Hullo." The inquirer asks if Mr. John Smith is in. The small boy, instead of answering the question, says "Who are you?" and after failing to listen for the reply, presently says "What's your name?" After this information is given he says, "What's the name of your firm?" and finishes up by asking what you want.

If your language is by this time sufficiently strong to drive away the smallest boy, the next size of boy kept by the firm comes to the telephone and repeats the whole performance. After that he calls a head clerk, and without giving him any of the information already elicited, leaves the exasperated caller to explain all these particulars again to the head clerk. If by this time Mr. John Smith has not gone out to lunch, the caller may eventually get through to him; but, unless his temper is extraordinarily even, he will hardly be in a fit condition to talk about business.

It is surely time that business firms, however important they may be, should realise that business worthy of their attention may arrive over the telephone just as often as through the post. It is an extraordinary thing that managers of large establishments, who would never dream of neglecting a polite letter, should leave a telephone inquiry to be dealt with in the manner described.

Troubles enough there are, undoubtedly, in the working of the system itself, but, in our opinion, these are minor matters compared with the difficulties due to the failure of business people to give intelligent attention to their telephone arrangements.

TRADE STATISTICS OF SIAM.

The following figures, showing the imports of electrical and similar goods into the port of Bangkok during the year ended March, 1916, are taken from the recently-issued official trade statistics; the figures for the year ended March, 1915, are included for purposes of comparison, and notes of any increases or decreases are given. Imports stated to be from Singapore and Hong-Kong are for the most part the products of other countries shipped *via* these two ports:—

	1914-15. Ticals.	1915-16. Ticals.	Inc. or dec. Ticals.
Parts of lamps.—			
From Singapore	9,000	7,000	— 2,000
" Hong-Kong	7,000	6,000	— 1,000
" United Kingdom	11,000	24,000	+ 13,000
" Germany	5,000	—	— 5,000
" United States	7,000	5,000	— 2,000
" Other countries	7,000	5,000*	— 2,000
Total	46,000	47,000	+ 1,000

* Japan.

	1914-15. Ticals.	1915-16. Ticals.	Inc. or dec. Ticals.
Lamps.—			
From Singapore	49,000	13,000	— 36,000
" Hong-Kong	104,000	39,000	— 65,000
" United Kingdom	53,000	17,000	— 36,000
" Germany	15,000	—	— 15,000
" United States	10,000	16,000	+ 6,000
" Japan	70,000	83,000	+ 13,000
" Other countries	9,000	4,000	— 5,000
Total	310,000	172,000	— 138,000

Electrical goods and apparatus.—

From United Kingdom	112,000	146,000	+ 34,000
" Germany	167,000	5,000	— 162,000
" United States	64,000	127,000	+ 63,000
" Singapore	12,000	3,000	— 9,000
" Sweden	8,000	22,000	+ 14,000
" Italy	9,000	28,000	+ 19,000
" Austria	11,000	—	— 11,000
" Holland	7,000	21,000	+ 14,000
" France	6,000	5,000	— 1,000
" Japan	70,000	27,000	— 43,000
" Other countries	7,000	25,000	+ 18,000
Total	473,000	411,000	— 62,000

Manufactures of brass.—

From Hong-Kong	483,000	452,000	— 31,000
" United Kingdom	48,000	54,000	+ 6,000
" China	76,000	52,000	— 24,000
" Germany	8,000	—	— 8,000
" Japan	5,000	42,000	+ 37,000
" Other countries	41,000	32,000	— 9,000
Total	661,000	632,000	— 29,000

Manufactures of copper.—

From Hong-Kong	1,000	1,000	—
" United Kingdom	36,000	7,000	— 29,000
" Other countries	7,000*	5,000†	— 2,000
Total	44,000	13,000	— 31,000

*Singapore Tls. 4,000. †Italy Tls. 2,000.

Scientific instruments and apparatus.—

From United Kingdom	43,000	13,000	— 30,000
" Germany	24,000	2,000	— 22,000
" France	26,000	10,000	— 16,000
" Other countries	29,000	27,000	— 2,000
Total	122,000	52,000	— 70,000

Rail locomotives.—

From Singapore	4,000	—	— 4,000
" United Kingdom	1,000	230,000	+ 229,000
" Germany	61,000	—	— 61,000
" United States	—	12,000	+ 12,000
Total	66,000	242,000	+ 176,000

Prime movers other than road locos, marine, milling, and agricultural machinery.—

From United Kingdom	27,000	68,000	+ 41,000
" United States	1,000	5,000	+ 4,000
" Germany	2,000	—	— 2,000
" Other countries	3,000*	24,000†	+ 21,000
Total	33,000	97,000	+ 64,000

*Sweden Tls. 2,000. †France Tls. 21,000.

Machinery unenumerated, including detached parts, and not including textile or sewing machines.—

From United Kingdom	480,000	240,000	— 240,000
" Germany	63,000	3,000	— 60,000
" United States	388,000	118,000	— 270,000
" Other countries	33,000*	258,000†	+ 225,000
Total	964,000	619,000	— 345,000

*Italy Tls. 7,000. †Denmark Tls. 226,000.

Machine belting.—

From United Kingdom	62,000	116,000	+ 54,000
" Germany	13,000	2,000	— 11,000
" Other countries	7,000	15,000*	+ 8,000
Total	82,000	133,000	+ 51,000

*Japan Tls. 3,000.

Iron and steel wire manufactures.—

From United Kingdom	48,000	79,000	+ 31,000
" Germany	12,000	1,000	— 11,000
" Belgium	10,000	—	— 10,000
" Other countries	8,000	65,000*	+ 57,000
Total	78,000	145,000	+ 67,000

*United States Tls. 46,000.

	1914-15. Ticals.	1915-16. Ticals.	Inc. or dec. Ticals.
From United Kingdom ..	520,000	201,000	- 328,000
" Germany ..	230,000	—	- 230,000
" United States ..	234,000	—	- 234,000
" Other countries ..	288,000	70,000	- 218,000
" Total ..	3,000	62,000*	+ 59,000
Total ..	1,284,000	333,000	- 951,000

*India Tls. 30,000.

Cars or trucks for railways or tramways.—

	1914-15. Ticals.	1915-16. Ticals.	Inc. or dec. Ticals.
From United Kingdom ..	4,000	—	- 4,000
" United Kingdom ..	233,000	357,000	+ 124,000
" United States ..	5,000	—	- 5,000
" Other countries ..	40,000	—	- 40,000
Total ..	282,000	357,000	+ 75,000

Cablehouse manufactures, other than tires.—

	1914-15. Ticals.	1915-16. Ticals.	Inc. or dec. Ticals.
From Singapore ..	55,000	75,000	+ 20,000
" United Kingdom ..	28,000	30,000	+ 2,000
" Germany ..	11,000	1,000	- 10,000
" Other countries ..	7,000	13,000	+ 6,000
Total ..	101,000	119,000	+ 18,000

NOTE: £1 = about 13 ticals.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Published expressly for this journal by Messrs. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 16,588. "Electric flashlamps or torches." W. FENTON. November 20th.
- 16,591. "Two-way master switches for actuating sets of contact switches for reversing motors of planing machines, &c." J. G. STRIK. November 20th.
- 16,600. "Portable electric battery torchlights." E. NUTTALL. November 20th.
- 16,609. "Speed regulating mechanism for electric motors." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). November 20th.
- 16,610. "Electrical switchgear." F. BERGMANN (Ilganig Electric Co.). November, 20th.
- 16,611. "Overhead trolleys for tramways and railways." C. H. MOORE. R. H. MOORE. November 20th.
- 16,633. "Means for signalling with electric lamps." A. J. CASHMORE. November 20th.
- 16,636. "Electric lampholders, adapters, &c." J. C. WHITE. November 21st.
- 16,641. "Spark plug for high-compression engines." W. A. LEBETEL. November 21st.
- 16,648. "Spark plug for internal-combustion engines." A. S. FLETCHER AND S. SMITH & SONS. November 21st.
- 16,652. "Method of supplying power to electrically-propelled trains with continuous conductors." A. BERNIS. November 21st.
- 16,661. "Electrodes for welding." M. M. IRVINE. November 21st.
- 16,695. "Electric signalling." H. GREEN. November 22nd.
- 16,696. "Tram rails." M. E. MORGAN & W. A. MORGAN. November 22nd.
- 16,708. "Electric device for stopping railway trains that have run past signal." W. H. WHITESIDE. November 22nd.
- 16,710. "Combined pocket and suspension electric lamp." C. R. HALL. November 22nd.
- 16,731. "Electric flashlights, torches, &c." J. FARREN. November 22nd.
- 16,737. "Radio-telegraph and telephone stations." F. G. SIMPSON. November 22nd.
- 16,740. "Brakes on electric trams, &c." R. H. WILKINSON & W. H. LEWIS. November 22nd.
- 16,760. "Dynamo-electric machines for starting and lighting systems, &c." A. E. WHITE (U.S. Light & Heat Corporation). November 22nd.
- 16,789. "Means for attaching and securing electric lamps." H. M. AINSWORTH. November 23rd.
- 16,800. "Ohmmeter." B. P. ROMAIN. November 23rd.
- 16,835. "Relays." W. H. DAVIS. November 24th.
- 16,840. "Trolley-wheel guide for trams, &c." G. ALLEN. November 24th.
- 16,841. "Method of attaching electric-connecting wires on pocket electric battery, torch, &c." F. C. TAMMADIA & F. R. TAMMADIA. November 24th.
- 16,849. "Apparatus for preventing inverse currents in secondary discharge of induction coils." C. E. S. PHILLIPS. November 24th.
- 16,850. "Electric reflectors." A. SUTTER. November 24th.
- 16,855. "Cooling sparking plugs of internal-combustion engines." A. F. LAMKIN. November 24th.
- 16,861. "Apparatus for circular grinding of commutators of electrical machines." A. NOKREL. November 24th.
- 16,862. "Connection for electric leads." P. CLERGEY & SOC. CLERGEY, BLIN & CIE. November 24th.
- 16,867. "Dynamo-electric machines." BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO. November 24th. (U.S.A. December 8th, 1915).
- 16,890. "Apparatus for indicating and measuring small electric currents." A. W. SUGGESS. November 24th.
- 16,892. "Telephone instruments." INTERNATIONAL ELECTRIC CO. & H. E. R. ROUSE. November 24th.
- 16,897. "Means for automatically rendering defective telegraph signals uniform, and for storing them up preparatory to transmission." A. FRASER AND EASTERN TELEGRAPH CO. November 24th.
- 16,900. "Switching mechanism." W. CHIDBURN AND V. R. CHIDBURN. November 24th.
- 16,907. "Connection of electric cables to junction boxes, &c." BRITISH INSULATED & HEATED CABLES, LTD., AND R. W. BLADES. November 25th.
- 16,908. "Attachment of electric line to holders." S. BERRY, C. H. TAYLOR AND O. GRUNDY. November 25th.
- 16,944. "Electric switch." G. MAART. November 25th.

PUBLISHED SPECIFICATIONS.

1915.

- 14,111. ELECTRO-MAGNETIC POWER TRANSMISSION CEARING. H. Zoelly. October 5th. (Convention date, October 6th, 1914, Switzerland.)
- 14,740. TELEPHONE EXCHANGE AND LINE PLUGS. A. Marr. October 19th (April 19th, 1916).
- 15,448. CIRCULAR CONNECTIONS OF LITHIUM DISCHARGE APPARATUS. British Thomson-Houston Co. (General Electric Co., U.S.A.). November 2nd.
- 15,579. TELEPHONE ALARMING. W. J. Moller-Jackson (Western Union Telegraph Co., U.S.A.). November 4th.
- 15,762. ELECTRICALLY-CONTROLLED CLUTCHES. W. Langdon-Davies, A. Soames and Niamloob Vennotschap de Nederlandsche Thermo-Telephon Maatschappij. November 8th.
- 16,053. AUTOMATIC PROTECTIVE GEAR FOR ELECTRIC SYSTEMS. M. Rosebourn (formerly Rosebourn) & F. A. Cousc. November 13th.
- 16,056. LIGHTNING ARRESTERS. E. C. R. Marks (Bancken). November 13th.
- 16,058. ELECTRIC SUPPLY METERS. H. O. Merriman & T. Speirs. November 13th.
- 16,290. PORTABLE ELECTRIC BATTERY LAMPS. B. Forbes. November 18th.
- 16,854. DYNAMO-ELECTRIC MACHINES OF THE COMMUTATOR TYPE. M. Walker. November 30th.
- 17,390. CONNECTION BETWEEN ELECTRIC INCANDESCENT LAMPS AND HOLDERS. S. Fildes. December 4th.
- 17,128. ELECTRICALLY-DRIVEN VEHICLES. British Thomson-Houston Co. (General Electric Co., U.S.A.). December 6th.
- 17,166. ELECTRIC REGULATING SYSTEMS. D. F. Campbell. December 7th.
- 17,570. REVERSIBLE ELECTRIC STEP-UP-STEP DOWN RATCHET MECHANISM. I. H. Parsons & A. E. J. Ball. December 16th.

1916.

The numbers in brackets are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

358. ELECTRIC LIGHTING SYSTEM OR CIRCUITS. H. Wrigley. January 8th, 1916. [101,985.]
951. ELECTRIC INDICATORS. P. M. Lincoln. January 20th, 1916. [101,896.]
- 1,116. FLUID-PRESSURE-CONTROLLED COLLECTORS FOR ELECTRICITY. Vacuum Brake Co., H. J. Dover & W. P. Walker. January 24th, 1916. [101,737.]
- 1,628. ELECTROLYTIC APPARATUS FOR LAUNDRY AND OTHER HYGIENIC PURPOSES. E. KUSS & V. Roberts. February 3rd. (Patent No. 101,829.)
- 2,242. TELEPHONE RECEIVER. A. Williams & L. D. Williams. February 15th, 1916. [101,396.]
- 2,328. ELECTRIC DISCHARGE VACUUM TUBES. S. Dushman. February 20th, 1916. [100,104.]
- 2,552. MINERS' ELECTRIC HAND LAMPS. A. H. Railing & A. E. Angold. February 21st, 1916. [102,001.]
- 2,584. ELECTRIC FURNACE. W. J. Wrighton. February 19th, 1916. [100,093.]
- 2,600. ELECTRIC SUPPLY METERS. Landis & Gyr Soc. Anon. February 22nd, 1916. (Patent No. 100,109.)
- 2,986. ELECTRIC CABLES. T. O. Callender and Callender's Cable & Construction Co. February 28th, 1916. [101,914.]
- 3,062. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. A. T. Austin. March 1st, 1916. (Patent No. 101,825.)
- 3,084. ELECTROLYTIC PRODUCTION OF SODIUM PERBORATE. Deutsche Gold und Silber-Scheideanstalt Vorm. Roessler. March 10th, 1916. [100,152.]
- 4,752. COMBINED ELECTRIC LAMP HOLDERS AND SWITCHES. W. Donovan. March 31st, 1916. [102,012.]
- 4,806. ELECTRIC SIGNALING SYSTEMS AND APPARATUS, PARTICULARLY APPLICABLE TO AUTOMATIC MULTIPLEX PRINTING TELEGRAPHY. A. F. Dixon. April 22nd, 1916. [100,306.]
- 5,750. ELECTROLYTIC REFINING OR EXTRACTING PROCESS. United States Metals Refining Co. April 20th, 1916. [100,318.]
- 6,260. TROUGHING OR TRAYS FOR ELECTRIC CONDUCTORS, CONDUITS, PIPES, AND THE LIKE. May 2nd, 1916. [102,015.]
- 7,975. ELECTRIC HEATING APPARATUS. E. Erichsen. May 22nd, 1916. [102,020.]
- 9,139. SWITCH-OPERATING MECHANISM FOR USE WITH ELECTRIC TRANSFORMER STARTERS AND THE LIKE. W. Barraclogh. June 29th, 1916. (Patent No. 101,853.)
- 9,826. TIME-LIMIT ELECTRIC RELAYS. British Westinghouse Electric and Manufacturing Co. July 12th, 1916. (Patent No. 100,892.)
- 10,090. MULTIPLE CONTROL APPARATUS FOR ELECTRIC RAILWAYS. Akt. Ges. Brown, Boveri & Cie. July 29th, 1916. [101,023.]

A Metric System Ready Reckoner.—A handy and ingenious ready reckoner for use in converting British into metric measures, and *vice versa*, has been issued by MESSRS. EDWARD LE BAS & CO., of Dock House, Billiter Street, E.C., under the title of "The Combination" Metric Ready Reckoner. The copyright is attributed to Mr. O. T. Evennett. The tables provide for the conversion of the units of length, area, volume, and weight in common use, as well as a variety of compound units, and are conveniently arranged for rapid computation, advantage being also taken of type in three colours and two sizes to facilitate reference and prevent errors. Apart from minor discrepancies, such as that between the values given for 1 lb. and 10 lb. in kg., and the irregular use of cm^2 for cm^3 , our main criticism, as in previous cases, is directed to the illogical treatment of significant figures. The equivalents for inches, sq. inches and cu. inches are given in some instances to 3 figures, in others to 5; for feet, from 3 to 7; for yards, from 4 to 7; for lb. to kg., and for gallons to litres, 5 to 6, but for tons to kg., 8 figures; on the other hand, in the short tables for conversion from metric to English measures, and for compound measures, six figures are generally given. As a matter of fact, four significant figures are quite sufficient for almost all conversions involved in commercial transactions; at least four should always be given, even if some of them are ciphers; if the fifth figure is given, it might with advantage be in smaller type, or subscript. The point may be thought of little moment; it is, however, of importance—not only as embodying correct ideas of physical measurements, but also because an array of 6 to 8 figures alarms the man in the street, who naturally associates it with the metric system, whereas in fact it has nothing to do with the latter at all. The very wide use of four-figure logarithm tables, and of the slide-rule, indicates the degree of accuracy which is necessary and sufficient, with few exceptions. In a foot-note the value of the litre is given in pints to no fewer than 10 figures! It cannot possibly be measured to more than 7, with the utmost refinements.

THE
ELECTRICAL REVIEW.

Vol. LXXIX. DECEMBER 15, 1916. No. 2,038.

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DEMobilISATION AND
RECONSTRUCTION.

WHILE there are indications that we are on the eve of great events in respect of further national organisation of our resources for the successful prosecution of the war, there is no disposition to leave such matters as demobilisation and reconstruction after the war to settle themselves. The prime business in hand at the moment is the determined prosecution of the war to complete victory over the powers that were mainly responsible for the world holocaust begun in August, 1914. But we shall commit a graver disaster than perhaps even the war itself unless we prepare, as far as practicable, immediately for some of the things which will inevitably ensue when Peace can be definitely relied upon. Therefore, the publicity which has been given during the past ten days to reports on demobilisation problems and reconstruction proposals cannot be considered ill-timed merely because we are passing through re-arrangements of the Cabinet and the dull days of the third winter of the war.

The report of the Joint Labour Committee on Labour Problems expresses the studied conclusions of a sub-committee representing various Labour organisations. It is estimated, as far as it is possible to foresee matters at the moment, that anywhere between 6,000,000 and 8,000,000 persons, seven-eighths of whom are men, will be discharged or, may we be allowed to say, removed or transferred, from their present employment. Some millions of them are exclusively engaged making what are comprehensively described as munitions of war; many of these will, we suppose, find plenty of other business awaiting them in the same works as soon as material is available. Other millions are probably doing more or less ordinary work now in place of men who will expect to return to their former positions. If ever it were necessary to prepare for an event in advance in order to avoid calamitous consequences, it surely is so in respect of this "colossal" general post in industry," as it has been aptly described. It is considered by the Joint Committee that demobilisation will extend over two or three years, and a number of detailed suggestions are advanced as to provision that should temporarily be made available both for the changing munition worker and for the returning soldier, disabled or otherwise. These details will form parts of a policy which will have to be nationally elaborated in order that the burden may be spread as equally as possible, and the State will necessarily have to bear a considerable share in the inevitable cost, for it is as much a war expense as is the cost of mobilisation.

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(J. A. Berly's).

1916 EDITION.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

There will be need for the greatest possible consideration, tact, and diplomacy if we are to avoid widespread grievances, for already the soldier does not hesitate to show how keenly he feels the unequal sharing of burdens which deprives him of his all in order that he may fight, while his next-door munitions-working neighbour batters fat on war earnings. Whether and what unemployment compensation shall be granted, and the precise nature of the machinery to be set up for finding occupations for workless men and women, these and many other like points will require before long to be taken seriously in hand by the new Government, but for the present the one really pressing and important thing is for the most efficient possible organisation to be established. For some time past there has been a Reconstruction Committee of the Cabinet receiving and considering all sorts of proposals concerning "after the war," but we opine that the late Cabinet made little advance, its wheels being heavily clogged with the conduct of the war. We have so many committees at work that it requires a master mind to remember exactly how all their different duties are co-ordinated, but the new Government will find it necessary to settle seriously down to consider these reconstruction problems while the War Council wages war without undue waste of time in controversial questions.

But while the Joint Committee of Labour has studied its own special questions, and while the Cabinet Reconstruction Committee has "received" proposals, the Labour Adviser's Department and the Pensions Schemes have not neglected certain very definite aspects of the anticipated situation. And beyond all these, and by no means the least important, the great Federation of British Industries has been assiduously at work. This magnificent organisation, a more powerful industrial federation, we believe, than has ever before been brought into being here, counts among its members most of the great British engineering and industrial companies and works. Formed with many worthy objects, all of which will receive their share of attention in due course, it has, and we think rightly, first concentrated its combined experience and strength upon certain aspects of internal industry as they must occur after the war. It has, at a meeting held in London, of which reports have been published in the daily Press, adopted a number of proposals. In the belief that these proposals form a reasonable basis for timely and profitable reflection and discussion, we print them in full below:—

1. That the cordial and whole-hearted co-operation of employers and employed will be the most important element in the success of any scheme for dealing with the reinstatement of the men of the Forces and munition workers in civil employment, and the general redistribution of labour after the war, and for handling any subsequent problem of unemployment or labour dislocation.

2. That no machinery now in existence can adequately deal with the reinstatement in civil employment of the present Forces.

3. That powers should be obtained from Parliament to set up without delay a Central Statutory Board to regulate and supervise (a) the reinstatement in civil employment of the present Forces; (b) the settlement in normal employment of civilian workers now in Government or controlled establishments; (c) any general redistribution of labour arising out of the war. Appropriate transfers of existing powers and duties will have to be made by the various Government Departments to the Central Statutory Board, so that complete authority shall be vested in the new Board.

4. That not less than two-thirds of the members of this Central Statutory Board should be representatives of employers and employed in equal numbers, such members being appointed by the Crown from associations of employers and

from the Trade Unions of the United Kingdom respectively, the remaining members of the Board to include representatives of Government Departments, &c.

5. That where a Trade Union, by arrangement with employers' associations, is capable of placing its members in employment, it should be competent for the Central Board, if it deems it to be in the national interest, to delegate to the Trade Union in question the responsibility of dealing with the reinstatement of its own members.

6. That Local Boards should be established wherever necessary to assist the Central Board. Such Local Boards to have the same proportionate representation as is provided for the Central Board.

7. All expenses properly incurred by the Central and Local Boards should be paid out of moneys provided by Parliament.

The Secretary of the Federation, Mr. R. T. Nugent, has written to the Press stating that these are the proposals of the most important and representative industrial organisation in the country, which comprises among its members numerous large firms and over 40 associations in the iron, steel, engineering, shipbuilding, textile, dyeing, brewing, electrical, chemical, and other industries. These proposals, he states, constitute the first attempt of a representative body of employers and Trade Union leaders to make suggestions for the solution of one of the great post-war problems on definite and practical lines. The organisation sees, as do most others who have studied the position of Labour as it has developed in war-time, that unless there can be far greater agreement between Capital and Labour in future than there has been in the past, we cannot "carry on" prosperously and efficiently as an industrial nation after the war. And we cannot possibly expect to reach any state of after-the-war co-operation of Capital and Labour unless we strain every nerve to secure the redistribution of Labour in the process of demobilisation with the absolute minimum of grievance and friction. We must all agree that "the cordial and whole-hearted co-operation of employers and employed will be the most important element in the success of any scheme" bearing on that matter. The movement to secure industrial harmony, or an "industrial truce" is, to our minds, one of the most important next to the conduct of the war itself; another, of course, to which it is closely related is after-the-war trade organisation and national policy in regard thereto. We trust that the Federation and the Joint Labour Committee will be able to so influence the new Government that the very necessary organisation, fully representative of both employers and employes, which the situation demands, shall get to work without delay. In our new efforts at national reorganisation let us mobilise the right men for this particular national service.

MORALS FROM GERMANY!

WE suppose that few men in the City of London will be credited with a shrewder insight into financial and general commercial affairs than Mr. C. J. Stewart, the Public Trustee. Prior to the war it had been his duty to investigate the affairs of many a business which had fallen upon bad days, and some large concerns it was his privilege to personally take in hand and pilot into happier times. We believe that there is nothing but admiration for the excellent way in which he organised and controlled the Public Trustee's Department for the matters which came under its peculiar care in pre-war days. With the European war, and the necessity for us to deal with German-owned holdings in companies operating here, Mr. Stewart's duties naturally took

on an even more complex character when certain responsibility in that connection was relegated to him. Whereas before the war he had occasion to investigate the operations of many a British concern, discovering points of weakness which had occasioned failure, he has during the war had to go most minutely into the doings of successful companies and businesses in which German capital and German influence have been important factors. He could tell us a great many things to interest us did he feel free to speak the manifold details that are in his mind, and we hope that in due course he, as well as those who have had to do with the supervision, control, and winding up of companies, under the Trading with the Enemy Acts, will be free to unburden himself in the interests of the future welfare of British and Allied commerce and industry. He has, we are glad to say, already delivered an address to the City of London Tradesmen's Club on "The Public Trustee and the War," and those who have a mind to criticise everything that is done by public departments which have to handle the war-time difficulties of enemy trade connections, finance and influence, might do worse than read that speech in order to understand how great some of those difficulties and problems are. Compelled to avoid the detail, we fasten upon two pieces of counsel that he has given us as the result of his unique experience. He says that it is no exaggeration to say that 85 per cent. of the enemy companies dealt with by his Department were paying companies. In this respect he felt obliged to give the enemy his due. But why did they pay? Partly because it had been the custom of most of these companies "to write everything down to the bone." Goodwill was always written off, as were big depreciations also. "These companies were in a very strong position, and it was really a lesson to some of our own joint stock companies to see how the German companies acted in this respect."

We do not forget that Mr. Pownall, the President of the Institute of Bankers, was careful in his address, referred to here a few weeks ago, to point out that there were no company promoters in Germany. When we are inclined to sit in reflective mood remembering some of our modest efforts to ensure the soundness and stability of British electrical industry, we recall many an occasion when the ELECTRICAL REVIEW referred to the readiness of some British companies to carry the promoter's legacy of goodwill, or to allow patents to stand at what seemed to us extravagant figures, or to fail to provide properly for depreciation—who does not remember glaring cases of failure to write down huge stocks to their proper figure, and the consequences of such short-sightedness? It is to be hoped that engineering and electrical companies who are making war profits will use a fair proportion of such funds as are left, after "Excess Profits" taxes have been taken, to rendering their balance sheets as clean and healthy as possible. Mr. Stewart, at any rate, holds up the German concerns as examples as a result of his personal investigations, and our readers will have learned from our pages what has been the practice of the great Teutonic Electrical Trusts. There are some excellent examples of the same sort of thing where goodwill and patents have practically disappeared from British electrical manufacturing balance sheets, but there are others which may not be free from the influence of the past so soon as one would wish for their good. We can quite believe that a student of the past would blame some of our electrical finance, as strongly as others blame some of our legislation, for the shortcomings of the electrical industry.

Another point referred to by Mr. Stewart, and one upon which we have frequently laid emphasis, is the generosity which these German-owned companies displayed in dealing with their staffs. We do

not, of course, say that it is general for British concerns to be ungenerous, but there are businesses which are frequently described to us as "notoriously bad payers." In our opinion, this must inevitably prove in the long run a "penny wise and pound foolish" policy. Englishmen who have worked for German, or partly German, electrical concerns here have told us again and again that they certainly had no sentimental preference for working for foreign companies, but German firms, knowing the value of a good man to them, and observing the British indisposition to pay electrical men a reasonable remuneration, did not fail to take advantage of the situation. They have undoubtedly, in certain well-known exceptional cases, paid very high figures in order to get a British commercial engineer to conduct their operations at home or in the British Colonies. Mr. Stewart says: "They seemed to think it paid well to give the best treatment to their men."

There is a growing conviction that skilled and other factory labour must be better paid if it is to yield the best results in industry. Is there no room for improvement in dealing with the man who does not perform the manual labour of the works, but is the *brains*, or the *business-getter* of the organisation? We are not suggesting that, taken as a whole, Germany pays her own engineers better than Britain does hers, but she certainly has shown a better appreciation of the value of the men to whom she looks to develop her industrial operations, and Mr. Stewart's remarks will not be wasted if they serve to remind British traders and manufacturers of this one detail of German organisation, in which the Teuton has undoubtedly reaped an advantage.

Institution Notes.

THE current issue of the *Journal* of the Institution of Electrical Engineers affords further evidence of reform in procedure on the part of the Council, which will be welcomed by all who have the best interests of the Institution at heart. Very little is known by the general body of members regarding the work that is done by the Council, its numerous Committees, and its official representatives on other bodies: hitherto, apparently, it has been the policy of the Council to do good by stealth, and only those who are enabled to obtain a glimpse of its inner workings can form an adequate or just idea of the really enormous amount of work that is performed by the self-sacrificing Members of Council and their nominees—not even the *personnel* of the various Committees, as a rule, being divulged. However, a long step has now been made towards a reasonable measure of publicity, by the publication of a list of representatives of the Institution on 11 external Committees, Boards, &c., that are engaged on "work of national importance," and of a list of members of 11 Institution Committees (with numerous Sub-Committees), together with the names of representatives of other bodies who are not necessarily members of the Institution. The publication of these names cannot fail to strengthen public confidence in the recommendations of the Committees, or to reassure members as to the activity of their leaders, and will, we feel sure, prove beneficial to the Institution.

Nevertheless, we are not yet satisfied. To ask for details of the proceedings of the 21 Committees, Sub-Committees, and Panels would obviously be unreasonable, but need the Council carry on its deliberations always behind an impenetrable veil of secrecy? We hope that we may yet see in the *Journal* at least a précis of the Council's proceedings and conclusions, and that it will take the members more fully into its confidence, and concern itself more intimately with their personal welfare.

In conclusion, our congratulations are due to the Institution on the fourth list of military honours, the ninth list of members on active service, and the fifth list of promotions, &c., all of which show how nobly the members of the electrical profession have responded to their country's call.

RESISTANCE STEPPING OF MOTOR ACCELERATING RHEOSTATS.

By L. BOOTHMAN.

This is rather a hackneyed subject, but the following, culled from practical experience, outlines some points not mentioned in the many articles that have been written on this matter. Incidentally, it tends to simplify the determination of the necessary data for the greater number of motor applications with equally good results to those more elaborately calculated.

An ideal starting rheostat, from a smooth acceleration and current stability point of view, would give a straight line acceleration, *i.e.*, the resistance is decreased uniformly at a uniform rate. This is so, regardless of the type of motor

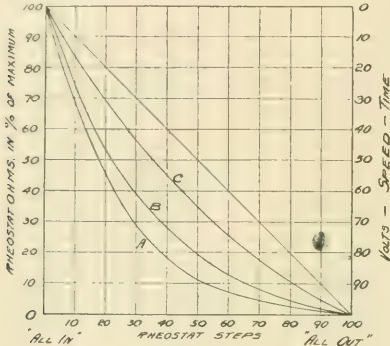


FIG. 1.

or its characteristics, and is practically fulfilled by the liquid rheostat.

The larger number of rheostats used, however, cut out the resistance in a definite number of steps, so that a straight line acceleration is not desirable solely on account of the variable current, torque, and consequent acceleration impulses that would result.

For theoretically limiting the current during starting between a maximum and minimum amount, often the resistance is stepped out in a geometrical ratio, obtained graphically, by calculating or setting of the slide rule. In the case of D.C. or A.C. motors the armature or rotor resistance is required to be known. With series or compound-wound D.C. motors the resistance of the series field, and, in addition, also the saturation curve of the machine, should be known, because in all commercial motors some degree of saturation is present, and the increase in field current strength does not give a proportional increase in counter electromotive force generated in the armature.

Assume a rheostat that is theoretically correctly designed. Now if the operator does not pause sufficiently on any contact to allow the motor to attain its maximum speed for that step, the current rush on the succeeding step will be higher; also if the actual load on the motor is less than the assumed load taken into account when calculating, then after the first current increment the remainder are of less amplitude. The momentary starting torque and current of a motor under load are almost necessarily greater, owing to inertia, than when accelerating. Where the load torque increases with the speed, as with centrifugal pumps and ventilating fans, and during the accelerating period of hydroextractors, the current increases with increasing speed, and, therefore, the increments are damped. With motors possessing a series field, the self-induction of the field winding helps to damp these increments, and the increase in field strength raises the torque more than in the case of a shunt-motor, therefore the motor accelerates at a quicker rate.

With A.C. motors the choking effect of the windings is greater than for D.C. motors, and therefore the current increments are still less. Especially is this the case with small A.C. slip-ring motors having a large number of turns on the windings, and calculations based on open-circuit slip-ring voltage and current, with the rotor stationary and

full voltage on the stator, will not allow the assumed current to flow.

A point sometimes overlooked is that in the case of constant-torque machines the time required for acceleration is in proportion of the total time to the amount of resistance cut out at each step; the capacity of the resistance should be designed accordingly. On cutting out a section of resistance the rate of acceleration is increased, and as the motor gains in speed, gradually decreases, but the average rate can be taken as constant.

In the actual manufacture of rheostats, use has to be made of an available range of standardised resistance units which have fixed and definite steps, and which are commercially very good if accurate within a 5 per cent. ohmic variation. Cast alloy resistors vary as much as 20 per cent. in ohmic value from their designed standard, due to variations in material, &c. Carbon resistances vary in their ohmic value from time to time, due to humidity, contact pressure, and other causes depending on their design, in addition to the inherent negative temperature coefficient of carbon, while some metals in use have a positive temperature coefficient, and thus by the time the later steps are reached their resistance has already changed. This alteration is again a variable quantity, depending on the temperature attained. Even when the resistance steps are carefully calculated, especially where a standard line of starters is developed and kept in stock, a theoretical source of error occurs immediately if the machine resistance assumed differs from that of the actual motor that the rheostat controls. All this tends to nullify the nice calculations that have been made, and only in exceptional cases is there any need for them. Users of electrical apparatus are more concerned with their practical immunity from breakdown than with any supposedly theoretical accuracy in design.

In general, the number of starting steps is already fixed, depending on the type of controller, and the stepping can be quickly made by means of the curves here shown, selecting one according to the acceleration and type of rheostat required. The curves are plotted to percentages of total rheostat ohms and steps, and preclude any necessity for knowing armature resistance, &c. It is immaterial whether

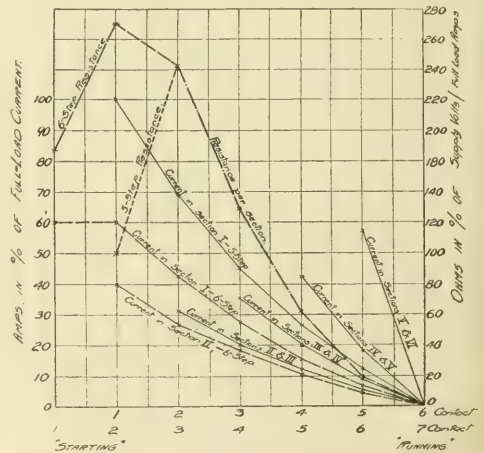


FIG. 2.

the motor is started under load, as the total resistance is determined by the torque, *i.e.*, current required at starting. The straight line in fig. 1 is drawn for comparison. The curves represent the rate of motor acceleration. With motors exerting a constant torque they also indicate approximately the speed of the motor in R.P.M. at any point during starting (assuming the motor has been allowed to attain its maximum speed for that step), the time required to reach that speed, and the voltage drop across the motor. This is all expressed in percentage of the normal. For given conditions the total energy dissipated in resistance during starting is practically the same for all curves.

Curve A is a typical geometric ratio stepping. For the

faceplate type of rheostat, I do not recommend this, as the comparatively large voltage drop between the first contacts is liable to create arcing.

Curve B is preferable, and with series motors it gives a more uniform acceleration with less current variation than would Curve A.

Many "slow-motion" or "step-by-step" rheostats, either hand or automatically operated, give an equal time interval on each step. If geometric stepping is used for these, and the motor is accelerated to its corresponding speed on the first contact, then the succeeding time intervals are in an increasingly greater ratio than necessary, increasing the amount of resistors required, and lengthening the total time for acceleration, with greater energy loss in the resistance. In practice a compromise is often made between this and equal stepping, as per Curve C. The current increments that ensue, it is found, present no difficulty, and it is often more important with starters possessing only a few steps to have a more uniform acceleration than to have regard to these increments. Compare this with the auto-transformer, star-delta, and series-parallel starting of A.C. motors.

For starting large motors it is difficult to utilise to the best advantage the large capacity, with low ohmic value, required if using resistance that is first of all in series, and then cut out in steps. The best plan is to insert a section of resistance, and then parallel the others with it successively. The curves shown in fig. 2 for D.C. motors are for a five-step starter, allowing normal full-load current at starting, and a six-step, allowing 60 per cent. on the first contact, and attaining full load on the second, using parallel resistances throughout. The resultant resistance in circuit, with the motor at each step, is identical with Curve C in fig. 1. The actual ohms (expressed as a percentage of supply voltage, full load current) for each section of resistors is shown. It will be noticed that the resistance curves for the five and six-step starters coincide from one point, and that the current curve for the first section of resistors in the five-step is exactly the same as the resistance Curve C in fig. 1. The amperes for sections 1 and 2 in the six-step starter, added together on the various steps, also coincide with Curve C. Of course, the actual currents on each step, when added, total 100 per cent. of normal, i.e., current increments are neglected. By these curves it is easy to obtain the capacity of resistors required for any motor and starting conditions where these numbers of steps and this acceleration are suitable, and similar curves (or, preferably, tables), can be made to cover a range of apparatus.

THE ALEXANDERSON MAGNETIC AMPLIFIER.

THE two fundamental difficulties met with in radiotelephony, but not in radiotelegraphy, are: the necessity of generating a uniform series of continuous or undamped electrical oscillations at an exceedingly high frequency, and of adequate power; and the fact that the carbon microphone, which is still the most convenient and efficient instrument for the reproduction of atmospheric vibrations in the form of fluctuations in an electric circuit, can deal only with very moderate currents and small power. The problem of generation has been solved in various ways, including the construction of alternators of very high frequency to the design of Mr. E. F. W. Alexanderson, of the General Electric Co., U.S.A.; the same inventor has also devised an extremely ingenious method of enabling the small variations of electric power produced by a microphone to be enormously magnified, so as to control power of any desired magnitude, and to reproduce faithfully the vibrations set up by the human voice, on a vastly greater scale. An account of this invention was given in the *General Electric Review*, and as Dr. J. A. Fleming, in his recent course of lectures on "Long-Distance Telephony," referred to it as of considerable promise, the following description may be interesting. The article from which we derive the particulars was a reproduction of a paper read before the Institute of Radio-Engineers, U.S.A., in February last, by Mr. Alexanderson and Mr. S. P. Nixdorf.

The fundamental principle of varying an inductance by changing the permeability of an iron core was suggested in the early work of Fessenden, as a means of changing the tuning of a radio antenna; the magnetic amplifier shown in its simplest form in fig. 1 was, on the other hand, developed as an accessory to an alternator, in order to take advantage of the better mechanical construction of a solid steel rotor, and yet produce the results that could be obtained by field control in a machine with a completely laminated magnetic circuit. The combination of the constant-field alternator with the stationary controlling device produces the same effect as a machine with variable field excitation.

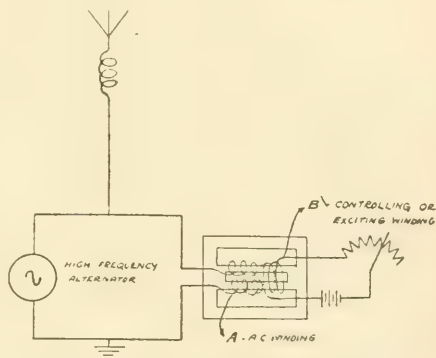


FIG. 1.—CONNECTIONS OF SIMPLEST FORM OF AMPLIFIER.

as regards not only the proportionality between excitation and electromotive force, but also such phenomena as self-excitation and instability.

If two windings are related to one another and a common magnetic structure, as shown in fig. 1, it is evident that there can be no direct transformation from one winding to the other; for each turn in the controlling or exciting winding B includes both the positive and the negative branch of the flux produced by the A.C. winding A, and hence no resultant electromotive force is induced in winding B. On the other hand, the current in either winding

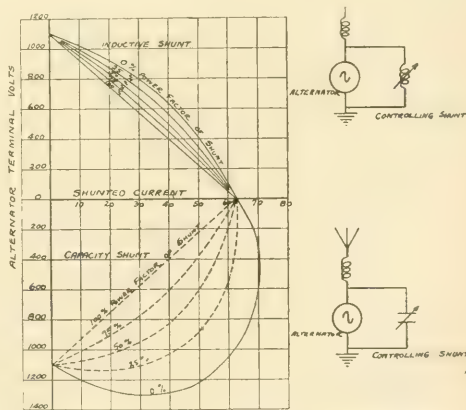


FIG. 2.—CHARACTERISTICS OF AMPLIFIER CONTROLLED BY VARIABLE SHUNT.

influences the permeability of the common magnetic material, and therefore changes the inductance of the other winding.

If a current flows in either winding of sufficient intensity to saturate the iron, the latter is thereby rendered practically non-magnetic, and the inductance of the other winding is reduced to the value it would have if the coil included only air. If, on the other hand, a current flows in the other winding which gives a magnetomotive force equal and opposite to the first, the iron is rendered magnetic

again. As the two branches of winding A are relatively opposite to winding B, one branch will oppose the ampere-turns of winding B on one half-cycle and the other branch during the next half-cycle. In order to have any large flux variation in winding A, the opposing ampere-turns must be at least equal to the ampere-turns in winding B. The relation of currents is substantially the same as in a transformer between the primary and secondary currents, although in this case one is an alternating and the other a direct current, or a current of different frequency. It is

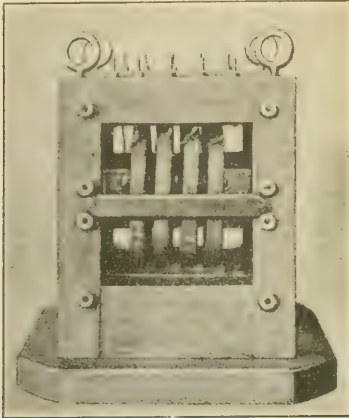


FIG. 3.—AMPLIFIER USED FOR TESTS.

thus obvious how current flow in winding A can be regulated proportionately to a controlling current in winding B. When the magnetic amplifier is used in shunt to the alternator, as in fig. 1, it has the immediate object of controlling the voltage rather than the current; the combined characteristics can be derived from the characteristics of the alternator when operating on an antenna and at the same time controlled by a variable shunt across its terminals, as shown in fig. 2. It is also possible to connect the amplifier in series with the alternator and the antenna, but the shunt connection is preferable, because its effect is the same as if the E.M.F. of the alternator in the antenna circuit were reduced, whereas in the series connection the amplifier does not influence the E.M.F., but changes the tuning of the antenna, and the working conditions are less satisfactory. The two A.C. windings can also be connected either in series or in parallel; this will be referred to later. Fig. 3 shows an amplifier used for tests with an alternator of 72 kw.

While the power expended in the controlling circuit in varying the antenna circuit is very small, there is a large amount of magnetic inertia to be overcome, which is equal to the energy stored by the change of the magnetic field, or the integrated area of the saturation curve between the points where the changes take place, and calls for a wattless flow of energy proportional to the energy per cycle, and the number of times per second the energy must be delivered and returned. The energy of the controlling field is not necessarily equal to the energy of the high-frequency field, but is of the same order of magnitude. The ratio of amplification is proportional to the ratio between the frequencies of the radio current and the controlling current. It is obviously desirable to produce a maximum flux variation in the controlling circuit, and to reproduce in the antenna circuit the telephone current in its true shape, and the authors discuss the conditions that must obtain at considerable length.

The parallel connection of the A.C. windings is found preferable to the series connection, having greater sensitiveness, and being able to carry large currents without causing instability. In this case the flux variations in the two branches of the core must be identical, because they

produce the same terminal voltage in the two windings, which are connected together; but the currents in the windings are indeterminate, because a cross-current of unknown strength may circulate between the two coils. This induced current tends to oppose any change in the average flux, and thus a telephone current in the controlling winding would simply cause a corresponding short-circuit current between the two A.C. coils without producing the desired flux variations. But as the A.C. winding need operate only at "radio" frequencies, which are very much higher than the frequency of the telephone current, it is possible to find a value of a condenser such that it acts as a short-circuit for the radio-currents, and an open circuit for the telephone current. Hence a condenser is introduced in series with each of the A.C. coils as shown in fig. 4.

Without the condenser shown in series with the amplifier, the upper curve in fig. 4 shows the relation between alternator volts and amplifier excitation; this curve approaches the axis of ordinates asymptotically with increasing excitation of the amplifier, and the voltage can be reduced to zero without using an excessive excitation current, so that the amplifier can be used as a controlling device for radiotelegraphy. In this form it is not suitable for telephony, on account of the departure from proportionality. This is remedied by inserting a series condenser as shown in fig. 4, the sensitiveness of the amplifier being at the same time greatly increased, so that a much smaller control current is needed, but a limit is set to the latter effect by the introduction of appreciable core loss due to hysteresis and eddy currents. The lower curves in fig. 4 show the variations of alternator voltage that can be obtained by using different values of series capacity, and the corresponding increases in the sensitiveness of the amplifier, as represented by the steepness of the curves, which also indicate that the increased sensitiveness is gained at the expense of range of control, or difference between maximum and minimum voltage. All the curves show a practically linear proportionality between excitation and voltage over almost the whole range available. The effect of departure from linear proportionality, and the con-

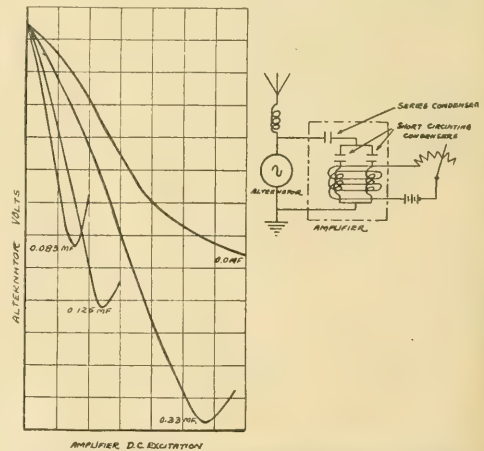


FIG. 4.—CURVES SHOWING SENSITIVENESS OF ALTERNATOR VOLTAGE CONTROL WITH DIFFERENT SERIES CONDENSERS.

sequent distortion of wave shape, is shown in the oscillograms of fig. 5.

The amplification ratio is defined as the difference between the maximum and minimum kilowatts output, divided by the effective alternating volt-amperes supplied to the controlling winding, and for operation suitable for telephone control ranges from 100 : 1 to 350 : 1.

A further improvement in sensitiveness can be obtained by using a combination of shunt and series condensers, the shunt condenser being so proportioned as to make the amplifier take leading, instead of lagging, current at low excitation, and allowing the alternator to assume its full maximum voltage. Fig. 6 shows an alternator output of 72 kw. controlled by telephone; the two curves on the

oscillograms, which are relatively upside down, show that the variation of the alternator voltage is in all details an almost exact reproduction of the controlling telephone current.

Apart from telephony, the magnetic amplifier is expected to prove of value as a non-arcing key for telegraphy, and particularly to make possible high-speed telegraphy at the same rate and with the same means as high-speed automatic

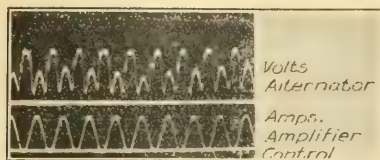


FIG. 5.—EFFECT OF LACK OF PROPORTIONALITY UPON THE WAVE SHAPE.

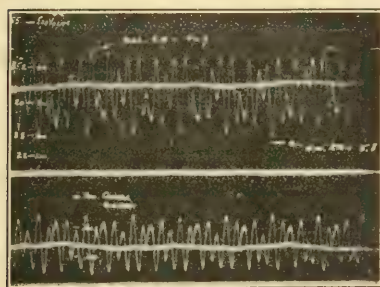


FIG. 6.—OSCILLOGRAM SHOWING TELEPHONE CONTROL.

telegraphy on land lines. Oscillograph records have been taken of telegraphic control from 500 to 1,500 words per minute. There appears to be no limit to the power that might be controlled in this way with apparatus of suitable dimensions.

LINKING-UP AND FALLING OUT.

By "ROVER."

THE article, "Linking-up Electric Power Stations," in the issue of November 17th, reminds me of some operating experiences in America, in cases where two or three stations were connected. There was no question of different phases or frequencies, these being merely cases of power houses of similar systems of supply working conjointly. In all instances there was a three-phase system driven by water power.

In the first case three power houses were interconnected—one of 6,600 kW., one of 3,000 kW., and one of 500 kW. The largest station generated at 4,400 volts, stepped up to 44,000 volts on the transmission line, and was 25 miles away from the distributing sub-station. The second and third generated at 11,000 volts direct on to a transmission line, and were respectively 7 and 10 miles away from the point of distribution. Previously the big station had been supplying an area by itself, but at times of peak load it was over-loaded, whereas the peak load in the other area happened at a different time of the day, so it was decided to link-up the two areas. Both systems had a frequency of 60.

The interconnecting was done by means of static transformers, 44,000—11,000 volts, with a synchroscope and oil switch, all situated in a sub-station in the main distributing area. It should be emphasised that in the big station there was no opportunity for speed regulation, as the governors were set for 60 cycles at full load, and locked in that position. In station No. 2 a certain amount of hand

regulation of the governors was possible. There was no automatic voltage regulator on the system.

All regulation for synchronising was, therefore, done at station No. 2, the operator at station No. 3 being merely told to stand by in case of a bad shot. To further complicate matters, the load on the area supplied by stations Nos. 2 and 3 comprised a good deal of mining machinery, including various hoists, a 500-H.P. pump liable to start or stop at any moment, and a 400-H.P. compressor which caused a variation of load of about 250 kW. every 35 sec. Add to this the fact that the governors at station No. 2 acted rather sluggishly, and you will then be able to gauge the state of mind of the operator in the sub-station trying to get a phase, 7 miles from the nearest power house. The telephone wires were strung on the same poles as the transmission lines, and hearing was not always distinct. Sometimes the operation took a quarter, sometimes half an hour, but always the staff were worked up to such a pitch of irritation and profanity that it was only the long distances between stations which prevented bloodshed.

The connection once made, things went fairly smoothly, although a short circuit in the distributing area—no uncommon occurrence in a mining camp when surface blasting is being carried on close to transmission lines—was liable to shut down all three stations; the connecting oil-switch, too, had a maximum relay set for about 1,000 kW., which occasionally opened when the sub-station operator's back was turned, giving stations Nos. 2 and 3 a pretty nasty jar, and temporarily spoiling the harmony between operating staffs.

Another supply system, of which I have more or less pleasant memories, was also in a mining camp. There was also a load of 5,500 kW. divided between two power houses 25 miles apart, one station of 5,000-kw. capacity, supplying 4,000 kW., and a smaller station of 1,800 kW., supplying 1,500 kW., both stations directly coupled to the same transmission line. The daily load factor was in the region of 90 per cent., and the work of operating consisted chiefly of booking the hourly readings and cursing the mosquitoes, which made even that slight task hard work. When the inevitable short occurred—caused by lightning, violent wind storms, or air concussion due to blasting—both stations were brought out. The bigger station went back on the line first, after five minutes' interval to allow all workmen to get clear, and then when the oncoming load had steadied a bit, station No. 2 would connect up, switching in one machine after another.

On this system fairly cordial relations existed between the staffs of the two power houses, except for the usual mutual complaint that the other station was running at an unfairly high power factor. On one occasion, however, relations got very much strained owing to shortness of water. Low water at the larger station forced the management to disconnect some of the load in the camp, and to run only one 2,500-kw. set instead of the usual two. The smaller power house, being situated further down on the same river, had perforce to shut down a set as well, and it was arranged that the larger station should carry full load on its one set, leaving the smaller station, with a much less load, to do the voltage regulation. This the smaller station either could not or would not do, and station No. 1 was accordingly sometimes carrying 25 per cent. overload, and sometimes running at three-quarter load. The superintendent of the larger power house thereupon decided that No. 2 should be forced to do the regulation, and he had his machine taken off the governor and placed on hand control, with the gate opened to the full-load mark. He ran in this condition for about a week.

The poor operators at No. 2 did not get a moment's rest during that week, and had to call in assistance to book their hourly readings. This state of things produced a good deal of friction between the two stations—No. 1 complaining of the inadequacy of the regulation by No. 2, and No. 2 cursing at having to attempt to regulate a very variable load on such a small machine.

Providence, however, straightened things out rather quickly, by sending some heavy rainstorms and increasing the water supply. But in the meantime our largest consumer had done his best to stir up further strife by developing a faulty main switch. This consumer was demanding about

1,000 kw., and it is fully as switch opened without warning. Then there was a lively time in both power houses—on hand control—with the gate wide open, and the other carrying about 400 kw. Station No. 2 lost their load completely, and both machines speeded up to a terrific extent. Station No. 1 had to close down on their water-wheel gate—not a very quick or easy operation when on hand control—and got everything nicely steadied down when the consumer started up again, and they had to open their gate once more. At the end of the week No. 2 declared their governor had broken down under the strain, but by this time the water level had risen sufficiently to run two machines at the larger station, and peace was restored.

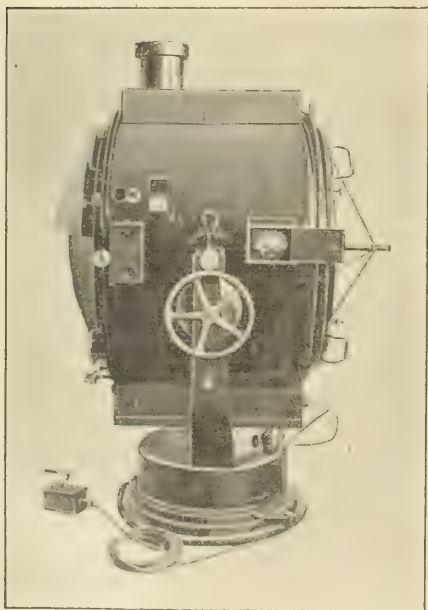
I think, therefore, that while the development of the linking-up of the 38—or is it 138?—London stations will prove highly interesting from a technical point of view, as a psychological problem it should be of absolutely absorbing interest—especially to those operators most closely concerned.

THE SPERRY SEARCHLIGHT.

By the courtesy of the Sperry Gyroscope Co., Ltd., we were recently enabled to witness the operation of the Sperry searchlight, which was described at some length in our issue of September 8th (page 256). At the present time, searchlight work is of more than ordinary interest, and the Sperry lamp particularly so, on account of the enormous advance which it represents on current practice using the pure carbon arc.

This advance is not only shown in the more powerful beam of projected light, but in the ingenious mechanism and adjustments provided.

The lamp, which we believe is the only complete



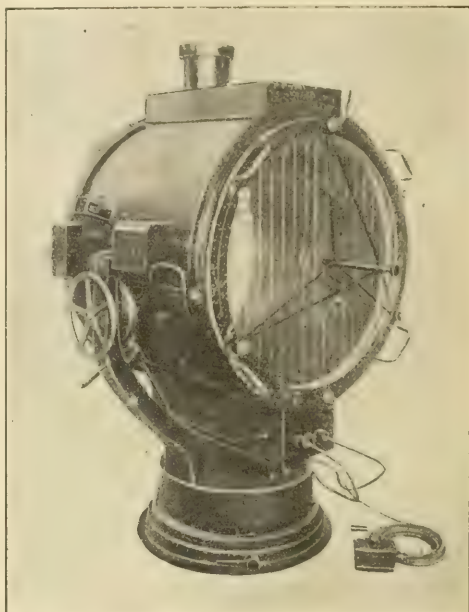
THE SPERRY SEARCHLIGHT. SIDE VIEW.

one which has been shown in this country, was the 90 cm. size, giving a maximum c.p. of from 105,000 to 112,000, with a wide angle of high intensity, this comparing with a maximum c.p. of 44,000 over a small angle in the case of the ordinary pure-carbon arc 90 cm. searchlight.

The greater brilliancy of the Sperry arc has been

obtained by making use, in addition to the heated crater surface, of superheated vapour produced in the arc, which burns in a flame above the latter. This result is due to the use of a specially impregnated positive carbon, the core being so proportioned that it burns away faster than the carbon shell, thus producing a deep crater.

Owing to the small size of the carbons, rapid burning of the positive carbon is necessary to secure



THE SPERRY SEARCHLIGHT. FRONT VIEW.

the necessary supply of vapour, and in the 90-cm. lamp, the positive carbon is 110 cm. long and 7 mm. in diameter, burning at the rate of 18 cm. per hour, with a normal current of 150 amps. The negative carbon is 30 cm. long and 11 mm. in diameter of solid carbon, copper coated.

The intrinsic brilliancy of the bright vapour in the positive crater is about 500 c.p. per sq. mm., and the distribution curve is much more uniform than in the pure-carbon arc.

While the reader is referred to our previous article on September 8th for a detailed description of the lamp mechanism, we may briefly indicate some of its features here.

To prevent the carbons being burned in such a way as to interfere with the formation of a proper crater, and to protect the feeding mechanism from the intense heat of the arc, a current of air is forced up through the electrode supports, which are narrow rectangular tubes designed to offer a minimum obstruction to the light. The air escaping round the positive holder is so directed as to shield the latter from direct radiation and cool it, and also serves to hold the arc flame in position and carry off waste gases.

The electrode supports are carried on a rectangular control box, situated underneath the drum, and containing all the essential mechanism for operating the arc; the cooling air for the electrodes is supplied by a small motor-driven fan in the control box, and the latter box, with the electrodes, &c., can be removed bodily from the drum, if required, in a few seconds.

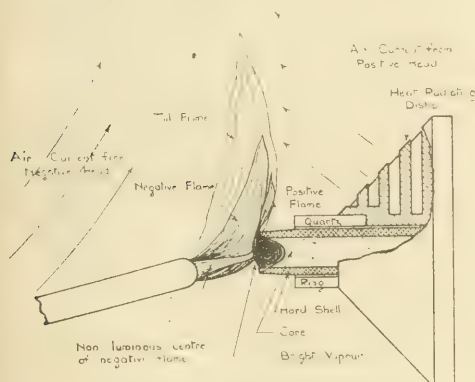
The small fan motor, by means of a suitable gear train and mechanism in the positive head, feeds the

positive carbon forward; the same motor also slowly rotates this carbon in order to maintain the symmetry of the crater and prevent the escape of the bright vapour.

The positive crater is kept at the focal point of the mirror either by hand control or automatically by means of a thermostat and solenoid, its actual position being ascertained by means of an image of the arc thrown on to a ground glass screen, on which a line is drawn to indicate the correct position of the positive tip.

The automatic control is a most interesting feature; a small focusing mirror inside the drum is so placed as to direct a beam of light through a slit on one side of the latter, on to the expansion strip of a small thermostat attached outside the drum, whenever the crater moves from its correct position, by the carbon burning back. This causes the thermostat contacts to open, de-energising the solenoid in the control box, and enabling a clutch mechanism to advance the carbon the correct amount. This control system gives satisfactory results, the regulation being closer than that obtained by manual control.

The negative carbon is also fed through its holder (but is not rotated), the movement being effected by the small fan motor, previously mentioned, under the control of a shunt solenoid connected directly across the arc, and also placed in the control box.



Diagrammatic View of the Sperry Arc.

The voltage across the arc can be varied by adjusting a tension spring which opposes the shunt solenoid.

The negative carbon is inclined at an angle of 14 deg. to the horizontal, the design of the holder being such as to cast the minimum shadow on the mirror; the negative holder and its support can be swivelled round sufficiently to permit the insertion of a new carbon from the front, the turning movement automatically relaxing the grip of the holder in order to facilitate this.

The negative holder and support are mounted on a sliding carriage on the control box, and when the current is off are drawn into striking position by a spring; when the arc is struck they are drawn back into the running position by a series solenoid.

In order to rapidly disperse the gases produced by the arc, which would otherwise form dense clouds in the drum, thus obstructing the light, and leave a possibly corrosive deposit on the mirror, and for other purposes, forced ventilation of the drum is necessary.

It is also necessary, especially with a short focal length mirror, to cool the mirror and its supports in order to prevent it from being cracked by the intense heat of the arc. For this purpose, a small motor-driven extractor fan is mounted in a little casing on the top of the drum; this draws air down

over the back of the mirror and up across its face to the exit situated over the arc. It has been found that large currents of air can be drawn through the drum without affecting the arc, which is shielded by its own ventilating system, and that fume extraction and ventilation can be effectively combined by the arrangement adopted.

The projector lamp is suspended in trunnions mounted on a turntable on the base, in the usual way, and arranged for either hand or power training; the training motors and the series resistances for stabilising the arc being mounted in the base.

It may be noted that the arc strikes up immediately it is switched on, and on switching off a red glow continues for a short period, during which the intensely hot carbon tips are cooling; an iris shutter is, however, fitted by means of which the light can be instantly controlled or obscured.

The Sperry searchlight is built in three sizes, for 60 cm., 90 cm., and 150 cm. projectors; when required a remote control system can be provided to enable it to be operated from a distance.

Turning to our views, it will be noted that the long positive carbon projects, in a holder, through the glass front of the drum; on the operating side of the drum are mounted a small case containing a combined volt and ammeter, also further back the thermostat in its case, and above it the ground glass observation screen for the arc. Observation holes with dark glasses are also provided on either side of the drum, also a variable resistance to control the speed of the fan motor in the control box. The main switch for operating the arc is situated under the front of the drum, with a projecting handle, and the current passes through the two tubular electrode supports—which are insulated from the control box—to the carbons, silver brushes being provided for this purpose in the case of the rotating positive carbon.

In conclusion, it will be seen that the Sperry searchlight represents a great increase in range and target illumination, two factors of great importance in warfare, where ability to pick up an enemy and, at the same time, to blind him, at the earliest moment is essential.

THE PARALLEL OPERATION OF ELECTRIC POWER STATIONS.

The paper by Mr. J. S. PECK on this subject was discussed by the BIRMINGHAM LOCAL SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS on December 6th. An abstract of the paper appeared in our issue of December 1st.

Mr. R. A. CHATTOCK, in opening the discussion, spoke of the advisability of linking-up generating stations, as this contributed to greater over-all efficiency of the stations and increased the reliability of general supply. He thought the case for linking-up was quite made out by such considerations, and the practical difficulties were not insuperable.

Mr. A. M. TAYLOR explained by the aid of diagrams that the use of Tirrill regulators was inadvisable in linked-up systems owing to their inability to permit the voltage of one station to adjust itself to variations of conditions in another station.

Mr. R. ORSETH referred to two great difficulties in the linking-up of stations, namely, that of the switchgear, which must be capable of standing the current of the combined systems, and the possibility of heavier surges than would occur in the systems when operated separately.

Dr. G. KAPP said he was not able to agree with the author's definition of "total synchronising power." Apparently the author took this to be the sum of the excess power given out by the leading machine and the deficiency of power in the lagging machine. He thought synchronising power should be defined separately for each machine. It was convenient to give the synchronising power in kw. per unit electrical degree phase difference between the two machines. Dr. Kapp also explained a diagram which he had devised for finding the total inductance for any ampere load on the machine. In conclusion, he added that when dealing with the induction motor and synchronising generator the author had pointed out that by making the slip fairly large it was almost impossible to overload the link between two stations,

and that a similar set might be used than if both machines were stationary. The two disadvantages mentioned were large differences in speed and a bad power factor. These, to Mr. Kapp, did not seem to be very serious, whilst the flexibility of the system and the freedom from dangerous over-loading were very important advantages.

Dr. C. C. GARRETT said that it was probable that the advantage of the existing generating stations was the most immediate and practical step which the electric supply industry might take in the campaign of national economy which a prolongation of the war would entail. The success of such linking-up proposals would in a large measure depend upon the control gear, which must be chosen with regard to the maximum value of the short-circuit current which could occur in the place where the switches were situated. Even with the existing supply stations it was very doubtful whether the breaking capacity of the oil switches which were available had kept pace with the growth of the generating plant. They could conceive of two stations whose switchgear was adequate, having regard to the individual totals of plant installed; the effect of linking them up, however, by diminishing the inherent reactance of the system greatly increased the short-circuit current and rendered the whole of the switchgear inadequate. This trouble could be partially guarded against by the introduction of reactance in the inter-connectors, but if they were to go in for large schemes of linking-up it would soon be found that the types of control gear available were inadequate, and this would prove a limiting feature. The largest types of oil switches hitherto made had probably been developed in America for overhead lines having comparatively large reactance values; it did not necessarily follow that the same switches would give satisfaction when used with underground cables, as would be largely the case with us. This question of control gear for very big supply systems was one which should be given special attention by the Institution. The American Institute had a Standing High-tension Transmission Committee, which was called upon to report periodically on the general progress of high-tension work. The Swiss Society of Electrical Engineers also did the same kind of thing, and he suggested that the Institution of Electrical Engineers should take this matter up. No action of the Institution could be more helpful in the advance of British electrical engineering than this. The present haphazard method of leaving it to the individual manufacturers and supply companies and corporations was very unsatisfactory, and a co-operative and co-ordinated effort was required. The V.D.E. had already issued a report upon this very question, but as far as he was aware nothing had been done in this country. It was essentially a question of research. Both manufacturers and users would heartily welcome any information on this subject. He suggested, therefore, that the Institution be asked to form such a committee with instructions to report, say, every six months. Such a committee would have to be thoroughly representative, and would not have to consist simply of a few worthy past-presidents and vice-presidents nominated in London. It would also have to spend a good deal of money, as experiments would have to be organised, &c.; moreover, in order to make rapid progress it would be necessary to retain the services of a good engineer to act as secretary to the committee. If such an organisation could be got to work, in a very few years the problems which were now a source of considerable anxiety to many supply companies' engineers would be solved and a great advance made in the reputation of British manufacturers of this class of apparatus. In view of recent announcements by the Government, it was very likely, if proper representations were made, that a grant of money from the Government for such a research might be procurable.

Mr. C. JONES, in a communication, wrote of the improvement he had been able to obtain in the power factor by the use of static condensers. In the particular system with which he was concerned three sets had been installed of 340, 400, and 600 microfarads capacity. These had been in use for twelve months without giving the slightest trouble.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Breakdowns of German Plant.

The articles on German plant contained in your publication last week have sent me to certain old letters filed away and almost forgotten, and as these deal in some of their paragraphs with the matter you are now discussing, they may be of interest to you.

I give below extracts from two letters after subjecting them to such sub-editing as is necessary to make a coherent story, but strictly retaining the sense of the originals whilst doing so.

"At the beginning of August we were informed that no more breakdowns should occur, so No. 5 generator burnt out its rotor that evening; a fortnight later it was running again and No. 3 generator

burnt out its stator, the trouble being bad stator joints which set the insulation on fire. When No. 3 generator was repaired, No. 5 generator broke down again with a burnt-out stator and the core had to be rebuilt; No. 5 generator was back at work again only a few days when No. 1 generator broke down, owing to the rotor banding coming adrift. The air pumps have also given a lot of trouble, probably owing to light shafts. The five generators are built by ———, 10,000 kW., 1,000 R.P.M., 5,000 volts."

"We have had a good deal of trouble on the cable system, the oil switches blowing up, and scattering the burning oil."

"At ——— sub-station a transformer broke down and was handed to the maintenance men: four of them were working on it, opening up, when there was an explosion and the men were enveloped in flames: one ran to the pond, but dropped dead a few yards away from it; another died during the day: of the other two, one may recover."

"A few days ago an oil switch burst at the same sub-station, and two men were injured."

The plant referred to has all been installed in a British colony and paid for by good British gold, and the whole of it was of German manufacture. The various breakdowns referred to in the letters were reported during a period of only a few months.

J. Shepherd.

Leeds, December 4th, 1916.

Trade with Italy.

During the last month we have received many catalogues and price lists from British engineering and electrical manufacturers; several of them mention that they had our address from page 484 of your ELECTRICAL REVIEW of November 3rd, 1916.

We have pleasure in thanking you very much for your kindness, and we can assure you that we, since 1883, have done all we can to have machinery from England.

Cav. Alexander Hamilton & Sons.

JOHN A. HAMILTON.

Messina, November 28th, 1916.

The Recruiting of Skilled Engineers.

In one of the leading articles of your issue of December 8th you dealt with the calling-up of engineers skilled in the handling of Diesel engines. In the early days of the war the recruiting of trained men placed the nation in a very awkward position, and, in a number of instances, it was necessary to bring them back into civilian life. There seems to be a danger of these grave errors being repeated. Last week, before the City Tribunal, two engineers on the staff of a large insurance company, one an electrical surveyor, the other on the technical office staff, had their appeals for exemption rejected, apparently without any evidence being taken.

The importance of electrical work in the war is recognised even by the layman, and there is no class of men doing better service to the nation than the engineering staffs of insurance companies. They must have a wide technical and practical experience, be acquainted with every make and type of apparatus, and have a unique knowledge of power plants. Large numbers of controlled establishments, and thousands of firms doing work of national importance, are covered with insurance companies, and surveyors spend most of their time in getting these works out of trouble and preventing them from getting into it. As a matter of fact, even people who do not insure often retain these companies simply for the value of their inspections, tests and advice. In addition, the staffs do a lot of good work in the testing of machinery, both new and second-hand, previous to purchase, and also get out the plans and carry out the complete electrification of works. It must further be borne in mind that the companies themselves are not getting any extra premium, although large numbers of machines are working day and night, resulting in an increased number of breakdowns; in addition, the prices of repairs are more than doubled, and are nearly all class A or B.

If these men are to be taken away they should at least be put into positions where their services could be properly utilised. I doubt if this was the case as far as the two engineers mentioned were concerned.

Jaques.

The Armorduct Manufacturing Co., Ltd.

Mr. Nield, in his question in the House Commons on Monday last, of which you give an account in your last issue, refers to me as the nominee of the German shareholders. I desire to state that I am not, and never have been, their nominee.

I founded this business (at the age of 21), and when its development required capital took it from Germany when I failed to obtain it here, and your readers will hardly regard that as a crime. I tried repeatedly to replace this German capital by English capital, and failed owing to the antipathy with which industrial investments were regarded in this country prior to the war.

The Board of Trade Parliamentary Committee, with the full knowledge of all the facts and of my history, invited me to make an offer for the alien interests of the company: I have made this offer, and, whether it is accepted or rejected, I have acted throughout in the best interests of the country of my adoption.

W. Ratcliffe-Small.

London, E.C., December 12th, 1916.

Australian Postal Contracts.

Referring to the paragraph under this heading which appeared in your issue of September 1st, I beg to advise you that although, after three months' delay, the Postmaster-General's Department replied to a communication dated October, 1915, giving reasons why an arbitration clause, or its equivalent, should be inserted in contracts, intimating that it had been decided not to vary the conditions of contract in regard to the rejection of material by making provision for the appointment of a Survey Board, Clause 10, which provides for a Survey Board, has been inserted in a large number of contracts entered into by the Department with members of my Committee since this date.

R. H. Butler,

*Secretary, the Australian Electrical and Allied
Contractors' Committee.*

Melbourne, October 20th, 1916.

BREAKDOWNS OF GERMAN PLANT.—If our other correspondent in Leeds will forward his address, in accordance with the rule at the head of this section, we shall be pleased to insert his letter on this subject.—EDS. ELEC. REV.

NATIONAL INSURANCE (UNEMPLOYMENT) ACTS, 1911—1916.

UNEMPLOYMENT INSURANCE.

Decisions by the Umpire.

A. THE Umpire has decided that contributions are payable in respect of:—

2,072 X. Pointsmen, signalmen and other workmen engaged in regulating traffic at factories engaged wholly or mainly in munitions work, or in any trade insured under the National Insurance (Part II) (Munition Workers) Act, 1916.

2,076 X. Workmen engaged in the preparation of slate for electrical appliances, tanks, or vats for use in the manufacture of munitions of war.

2,078 X. Workmen (including stranders and coverers) engaged wholly or mainly in making telephone cords.

2,079 X. Workmen engaged wholly or mainly in covering metal wire with silk, cotton or other material.

B. THE Umpire has decided that contributions are *not* payable in respect of:—

2,077. Workmen (other than those insurable under Part II of the National Insurance Act, 1911) engaged in the repair of bridges which are built up on the site.

LEGAL.

BRITISH-THOMSON-HOUSTON CO., LTD., v. DURAM, LTD.
TUNGSTEN WIRE PATENT LITIGATION.

(Continued from page 626.)

MR. SWINBURNE said he had made himself acquainted with the specifications in the case. With regard to Siemens's German specification of 1902, that dealt with tantalum, niobium and vanadium. Any knowledge about those metals would tell them nothing as regarded the working of tungsten. The same applied to the Abel specification of 1900, which also dealt with these metals. The specification of the British Thomson-Houston Co. of 1906 stated that "difficulty has been encountered in drawing or rolling filaments from tungsten, because of its non-ductile character as ordinarily obtained." "We have discovered that when tungsten is heated it undergoes remarkable molecular changes, and, in fact, becomes so ductile that it may be easily worked when hot." "The metal becomes so ductile that it may be hammered into bars, rolled into sheets, or drawn through dies into wire." The process was described in the specification, and he had seen the process actually carried out. It was an important process for lamp filaments, and was practically replacing all the others, and the metal was coming into use for other purposes as well, such as making electric spark contacts. He had not found in any of the earlier documents pleaded in this case instructions which would enable him to work tungsten.

Witness was cross-examined by MR. TERRELL, K.C., with reference to the meaning of malleability in metallurgy, and also with regard to the ductility of certain metals. Counsel suggested to witness that it was found impossible to make tungsten for a lamp unless it was got coherent. Mr. Swinburne agreed, and also assented to counsel's remark that when it was first made coherent it was by the same process as osmium. The built-up tungsten filament first got on to the market about 1907, and the drawn-wire filament much later.

Can you account for the fact that it was not brought on to the market between 1906 and 1911-12?—From 1906 to 1911 is five years and that is not out of the way for developing a process like

this into commercial work. It is not that you have to draw the wire and make a new lamp, to compete with gas, or something of that sort, you have to compete with an existing lamp; you cannot get it into commercial use till you are better than the existing lamp.

On December 6th MR. SWINBURNE continued his evidence for the plaintiffs.

MR. T. TERRELL, K.C., in further cross-examination, suggested that there was a difference between ductility and malleability.

WITNESS said, in his opinion, ductility involved malleability plus tensile strength. This specification did not talk of malleability.

When you heat the metal and start hammering it, there is no more ductility in the metal than there was before you began in the sense of differentiating it from malleability?—I think there is: I think the hammering generates ductility. Mr. Swinburne also said that, in his opinion, the word "ductility" was used loosely to mean workable.

Prof. C. V. BOYS, F.R.S., said he had read and considered the specification of the plaintiffs, and took part in certain experiments with reference to the subject matter of the patent. The information on the subject of tungsten at September, 1906, the date of plaintiffs' patent, consisted of Moissan's experiments. Tungsten powder was well known at that time, and possibly the squirted filaments of tungsten; but he was not sure that they were on the market then. Asked as to the possibility of investigating the malleability and ductility of tungsten from the then known materials available for research, witness said it was possible to repeat the experiments of Moissan, and to get his result. As to the filaments, they were a finished product, and owing to its brittleness and hardness he would never think of drawing it. He did not know of any tungsten which could be put into the form of rods. Dealing with the Siemens specification, Counsel asked if there was anything in that document which would be helpful to a man who was facing the problem of making tungsten?—Witness said they could gather nothing about tungsten from other metals. The document told them nothing in words and nothing by inference.

HIS LORDSHIP: Suppose you take a fritted tungsten rod and expose it to further prolonged heating, do you increase its malleability apart from any subsequent working or heating?—I think that is the case: the greater the temperature and the greater the length of time you maintain it, the more coherent and compact the metal becomes.

Cross-examined by MR. KERBY, K.C., for defendants, who asked what directions the specification of plaintiffs gave, for working tungsten for other purposes than wire drawing, WITNESS said they could roll it into sheets.

You have seen experiments: do you think it can be hammered into bars, proceeding according to the specification?—I believe I can hammer it, working very carefully; but I think rolling is vastly better and quicker.

In September, 1906, if you had wanted to get a piece of tungsten rod, it was the obvious thing to get it from the powder by the squirting process?—If you wanted to do it, you could try the squirting process with tungsten.

In September, 1906, was there a difficulty in producing a built-up tungsten rod?—I do not know of its being done; but, if it had been tried, it would have succeeded.

As to the patent in question, at what stage in the process of rolling or drawing do you say the slug becomes ductile?—It may be that it is ductile before you roll it at all; I have not tried that; but as ductility requires a greater degree of strength and coherence than mere malleability, and you roll before you can draw, the process may be a gradual one.

On December 7th, MR. SWINBURNE was re-examined, his evidence having been interrupted on the previous day by an Admiralty engagement.

MR. WALTER, K.C.: From all the literature you knew until the instructions that were contained in this specification, did you know of any coherent form of tungsten?—No.

In the treatment of the powder which has been carried up to 1,000 degrees in the manner indicated in the specification, does that produce a different physical condition in the rod?—It does.

What is the general character of the change that has taken place?—A reduction of the dimensions of the body: that is to say, it gets smaller, and the particles come together so that they appear to be quite solid.

Do you know of any method by which tungsten can be obtained in a molten form, so that it could be formed into rods?—No.

As regards the nature of the operations, rolling, hammering, and so on, what is the preliminary to work such as Mr. Terrell spoke of?—In modern days all the metals used have been melted first.

Could such experiments have been carried out with tungsten up to the date of this specification?—No; you could not get tungsten, to start with, into the regular condition. Witness further stated that the prior specifications relied on by the defendants, dealing with the treatment of other metals, afforded no instruction as to the treatment of tungsten.

HIS LORDSHIP: Having read plaintiffs' specification from a scientific point of view, does it convey to you as a metallurgist that he is disclosing a method for dealing with a molten tungsten?—No; it conveys this idea, that you can take a powder and make it into a sufficiently coherent and solid form for working.

DR. PASSMORE, the well-known chemist, gave evidence as to experimenting with tungsten according to the process of hammering described in the specification. He satisfied himself, he said, that the coherent product as described when heated to a red heat only oxidised to the extent of bluing on the surface. All the tungsten he had hitherto worked with immediately on heating long below red heat oxidised. That was then his knowledge of tungsten. As to the effect of hammering, he took a slug made from the coherent process, and put it on a sheet of thin

Dr. Passmore took a sheet of asbestos, and he was able to work tungsten in the process indicated for the working of tungsten; he took the tantalum in the condition of powder, mixed it with glutinose, made it into a rod, and then, by the use of a hammer, and then, heating it up, tried to pass an electric current through it, and could not do it, the reason being that the metal contained some oxide. Dr. Passmore next gave his views on the methods described by Moissan with regard to tungsten.

The plaintiffs' case was closed and MR. COLLEMAN K.C. summed up the evidence on this side.

On December 8th, MR. TOM TIERRELL K.C. opening the defendants' case, said the fair reading of the evidence was that there had never been made a tungsten rod of anything like three-sixteenths diameter.

His LORDSHIP said he was not prepared on the evidence to say that making that was not an invented novelty.

MR. TIERRELL said they presented their case on this footing, that the patentees only put into practice a discovery, which discovery it was the business of the ordinary metallurgist to make in connection with either a new alloy or a new metal. That being so, and there being no difficulty and no suggested invention in carrying it into operation, there being no special apparatus necessary to do it, the only invention could be the bare application of the discovery that was alleged to be made. That discovery was the business of the ordinary metallurgist and was not invention. The evidence of Mr. SARGENT established this that given a chunk of tungsten, a metallurgist engineer being told to investigate its properties would, as a matter of ordinary business, try it cold and try it hot to find out its properties. He might be deceived about the tungsten, but he would find out, as part of his business, that it was malleable hot. There was no subject matter in the patent, because a so-called discovery could not be subject matter, and there was no invention or pretended invention in the application of a discovery. All that was said to flow from the discovery was that which flowed admittedly from the same fact in other metals.

On December 11th, MR. BALLANTYNE, expert chemist, examined by MR. KERBY, K.C., for defendants, said he had been in a number of these wire cases, and he had read the specification in this case. He remembered the proposal for the tungsten filament lamp. Before that, so far as he was aware, there was no use for tungsten except in the form of powder.

Was it known before the success of the filament lamp that wire made of tungsten would be a success for lamps?—That was believed up to 1904, and in 1904 we knew it when the built-up filament was a success. The patent became known in 1905. In September, 1906, he published in the *Journal of Chemistry* a précis of a communication in a German paper describing the lamps generally.

What to you, as a chemist and practical scientific man, does the specification in this action suggest as an invention?—I had a little difficulty at first in understanding what the point of the inventor was. At first I understood it was in order to get ductility by a process of heating, but I gathered afterwards that it was the working of a metal by melting.

What material did you understand to be referred to?—I understood it to be tungsten, which had started in the form of powder, and was converted into the form of a coherent. He added that he understood that it was necessarily started in the form of a powder, and if that could be melted it would produce tungsten in a coherent form. He could not say he knew, as an actual fact, that melted tungsten was on the market, but he believed tungsten had been used on the market in a form suitable for making filaments. He had tested the slugs which were made according to the patentees' process, and found the density to be in one test 167 and in the second test 16.

(To be continued.)

HENDON ELECTRIC SUPPLY CO., LTD., v. COLLINS.

At the Hendon Petty Sessions, on November 30th, Miss M. G. Collins, of Hampstead Garden Suburb, was fined £5, and £2 2s. expenses, for stealing electric current, value 5s., the property of the defendants. The company charges 1½d. per unit for heating and 3½d. for lighting, and the evidence given for the company showed that by means of a long flexible cord extending from one room to another, and a lighting socket attached to the heating plug, defendant was using heating current for lighting. Mr. J. M. Lickfold, who appeared for the prosecution, said that the company was proceeding in a number of similar cases, as this kind of thing appeared to be largely carried on in the district.

ELECTRICITY WORKS EMPLOYEES' LEAVING CERTIFICATES.

Two electrical engineers, employed by the Islington Borough Council, who appeared before the London Munitions Tribunal, said that they had asked for their leaving certificates because they had been refused the 3s. war rate granted to engineers on November 7th. Unless they obtained the extra 3s. or left the employ of the Council they would be turned out of their Trade Unions. Ald. SAINT stated that each man was getting an average wage of £2 10s. per week, and the Council desired to pay fair wages. The Council were supplying electrical energy at 1d. per unit, and were making a heavy profit. They wanted the men have to work under high pressure. If the wages were raised, the increased working cost would mean that the Council would have to bear part of the cost of running the business. The case was adjourned in order that the representatives of the men's Trade Union might be called.—*Daily Telegraph*.

MAXLEY & HOBART MANUFACTURING CO.

In the King's Bench Division, on December 6th, before Mr. Justice Rowlatt and a special jury, plaintiff, a pork butcher, of Harringay, sued the Hobart Manufacturing Co., of Charterhouse Street, City, to recover damages for injury to his right hand, caused, as he alleged, by the negligence of the defendants' servant. It appeared that on December 7th, 1915, plaintiff visited the Cattle Show at the Royal Agricultural Hall, Islington. The defendants, who are manufacturers of sausage-making machines, had a stand. The plaintiff, on going round the stalls, was invited by one of the defendants' servants to examine the sausage-making machine, and the plaintiff put his right hand into it, being unaware of the fact that the machine was actually working. The result was that the top portion of the index finger and part of the second finger on the right hand were cut off. He claimed damages, alleging that no warning was given to him that the machine was working, and that he should not place his hand inside it. The plaintiff, as a pork butcher, was permanently disabled in the use of his right hand, and he had lost the situation he was engaged in at the time. The plaintiff claimed damages and loss of salary. The defendants denied that the plaintiff was invited to examine the machine, and they said that the plaintiff was negligent in putting his hand into the machine. The defendants denied negligence.

MR. MARRIOTT, in opening the case, said that the machine in question was worked by electric power, started by a switch on top, and counsel suggested that the defendants' servant must have turned on the switch just as the plaintiff put in his fingers.

The PLAINTIFF, who is 30 years of age, gave evidence in support of his case. He said he was definitely invited by the defendants' servant to enter the stall and inspect the machine. He was proceeding to inspect the "worm" to see if it was tight; the machine was not working at the moment, but suddenly it started, and off came his fingers.

Evidence having been called for the defence, the jury awarded the plaintiff a total of £60 15s., and judgment was entered accordingly, with costs.

A. P. LUNDBERG & CO. v. WITTING & PARTNERS.

In the King's Bench Divisional Court, on Thursday, December 7th, Justices Ridley and Avory heard an appeal by the defendants against a decision of the Judge at Clerkenwell County Court in respect of a disputed contract for 180,000 mild steel grub screws.

MR. FORTESCUE, for the appellants, said the appeal was in respect of an action respecting an order for 180,000 screws ½ in. long—3 in. Whitworth thread—to be delivered by plaintiffs to defendants at the rate of 22,000 weekly. The action was brought to recover £42 5s., the price of certain of the screws. In the Court below the defence was that the screws were not in accordance with the contract, and defendants contended that they were entitled to regard them as worthless. There was a counterclaim for loss of profits and costs of stacking up machinery. The Judge found that there was a breach of contract, and that the screws were not in accordance with the sample. But he held that in the circumstances the people to whom the screws were to be delivered did not reject them within a reasonable time, and, therefore, they must pay the full purchase price of the screws. He also dismissed the counterclaim.

MR. PALMER, for the respondents, argued in favour of the finding by the Judge.

The Court allowed the appeal, with costs, and ordered a new trial. There was no doubt the screws were to be made to a certain pattern, and that they were not according to that pattern. The Court said the learned Judge was right in his first finding, but was not correct in the second.

EDISON SWAN ELECTRIC CO., LTD.

On Tuesday, a petition by this company, for the sanction of the Court to special resolutions altering the objects of the company, was heard by Mr. Justice Neville in the Chancery Division.

MR. JENKINS, K.C. (for the petitioner) said that his clients had very large and complete plant, and that they desired to extend their powers by entering into arrangements with the Government and municipal and other authorities, and doing any engineering work that was submitted to them. They also desired power to acquire patents for inventions relating to mechanical engineering, chemistry, chemical engineering, and anything of a like character in addition to their electrical patents.

His LORDSHIP granted the petition.

THE RATING OF ELECTRIC TRAMWAYS.

The assessment appeal of the L.C.C. was further heard on Tuesday, and the Court announced its intention to deliver judgment on December 21st.

Electrical Engineer Sentenced.—William Edward Milns

(39), formerly holding a prominent position in the Birmingham Corporation Electric Supply Department, and latterly an officer in the R.N.V.R., has been sentenced to six months' hard labour at the Crown Court of Birmingham Assizes, on a charge of assaulting Violet Curtis, aged 14, and to a similar sentence on other charges, both sentences to run concurrently.

WAR ITEMS.

Appreciation. A correspondent with the British Expeditionary Force, writing under date December 5th, 1916, says: "The weekly copy of the *Review* still reaches me regularly, and I am duly grateful for your kindness in sending it. As the means of keeping one in touch with everything that is going on in the electrical world, it is a truly valuable and welcome link."

Munitions Priority Branch.—The Priority Branch of the Ministry of Munitions, whose offices are at St. Edmunds Hotel, with Mr. Edgar Jones, M.P., at the head, will have charge of machinery for controlling the use and distribution of metals under the new committees that have been recently appointed for effecting economies in metals.

A Copper Committee.—It is announced that the Ministry of Munitions has appointed Mr. Cecil Budd, of Messrs. Vivian Younger & Co., London, and Mr. R. H. Rucker, of Messrs. Henry Rodgers, Sons & Co., London, as a Committee to advise the Ministry on the purchase and distribution of copper. Mr. Budd is chairman of directors of the London Metal Exchange, and Mr. Rucker is chairman of the Metal Exchange. Mr. Stroud, of Messrs. Charles Tennant & Co., will act as secretary to the Committee.

An Example to Follow.—The employees of the Birmingham Corporation Electric Supply Department at the outbreak of the war instituted a war relief fund, to which they have contributed over £1,000. Each Christmas they have sent to the men on service a Christmas present, and are doing the same this year. The men abroad will receive a parcel containing some dainties, and the men on home service will receive 5s. each. The wives of each of the men will also receive 5s., and 1s. for each child over 12, and a toy for each child under that age.—*Birmingham Post*.

Walther Rathenau Again.—An Exchange dispatch from Paris quotes the *Journal's* special correspondent at Zurich to the effect that in the course of the general meeting of the Allgemeine Elektrizitäts Gesellschaft, at Berlin, the chairman, Herr Walther Rathenau, known as the chief organiser of raw materials during the war, said:—

"Even those who make no mistake about the reality of the political and military situation have now the impression that for the first time for a very long while a distant glimmer of peace appears, but no hope should turn us from our duty. We must continue to extend our war factories, and build new ones, in order to increase our production. You know that Hindenburg's strong programme calls for the entire forces of the country, and the immense tension of these forces should turn Germany into one great arsenal. It is no longer a war of one army against another, it is a war of material. Our adversaries say that time works for them. No. Time works for no one; time fights against all."

Coal Supplies Held Up in France.—While the price of coal in France, writes the *Financial Times* Paris correspondent, ranges from £6 to £8 per ton, thousands of tons of coal continue to lie idle in French ports for lack of available transport. According to the *Petit Parisien* there are 800 barges containing 300,000 tons of imported British coal, unable to move for want of tugs. At the pit mouths of French collieries 500,000 tons lie waiting for transport, and a further 300,000 tons lie at various seaports. Meanwhile a number of important munition factories are working short hours owing to the lack of coal. The trouble arises in great part from the military control of the railways, the military authorities unnecessarily holding up large numbers of empty trucks for several weeks at a time. Speculators are taking advantage of this disagreeable—and, under existing circumstances, dangerous—condition of affairs, and quite recently a large coal dealer was able to exact the price of £9 1s. per ton for an immediate supply of 250 tons of coal. This price constitutes a record, even for France.

Germany and After-the-War Trade.—Mr. Gerard, the U.S. Ambassador to Germany, before leaving America on his return to Germany, delivered at a New York dinner an interesting speech on enemy after-the-war plans. According to *Reuter*, he said that in Germany, after the war, probably no one will be permitted to purchase anything made outside of Germany. There will be, in all probability, a central buying committee, which will do the purchasing from foreign countries for the Empire. This will permit the Germans to enter the markets in a position to say to a certain extent what prices they will pay for that which they wish to purchase. . . . If our peace and prosperity are to continue commercially, permission to combine for the foreign export trade should be given. Mr. Gerard thought that in every foreign nation after the war there would be similar central bodies for commercial protection and to reap commercial advantages, and these were the matters the States had to meet. At another point in his speech Mr. Gerard said that if America was to give the eight-hour day they had got to give the manufacturers and the working men some measure of defence against those countries where the working man worked 10 hours or more, and where so many women worked and had assistance furnished them.

Australia and Munitions.—In a recent speech at Melbourne, forecasting national organisation the Minister of

Defence (Mr. Pearce) said that they could not continue putting steel and iron into ornamental work when it was required for guns and shells.

War Bonus.—It was announced on the 9th inst. that a further war bonus of 3s. a week is to be granted to Sheffield Corporation women car conductors and other tramway employees receiving less than 48s. per week, at an annual cost of £15,000. War bonuses will now cost the tramways department £36,610 per year.

Tramways and Excess Profits Duty.—The Board of Directors, in response to an application by Auckland Electric Tramways Co., Ltd., have increased the statutory percentage in their case to 7½ per cent. in the case of a trade or business carried on or owned by a company or other body corporate, and to 8½ per cent. in the case of any other trade or business.

Export Prohibitions.—The list of export prohibitions has been amended, and particulars of the alterations appear in the *London Gazette* for December 12th. The following headings are to be deleted from the schedule:—

(B) Electric lamps, except carbon-filament lamps and arc lamps for street lighting.

(C) Pocket lamp cases and cases fitted with bulbs but not containing batteries.

(B) Lead, pipe, scrap or sheet, and solder containing lead.

(A) Valves, gas, steam, and water.

(A) Wood screws, made of brass, iron or steel.

(A) Preparations of manganates.

The following headings are to be added:—

(A) Manganese, peroxide of, and mixtures and preparations thereof.

(A) Zirconium compounds.

(B) Electric lamps, except carbon-filament lamps, are lamps for street lighting, and pocket electric lamps and their component parts.

(C) Electric lamps, pocket, and their component parts.

(A) Fuel economisers constructed of cast iron pipes, used as auxiliary heating apparatus in connection with land or marine steam boilers.

Metals and ores as follows:—

(C) Iridium, osmium, palladium, rhodium, ruthenium, and alloys of these metals.

(B) Lead (except pig lead), alloys of lead, solder containing lead, and manufactures of lead or its alloys, not otherwise prohibited.

(A) Thorium and its alloys.

(A) Zirconium and its alloys.

(A) Thermometers.

(C) Valves, gas, steam, and water.

(C) Wood screws, made of brass, iron or steel.

(B) Zirconium minerals.

Exemption Applications.—At the Aberdeen City Military Tribunal, Messrs. Bell & Lyon requested exemption for John Torn, apprentice engineer. It was suggested that a handyman might be got for the work being done by the apprentice. Mr. Bell said they could not get a man in the city. Mr. McDonald said he was told the Electrical Union was very severe. Mr. Bell said there was to be a deputation meeting this week about that, because there were one or two men engaged in Aberdeen who were not in the Union, and they were threatening to call out the rest of the men. The Chairman: I hope you will make a representation to the Ministry of Munitions if they attempt to carry out any threat of the kind. They will not stand any nonsense of that sort just now. Mr. Bell: We are entirely in their hands at the present time. Temporary exemption for two months was granted.

At Stoke-on-Trent, on December 6th, Mr. W. Thorn, manager of the Potteries Electric Traction Co., asked for reconsideration of an order that the company should surrender 38 men, in two instalments of 19 each. The first 19 had been released, and if the others had to go it would be impossible to maintain the whole of the services now running. To produce the other 19 men would mean drawing a very large number from running shed repair staffs, which were already depleted. He added that a high percentage of the passengers were workpeople and munition workers. The Tribunal decided to refer Mr. Thorn to the Military authorities, stating that the Tribunal had no objection to the retention of the men by the company if the Military were of opinion that they should be retained in their present occupation.

Certificates of conditional exemption have been granted to Messrs. A. A. Gates (26), managing clerk; and H. J. Russell (25), engineer's turner, appealed for by Messrs. Christy Bros. and Co., Ltd., electrical engineers, of Chelmsford.

At East Grinstead (Sussex), an appeal was made by Mr. J. H. Novis, electrical engineer, now engaged in making aeroplane fittings. The Tribunal decided to ascertain from the Ministry of Munitions whether a place could be found for appellant in munition works, or whether he could be allowed to remain in the district provided he continues his present work.

Before the Romford Rural Tribunal, on December 5th, Mr. J. W. Millar (39), electrical engineer to the Barking Chemical Co., appealed on the ground of national interest and certified occupation. The appeal was supported by the company, and

the Tribunal all the time but 14 days in which to find work for the man in question.

At Aldershot, on December 5th, Mr. Verne (36), electrical engineer and contractor, passed for general service, renewed for exemption. He said that the circumstances were such that he last appealed, except that he had sent only one of his original staff left, who had been rejected. He had conscientiously gone about to look after personally, and he had practically confined his work to the maintenance of motors in order that the machinery of various firms might be kept running. He contended that it was in the national interest that he should continue in the business. Exemption was renewed.

The Southampton Tribune has refused exemption to the electrical engineer at a local gunpowder factory, it being ascertained that the firm were solely making gunpowder for sporting purposes.

The Southampton Corporation Tramway Committee appealed for the retention of four married motormen, all of whom had been previously rejected. The Chairman: Are the Committee considering women as drivers? It is being done in other places. Ald. Dunsford: We do not want to do it. It is not women's work, especially through the streets of Southampton at the present time. Each of the men was exempted for three months.

The Salisbury Electric Light Co. appealed for a chief clerk and accountant. The manager said that he had made efforts to find a substitute, but without success. Exemption to March 1st was conceded.

Watford Tribunal has granted exemption to February 1st to G. Wall (30), foreman for the British Battery Co., Ltd., who appealed for his retention.

At Watford, the U.D.C. appealed for W. E. Field (30), stoker at the refuse destructor. The Military Representative said the man ought to be replaced. Three months were granted.

At Berkhamsted, Mr. A. E. Barren appealed for W. Meager (35), electrical engineer, of Potten End, who superintends the boilers and electrical arrangements at the house. Exemption was refused.

The Driffield Tribunal has granted exemption to March 1st to the electrician at a local picture palace.

Before the West Kent Tribunal, the Erith U.D.C. defended six months' exemption to E. G. Tapp (23), motorman on the tramways, opposed by the Military Representative, who said that a single man in Class B1 should not be left out of the Army. The tramway manager (Mr. Williams) said that the police would not licence a man under 20 or women as drivers. The tramway department had been certified as of importance for carrying on munition work, 75 per cent. of the 18,000 daily passengers were munition workers. The Chairman: Why don't they badge these men? Mr. Atkinson (Clerk to the Council): I think there is a scheme on foot. The Tribunal allowed the appeal, and directed that the man should not be called up before December 31st.

At Rochdale, Mr. G. L. Adamson, electrical engineer, withdrew an appeal for J. Heywood, aged 36, an electrical wireman, who had been badged.

At Rochdale, the Tramways Committee appealed for W. Brierley (28), married, coach body painter, and F. Travis (29), married, tramway traffic clerk, both passed for general service. Mr. G. Webster, the general manager, said Brierley was now practically engaged in repairing lifeguards, and Travis was the senior traffic clerk; all the men in this particular office had gone except one. Mr. Webster said that, on the whole, female conductors were satisfactory. Both appeals were refused, but time to January 31st was allowed.

During the application for two Corporation Clerks at Darwen, a member of the Tribunal said women were doing work in the town. The head of the department who was making the application observed, "Last month you said we had women on the cars. One of them jumped from a car when it was in motion, with the result that we have to pay compensation." One clerk was exempted, and the other allowed until the end of January.

At Oxford, the Electric Light Co. appealed for temporary exemption for F. E. Talbot (27), chief clerk, who has been with the company for 13 years, and was claimed to be indispensable. It was stated that the company had no desire to keep men out of the Army, but the financial year ended on December 31st, and Talbot was invaluable for that purpose. Four of the clerical staff of five entered the Army at the outbreak of war, and Talbot himself was anxious to go, but he was starved. The Substitution Office had frankly owned that they could not find a substitute. Captain Fox said that exemption till February meant a waste of three months. That was all very well if the war was going on for ever; but if they were going to finish it up next year three months was a serious matter. Talbot was a skilled man, and since the development of the air service skilled men were required. Mr. F. Gray (for the company): This man is not a mechanic. Captain Fox: I'm sorry; I thought he was. Cannot his work be done by a woman? Talbot: Not very well. Mr. Eeles, secretary to the company, said that Talbot was the only clerk left. As he was starved they thought they would have him to the end of the war, and that was the reason they had not trained anyone to take his place. It was agreed that Talbot should have temporary exemption to February 1st.

The West Kent Appeal Court, on December 5th, granted

exemption until December 31st to Mr. H. Somers (36), electrical engineer, of Anerley.

Before the East Kent Appeal Court, on December 6th, the Military successfully appealed against exemption allowed to Mr. S. W. Board (25), electrician, of Ramsgate, who is an auxiliary fireman, but he is not to be called up until February 6th.

At Weymouth, the T.C. appealed for the retention of two skilled labourers at the refuse destructor. The eldest was given until March 31st, and the other to the end of the year.

Reading Tribunal granted six months' exemption, on his taking up munition work, to J. Pickett (38), electrical fitter with Messrs. Baughan & Co.

An electrician in business at Epsom applied, on November 25th, for extended exemption on the ground of business hardship. He is passed in Class C2, and stated that every effort had been made to dispose of the business, but without success. Two months were conceded.

At Mansfield, the Tramway Co. sought conditional exemption for a motorman named Walter Arbon (27), a skilled driver on a difficult route, and the appeal was assented to.

Before the Dorset Rural Tribunal, Mr. Bruce Ward, of Westwood Park, claimed the retention of his electrician, G. M. Trigg (32), passed for general service, and he was given until January 1st.

An appeal by W. J. Watkins (23), engaged at the London Electrical Wire Works, has been resisted by the Essex Tribunal for 14 days to allow him to obtain substitution work, failing which he must join up.

At Southport Tribunal, Mr. A. S. Black, the Corporation electrical engineer, appealed for a wireman, aged 40, married. Mr. Black, in reply to the Military Representative, said that he had seventeen who had special certificates from the Minister of Munitions; seven were over military age. The Military Representative said a strong case would require to be shown why this man should not go. Mr. Black said that if the staff were further reduced, the undertaking would get into a dangerous condition. The man applied for was kept for the maintenance of consumers' installations, and he could not replace him. Exemption to March 1st.

BUSINESS NOTES.

The "Electrical Review" for December 29th.—In consequence of the Christmas Holidays our Advertisement Department requests advertisers to send in their new advertisement copy and alterations to existing displayed advertisements intended for the issue of the ELECTRICAL REVIEW for December 29th, by Friday, December 22nd. We shall be glad if our correspondents and other contributors will also send in their matter at the earliest possible moment.

Export Prohibitions.—The *London Gazette* for December 8th contains further lists of bodies and persons with whom trading is prohibited in Argentina and Uruguay, Brazil, Chile, Denmark, Netherlands, Portugal, Spain, Greece, and other countries.

Business Prospects in China.—Some notes from a recent report by H.M. Consul-General at Hankow, appearing in the *Board of Trade Journal*, show that the value of imports of electrical materials and fittings declined by 97,000 Hk. taels in 1915, as compared with 1914. This decline was not due to a falling off in the demand for up-to-date lighting, but to the difficulty in getting orders filled as well as to the increased cost. When conditions return to normal there is sure to be a great expansion in the demand for all kinds of electrical materials from all over China. A decline in the importation of machinery to the value of 700,000 Hk. taels was also due to the abnormal conditions, and not to a lack of demand. Many new enterprises in Hankow are contemplated in the near future, but the present time is not considered propitious for making purchases, and deals are being put off to a more favourable opportunity. There is a good demand for electrical and other machinery, but the high prices ruling, and the impossibility of guaranteeing early delivery, prevent much actual business being done. Before the war a large proportion of these and other goods were imported from Germany or Austria. Supplies are at present being obtained mainly from Japan and the United States.

Book Notices.—*Manual of Electrical Undertakings and Directory of Officials*. By E. Garcke. Vol. XX. 1916-17. London: Electrical Press. Ltd. 21s. net. Owing to war conditions, the production of this work has been delayed beyond the usual date, but in regard to its contents there is practically no change in the main features, excepting that the delay has made it possible to include later financial information, which is something to be thankful for. Nearly all the customary statistical tables summarising the progress of the industry are included, and the "Survey for the Year" indicates the very highly-increased service which the electrical industry has been able to render under war conditions, though only a moderate amount of fresh capital has been introduced. The increase in kilowatts connected by both supply companies and municipalities is less than in the preceding year, but there has been an increase in output among the companies of 125,000,000 units as compared with an increase of 33,000,000 a year ago. The municipalities also show an increase of 183,000,000 units as compared with 25,000,000 a year ago. These figures indicate the

extent to which the marginal capacity of supply undertakings has been encroached upon by the necessities of war. In regard to electrical manufacturing, the statistics given show that the average return of all the undertakings of which returns are available has fallen from 6.73 per cent. to 6.15 per cent.; the companies included are, of course, in some cases engaged also in non-electrical work, so that the revenue is derived from both electrical and non-electrical sources. Particulars are given of 2,650 electrical and allied undertakings representing capital amounting to 481 millions sterling. There is a large map of the United Kingdom showing all the traction, light and power undertakings. The account of the progress of the year occupies 100 pages, and among other matters dealt with are imports and exports, prices of investments, and financial information concerning German electrical and allied companies such as have formed a regular feature of our City columns for many years past, and of which a word later. The largest section (1,000 pages) of the volume is that giving statistical and general records of lighting, power and traction undertakings; telegraph and telephone concerns, manufacturing and miscellaneous, Colonial and British possessions, are also usefully covered in separate sections; and, finally, there is the usual directory of names and addresses of 20,000 officials. The twentieth edition, as a whole, well maintains the high reputation that previous volumes of the Manual have won for it. We have, of course, not examined the contents in detail, but in regard to the tabular information relating to German electrical and allied companies, which is reprinted by permission of the Export Department of the B.E.A.M.A., who compiled it, it might not have been bad policy to have asked the Association to revise the proofs; however, the names are sometimes rendered correctly. Obviously, as the publishers themselves say, the difficulties attending the production of statistical records have been abnormally great during the past year.

General Cargo: an Introduction to Salesmanship. By R. E. Goddard. London: Constable & Co., Ltd. 4s. 6d. net. The author of this book is foreign sales manager to Messrs. Humber, Ltd., of Coventry, and as the result of experience gained in the principal countries of the world, he has collected the information here imparted for the assistance of those who desire to make an effort, after the war, to get back some of the losses caused by the war. After discussing the universality of trade, he shows, in a chapter on the factory, that behind all our foreign trade preparations we must have a thoroughly efficient factory organisation. The only way to bring money into the country is by seeking fresh outlets for foreign trade; the only way to restore our credit is to redouble our exports. The manufacturer must not regard his foreign orders as a windfall, but should make definite plans as to how much of a given output he intends for export, and should modify the export portion, so as to produce goods suited for particular markets. This leads the author on to a consideration, in two chapters, of many points in regard to the export department. Five chapters discuss the following markets, and their requirements:—Europe, Asia, Australia, Africa, South America, the West Indies and the Pacific. Later the qualifications of the foreign representative are discussed, also the manner in which he should conduct himself, and his operations when following his occupation among many very different nationalities. It goes without saying that any man before trying to establish connections with races whose manners and customs and tastes are so different from those of Home, should educate himself as thoroughly as the available means allow in regard to these and other local characteristics. The best *modus operandi* for the permanent representative or agent who is sent out from home to live abroad receives attention, and in a final summary three methods of procedure in obtaining foreign trade are stated. First, foreign traders may be circularised, advertisements may be placed in foreign journals, and the results awaited; secondly, arrangements may be made with some recognised house of export agents at home; but lastly, and best, is the sending out of one of the manufacturing heads, or a good representative, armed with samples, to study the markets and fix up agencies direct. This method is, of course, the most expensive, and in our opinion it requires to be preceded by the first-named method in order that the way may be prepared in advance, but the ultimate gain from such personal efficient study of markets will be found to be far greater than in the case of either method one or two alone. The book is a timely one, and those who contemplate launching out may find in it many useful pointers.

"Journal of the Institution of Electrical Engineers." Vol. XLV. No. 261. London: E. & F. N. Spon, Ltd. Price 7s.—The issue for December contains the following lectures and papers:—"Some Aspects of Lord Kelvin's Life and Work," by Dr. A. Russell; "Theory of Armature Windings," by Dr. S. P. Smith, and the inaugural addresses by Prof. D. Robertson and Messrs. H. A. Nevill, A. E. McKenzie, and J. K. Stothert; also a ninth list of the names of 119 members on military service.

"Handbook of Machine Shop Electricity." By C. E. Clewell. London: Hill Publishing Co. Price 12s. 6d. net.

"Applied Electricity for Practical Men." By A. J. Rowland. London: Hill Publishing Co. Price 8s. 4d. net.

"Electrical Engineering." By E. J. Berg. London: Hill Publishing Co. Price 15s. net.

"Science Abstracts." Vol. XIX. Part 11. (A and B.) November 25th, 1916. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each net.

Rotary Converters. Issued by the British Thomson-Houston Co., Ltd., Rugby.—We have often pointed out the educational value of the publications of manufacturing firms, including both catalogues and descriptive pamphlets under this head; our attention has again been drawn to this subject by the receipt of a brochure on rotary converters from the B.T.H. Co., which is really a technical

treatise, in short compass, of great interest and value, representing a considerable advance upon its predecessor. The principles upon which the converter depends, the conditions as regards heating in the armature winding, the behaviour of the machine when running, &c., are lucidly discussed, and, in addition, new matter has been inserted dealing fully with the very important question of variation in voltage ratio by reactance control, boosters, induction regulators, and the split-pole system. The starting of rotary converters by various methods, including the convenient self-synchronising system, is explained, and the details of construction of the makers' converters are described at some length, the whole being fully illustrated. The brochure is entitled "Descriptive List No. 2,420 A"; but this is a misleading title, and does less than justice to the contents, which contain nothing in the nature of a catalogue or price list, but are purely technical, and will prove of the greatest value to engineers who use this type of plant.

We have received a list of new electrical books which have been added to the excellent library of electrical works issued by the Hill Publishing Co., including a comprehensive treatise on "Hydro-Electric Power," by Lamar Lyndon; "Pole and Tower Lines," by R. D. Coombs, and a number of works which we have recently reviewed.

Messrs. Constable & Co. will shortly publish an authorised translation by Mr. J. H. Johnson of "The Range of Electric Searchlight Projectors," by M. Jean Rey, in order to meet the urgent demand for reliable information concerning the theory and practical application of searchlight projectors, their range and resultant illumination. The whole subject is exhaustively dealt with, and embodies records of the author's original investigations and tests, carried out in various parts of the world under actual working conditions.

Openings in Italy.—The following are selections from lists of openings for British articles in Italian markets. The lists are issued by the British Chamber of Commerce for Italy, Genoa:—

No. 1,159.—Agent at Taranto would sell on commission or buy for own account, electrical articles, ironmongery. T.P.P.

No. 1,163.—Spezia firm wishes to get into touch with manufacturer of electrical and engineering materials. S.C.

No. 1,164.—Merchants at Genoa wish to represent manufacturers and shippers of industrial and marine engineering articles.

No. 1,170.—Agents at Spezia would represent on commission manufacturers of engineering articles, machinery for industries, belting, wire ropes, &c. S.C.B.F.

No. 1,187.—Monza agent would represent manufacturers and shippers of engineering articles (leather belting, &c.). M.D.C.

No. 1,188.—Florence firm wishes to get in touch with manufacturer of electric lamps, machinery for same, and vacuum pumps. F.A.R.D.E.

No. 1,192.—Genoa importers wish to purchase grinders, emery wheels, steel files, tools, machinery. G.A.P. & C.

No. 1,201.—Merchants at Genoa would handle machinery, electrical sundries, &c. G.G.H. & C.

No. 1,206.—Genoa merchants wish to be put in touch with manufacturer of engineering articles and supplies, lubricating oils and greases, cotton waste, leather belting, wire ropes, engine packings, machinery and tools (wood, iron and tinworking), &c. G.F.M. & C.

Commercial Electric Trucks.—THE BRITISH MINIATURE ELECTRIC VEHICLE CO., LTD., have started business at 10, Houghton Street, Southport, for the manufacture of 500 lb. commercial trucks for use in warehouses and works, provided that orders are accompanied by a certificate from the Ministry of Munitions.

Bankruptcy Proceedings.—CHARLES HERMAN LIEB-BRAND, described as an author, lately residing at Liangolle n, Felixstowe, who was largely interested in a scheme for supplying electricity to Suffolk.—At the London Bankruptcy Court, on December 7th, before Mr. Registrar Brougham, this public examination was held. The debtor, who is confined in the Stratford Camp as an alien enemy, was brought to the Court by a military escort. He has lodged accounts showing liabilities of £1,080 and assets valued at £6,633, and consisting for the most part of various claims under agreements. In the course of his evidence the debtor stated that in or about January, 1913, he obtained an option for the purchase of the undertaking and assets of the Suffolk Electricity Supply Co., but owing to the outbreak of war he was unable to arrange the formation of a new company to take over the option. In fact, he attributed his failure to inability to carry through his various schemes in consequence of the war, and the collapse of promises from people upon whom he had relied to help him through.—The Official Receiver: But, surely, the option for purchase of the Suffolk electricity scheme expired some considerable time before war was declared?—The debtor thought it was in June, or perhaps in September, 1913, that the option lapsed. He agreed that until the outbreak of war he was living at the rate of £1,000 per annum. He expended over £1,000 in connection with the electricity scheme, but was unable to give details of the expenditure beyond the items in his bank book. It was not his custom to keep books of accounts, and not being a trader, he was not bound to do so. The examination was concluded.

THOMAS BROOKES, electrician at munition works, late picture house proprietor, Halesowen.—December 27th is the last day for the receipt of proofs for dividend. Trustee, A. M. Fairbairn, 1, Priory Street, Dudley.

CONNOLD, R. E., late electrician, now R.N.A.S., Canterbury.—Second and final dividend, 1s. 1d. in the £, payable December 30th, at the offices of Corfield & Crippwell, 119, Finsbury Pavement, E.C.

Trade Announcements.—MESSRS. BELCO, LTD., Windsor House, Kingsway, London, W.C., have issued a circular letter contradicting a statement which is in circulation to the effect that the company numbers among its shareholders certain persons of enemy origin, and has on its board German representatives. We are informed that all the shares once so held have been acquired by holders British by birth and extraction, and that the board of directors as now constituted is wholly British. Further,

of the Board of Trade. The Board of Trade has decided that all shops are to be illuminated by electricity, and that the power shall be supplied by the Board of Trade. The Board of Trade has also decided that the power shall be supplied by the Board of Trade.

The Board of Trade has also decided that the power shall be supplied by the Board of Trade. The Board of Trade has also decided that the power shall be supplied by the Board of Trade.

Catalogues and Lists. **PAYSON ELECTRIC CO. LTD.**, 145, Wardour Street, London, W. Fourteen-page abridged list in which the company's products are arranged in alphabetical order. The list includes a complete list of the company's products, including a complete list of the company's products, including a complete list of the company's products.

IGRANIC ELECTRIC CO. LTD., 147, Queen Victoria Street, London, E.C. Fourteen-page abridged list in which the company's products are arranged in alphabetical order. The list includes a complete list of the company's products, including a complete list of the company's products.

LIGHTING AND POWER NOTES.

Aberdeen.—**EXTENSIONS.** The Corporation Electricity Committee has authorised Mr. Bell, the electrical engineer, to obtain tenders for the proposed extension of the power station buildings. The estimated cost is about £3,700.

Bath.—**PRICE INCREASE.** The City Council has increased the price of electricity for lighting by 4d. per unit.

Batley. The Townsmen and Electricity Committee last week decided to recommend the appointment by the Corporation General Purposes Committee of a Street-Lighting Committee. The engineer has been instructed to report, at the next meeting, on the value of the steam from the destructor used at the electricity works.

Birmingham.—The Electricity Supply Committee has been requested to furnish the Council with a summary of the advice given it by the officials of the department since November, 1911, as to the probable necessities for extending the generating plant, and its action thereon. *—Birmingham Evening Dispatch.*

Blackpool.—The Town Council has passed a resolution in favour of extending the borough boundary, so as to include the Bishop U.D.C. and the latter's electricity undertaking.

Bradford.—**PROPOSED NEW POWER STATION.**—The Electricity Committee is considering the question of a new power station on the big estate at Esholt, six miles from the city, which is the property of the Corporation, and is largely occupied by the city's big sewage undertaking. The site in Valley Road offers little room for further extension, there being practically only space for one more 10,000-kw. machine. At Esholt there is almost limitless space and plenty of water. It is regarded as likely that the proposal will figure amongst local contemplated after-the-war works.

Colombia.—The Municipal Council of Remedios, Department of Antioquia, has been authorised to raise a loan of £5,360, to be devoted to electric lighting and water works in the district; the Municipal Council of San Jeronimo, to raise a loan of £800, for the installation of an electric power plant; and the Municipal Council of Quibdó, the capital of Choco Intendency, to raise a loan of £2,000, for electric lighting works. *—Board of Trade Journal.*

Continental.—**GERMANY.**—According to the German papers, the Federal Council will shortly issue an order prohibiting any sort of illuminated advertisement, also ordering all shops (with the exception of those selling drugs and food) to be closed at 7 p.m., and restaurants, cafes, theatres and cinemas at 10 p.m. The lighting of private houses is to be restricted as much as possible, and the tramway services are also to be reduced.

Darlington.—**HIRING CHARGES.**—The report of the electricity department shows an increase of 23 per cent. in the number of units sold for lighting and power during the period from April last as compared with the previous year. In regard to the charges for outside electric lamps used by shopkeepers, the Committee has decided that the present annual charge of 14s. per lamp shall be suspended after the twelfth quarterly payment, provided the hirer signs an agreement to hire the lamp for a further three years. Where no agreement is entered into, the charge is to be 14s. per annum until the restrictions are removed or for a maximum period of six years from the date of the installation of the lamp.

Deal and Walmer.—The Board of Trade has extended the time under the Deal and Walmer Gas and Electricity Co. for laying mains by one year.

Derby.—**LOANS SANCTIONED.**—The T.C. has received sanction for a loan of £1,000 for motors and £1,000 for motors.

Elland (Yorks.).—**STREET LIGHTING.**—Efforts are being made to secure better street lighting. The streets are very largely lighted by electricity, and councillors find difficulty in seeing any objection to electric lighting, in view of the ease with which it can be extinguished at a moment's notice.

Farnham.—**PRICE INCREASE.**—The Gas and Electricity Co. has increased the price of electricity for lighting to 8d. per unit, and for purposes other than lighting to 4d. per unit, except for four hours per day, during which period the charge will be 8d. per unit.

India.—**ELECTRIC HEATING.**—*Indian Engineering* states that the Simla Municipal Corporation has decided to offer special cheap rates for electricity used for heating and cooking purposes during the winter months November to March. In hill stations in India the maximum demand on the power station in the summer is considerably higher than that in the winter, and if special concessions in the way of cheaper rates are given to the winter residents, it is hoped to bring the winter demand up to that of the summer. As the system is a hydro-electric one, with fixed charges for maintenance, &c., and no fuel charges, there are no financial difficulties. The demand for electric heating in Simla this winter is considerably in excess of what it was last year, and when the cheap rates are made public it is anticipated there will be a greatly increased demand.

It has been found that electricity at half an anna a unit compares very favourably in cost with coal and wood fires for general heating purposes and charcoal for cooking purposes.

London.—**HACKNEY.** The Finance Committee has reported on the excess expenditure, beyond the original estimates, on the generating station extensions, and recommends that application be made to the L.C.C. for sanction to a loan of £10,833 to cover the additional expenditure. The original estimate was £140,650, which included work not yet carried out, and the total cost has been £144,516, while the loans sanctioned were for £134,050. The estimated cost of the buildings, £16,400, increased to £27,233, due to delay and increased price of materials, &c.

Malvern.—**STAND-BY SUPPLY.**—The Electricity Committee has had under consideration the question of the charge to be made where the supply of electricity is required only as a stand-by, and has recommended that a charge of 10 per cent. per annum be made on the last full year's consumption in respect of the premises; in cases where a full year's consumption is not available, a charge is to be made proportionate to the size of the plant, such charge to be exclusive of any charge for electricity supplied.

Oulton Broad.—The U.D.C. has consented to Lowestoft T.C. supplying electricity to the new works of Messrs. J. W. Brooke and Co., Lowestoft having made arrangements to supply energy.

Ripon.—**E.L. SCHEME.**—The B. of T. has refused to vary its order not to allow the City Council to take further steps for obtaining a provisional order for the supply of electricity to Ripon and adjoining parishes. At a meeting of the Council, specially called last week, it was, however, decided again to approach the B. of T. with a view to its reconsideration of the question.

Rochdale.—The Gas and Electricity Committee has been instructed to report on the causes of the unsatisfactory conditions in relation to the supply of electricity, and its proposals for meeting immediate and future demands for supply.

Sheffield.—**PROSPECTIVE EXTENSIONS.**—The Parliamentary Committee of the City Council has passed a resolution in favour of promoting a Bill in the present Session of Parliament to enable the Council to provide a new generating station, also to extend the city boundaries so as to include within the city the site proposed to be utilised and certain adjoining land. In accordance with instructions, the general manager has submitted to the Electric Supply Committee a statement of estimated income and expenditure on revenue account for the years ending March 25th, 1917, and 1918. He put the revenue for the former at £431,000 and for the latter at £525,250, while the expenditure for the year ended March, 1917, would be £228,527 and for 1918 £293,812, leaving gross profits of £202,473 and £232,438 respectively. Two extra-high-tension feeder cables are to be laid between Nepend station and Carbrook sub-station a distance of 5,920 yards, at an estimated cost of £23,770. Other extensions include the following:—To Effingham Steam Works and Rolling Co., estimated cost £567; to Sheffield Forge and Rolling Mills Co., estimated cost £547; to Spartan Steel Co., estimated cost £370; to Messrs. J. Bedford & Sons, estimated cost £237; to Messrs. W. Atkins & Co., estimated cost £125; to Messrs. W. Turner & Co., estimated cost £121.

St. Annes-on-the-Sea.—**YEAR'S WORKING.**—The Urban Council's electricity works for the past year show an increased sale of 15,734 units, the decrease on public and private lighting being more than made up for by the increase in motive-power supply.

St. Helens.—**PRICE INCREASE.**—The charges for electricity for power purposes are to be increased by 20 per cent., instead of 10 per cent., as from January 1st, 1917.

Stockton-on-Tees.—Under the title of the Corporation Lighting Committee, a Committee has been appointed to take over the work until recently carried out by the Electricity Committee and the Gas Committee.

Torquay.—The Tramway Co. has offered to purchase the Corporation's electricity undertaking, but the Council has replied that it does not contemplate selling the undertaking.

Walsall.—**SHORTAGE OF PLANT.**—The Electricity Supply Committee reports that the delay in getting the plant at the Birchills station into commission has increased the difficulty of maintaining the heavy winter loads with the plant at the Wolverhampton Street station, and during the past month several breakdowns have occurred. If necessary, the tramway supply will be shut down or curtailed, to enable the supply to factories to be maintained.

Wimborne.—A special meeting of the Council is to consider the proposed application for a prov. order to supply energy in Cuddington, which has been favourably considered by the B. of T. The L.G.B. has sanctioned the borrowing of £727, excess expenditure, in connection with the Malden and Coombe supply.

Yeadon.—**PROV. ORDER.**—The Electrical Distribution of Yorkshire, Ltd., has notified its intention to apply for a prov. order for the supply of electricity in Yeadon.

TRAMWAY and RAILWAY NOTES.

Accrington.—**WAGES.**—The Corporation has sanctioned the proposal of the Electricity and Tramways Committee to increase the wages of car drivers, conductors, and cleaners by 1d. per hour. The drivers, who are at present receiving 7½d. per hour, will only accept the advance as a war bonus, pending a settlement as to their claim for 8d. per hour.

Ashton-under-Lyne.—**TRAMWAY PURCHASE.**—The T.C. has decided to promote a Bill in Parliament to take over the tramway system of the Oldham, Ashton, and Hyde Tramways Co. within the borough, which will link-up with the tramway systems of Oldham, thus providing for through running.

Australia.—Messrs. McCarty, Underwood & Co., consulting engineers, have submitted a report to the Richmond (Vic.) Council on the proposed electric tramway from Prahran, *via* Richmond, to Clifton Hill, a distance of 3.9 miles. The cost is estimated at £173,367, the proportional costs to the interested municipalities being: Collingwood, £65,934; Richmond, £65,820; Prahran, £41,623. A new bridge over the Yarra river to carry a double-track tramway has also been suggested.

An Order in Council has been granted by the Victorian Government for the construction of two miles of electric tramway traversing the municipalities of Fitzroy, Northcote, and Preston. The Prahran and Malvern Tramway Trust (Vic.), which has hitherto had its cars manufactured in Adelaide, has now commenced construction on its own account. The side frames of the trucks will be of cast, instead of forged, steel.

Bolton.—**ELECTRIC VEHICLES.**—The Electricity Committee has appointed a Sub-Committee to consider and report upon the question of purchasing an electrically-propelled vehicle for the use of the electricity department, and also, if thought desirable, to confer with the several Committees of the Corporation using horse or other vehicles as to the desirability of obtaining electrically-driven vehicles.

WAGES.—The Tramways Committee has received a letter from the Lancashire District Council of the Amalgamated Association of Tramway Workers, giving 21 days' notice on behalf of members of the Association in the employ of the Corporation Tramways Department, to withdraw their labour unless their recent application for an advance of wages and better conditions of labour is agreed to by the Corporation. It was decided that the terms of the letter should be reported to the Board of Trade Committee on Production.

Bradford.—**WAGES.**—The Tramways Committee is in negotiation with the workers in respect of an application for increased wages, which, if granted according to the men's requests, will cost about £21,000 per year. The men also ask for a revision of working conditions. It is understood that the Sub-Committee proposes to offer payment of time-and-a-half for the seventh day of work, in lieu of the men's request for time-and-a-half on Sunday—the Sub-Committee preferring not to specify Sunday as necessarily the seventh day. The Sub-Committee also offers to pay time-and-a-half for time worked beyond the normal day, which may be 11½ hours, in lieu of time-and-a-half for all above the 9½-hours' day asked for by the men. In regard to rates of pay, the Sub-Committee considered only the drivers and certain shed workers, who, it is believed, were offered an increase equivalent to half the savings which might be effected by them in the consumption of energy during the next six months. It should be mentioned, however, that similar proposals to these were, so far as can be gathered, rejected by the men a week previously. It is understood that the full Tramways Committee approved the Sub-Committee's action by a small majority.

ROAD MAINTENANCE.—The Corporation Tramways Committee and the Finance and General Purposes Committee have, subject to final approval, come to terms in regard to the division of responsibility and cost for the laying, renewing, and repairing of the tram-

way permanent way. The staff and workmen employed and paid by the Tramways Committee, but at present under the control of the city engineer, are to be transferred to the control of the tramway manager. The foundations and paving work of roads over which the tramways run will be under the Street and Works Committee, an agreed sum per annum being paid by the Tramways Committee for this work, so far as it applies within the rails, and for 18 in. on each side. This sum would have regard to the present mileage, and be subject to reconsideration at the end of three years, and would cover all repairs and renewals, which have now become tolerably uniform year by year. In the construction of new lines, the cost of foundations and paving to be the subject of a special agreement between the two Committees, or fixed as before mentioned. All work in connection with the specifying, purchasing, and laying of metals, either for new work, renewals, or repairs, to be carried out by the Tramways Committee.

The Tramways Committee has passed a resolution recommending adequate lighting on tramway routes where electric street lighting is installed.

No cars are to be run on Christmas Day, as last year.

Burnley.—**SERVICE CURTAILED.**—The T.C. has decided that the last cars on the Padiham and Nelson routes shall leave the Town Centre not later than 10 p.m., and on other routes not later than 10.15 p.m. The change commences on Monday next.

Continental.—**SPAIN.**—A new company has just been formed at Aviles (Asturias) with a capital of £50,000 and the title La Compania del Tranvia Electrico de Villalegre y Castrillon, to construct and work an electric tramway between the towns named.

Darlington.—**FARES.**—At a meeting of the T.C. last week, the Electricity and Light Railway Committee recommended that the 3d. fares be suspended temporarily on Saturdays after 1 o'clock. Ald. Starnmer, who moved the report, said that at present they were unable to deal with the traffic, and the fairest way was to give those who were going the longest distance the chance of a ride. The recommendation was agreed to.

Edinburgh.—**TRAMWAY FERRY.**—Possibilities of tramway extension from the city to Queensferry, in connection with the development of Rosyth have been discussed by the Tramway Committee of the Town Council. It is suggested that an electric system from the city could be extended to Queensferry, and linked with the Rosyth area and Fifie towns by means of ferry boats, on which the cars could be taken across the Forth. The matter will be further considered.

Glasgow.—**HALF-YEAR'S TRAFFICS.**—The traffic returns for the T.C. tramways to the evening of December 2nd, which is two days more than the six months of the financial half-year, show that the total receipts during that period have been £623,046, as compared with £574,254 in the corresponding period of last year, an increase of £48,791. The number of passengers carried has been 193,800,839, as compared with 179,590,102, an increase of 14,210,737. Last week the receipts were £23,346, an increase of £2,349 as compared with the corresponding week of last year, while the number of passengers was 7,485,148, an increase of 711,061.

Keighley.—**ELECTRIC VEHICLE.**—The T.C. has given sanction for the purchase of an electric vehicle for the removal of ashes. The cost, about £1,100, is to be met by the savings on the estimates last year and this.

Leeds.—**NEW ROUTE.**—By the opening of a new tramway route, the residents of the thickly-populated district of Stoney Rook will be enabled to get right to the centre of the district, instead of to the fringe. The route was opened on Tuesday, the 5th inst.

Liverpool.—Mr. Mallins, the general manager of the Corporation tramways, is experimenting with an apparatus for solving the question of calling out stations. The device, which is a gramophone arrangement connected with an electromagnetic route indicator, will announce the names of stations automatically, and it has been attached to one of the cars for experimental purposes, a demonstration being given last week-end.

Newcastle-on-Tyne.—**EXTENSIONS.**—At a meeting of the City Council on the 6th inst., a recommendation of the Tramways Committee was adopted that, in order to deal adequately with the traffic in Union Road and Miller's Lane at the east end of the city, a junction be constructed between the lines in the two roads named, and the rails leading out of the south end of the sheds in Miller's Lane be joined up with the rails in Shields Road. The total cost, including land, is estimated at £6,000.

The City Council has approved (December 6th) of a recommendation by the Tramways Committee that land two acres in extent near the Scotswood Suspension Bridge be purchased for tramway purposes for £3,500.

Beginning last Monday, the last cars on all routes leave the city at 10 p.m.

Rochdale.—The Tramways Committee has reported against the application of the Rawtenstall electrical engineer that, in view of the greatly increased cost of coal, it should consent to an increase of 10 per cent. on the price of energy supplied for tramway purposes on part of the Bacup section.

The Committee has declined the request of the men's Union that there should be a cessation of the service on Christmas Day, but with the usual payment. Applications for increased wages are to be referred to the Committee on Production.

Scarborough.—**DECEMBER.**—At the annual meeting of the Scarborough Tramway Co. last week, pleased surprise was expressed that, in spite of the considerable difficulties which it had to face, it was enabled to pay a dividend of 1s. 6d. per share.

Sheffield.—Employees in the tramway and motor department are to receive additional allowances estimated to cost £15,120 a year, making the total estimated cost of war allowances granted £101,411 per annum. The total estimated receipts from the tramways for the year ended March 25th, 1917, are £509,857, and for the year ending March 1918, £526,084. The total estimated expenditure for the two years is £475,662 and £505,938.

Southport.—**YEAR'S WORKING.**—The annual report of the manager of the Corporation tramways shows that the traffic receipts created a record for the undertaking, being £20,005, the total receipts being £100 more and practically the same as last year. Considering the war, and that 12,244 car-miles less were run, Mr. Kenyon considers the results very good indeed.

Swansea.—The electrical engineer reports that the whole of the energy for the Tramways Co. is now supplied from the Corporation generating station.

The list of work to be undertaken after the war includes tramway extensions estimated to cost £51,000.

Wolverhampton.—The Tramway Committee proposed to pay £15 royalty to the manager for each car fitted with the "Silvers' Dynamic Pickup," provided the T.C. had the option of fitting any number of cars for £750, less royalties already paid. The recommendation was referred back by the T.C.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Postal authorities have decided to introduce into Australia, on trial for 12 months, at the central exchanges in the capital cities, a system whereby if any telephone subscriber is out of call, the telephone operator will take a message and telephone it to the subscriber as soon as he may be available. *—Melbourne Age.*

Greece.—It is announced that wireless communication has been re-established between Athens and Constantinople.

Italy.—Italian steamers and sailing vessels having more than 50 persons on board (including the crew) are now required to carry wireless telegraph apparatus.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—**SYDNEY.**—January 22nd. Electrical plant (converter, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.*

February 19th. Municipal Council. Meters, maximum demand indicators, feeder regulators. Specification from E.L. Department, Town Hall.

QUEENSLAND.—December 12th. P.M.G.'s Department. Caps and lamps for switchboard, covered wire, benders, sleeves, and tapes. See "Official Notices" December 1st.

January 1st. P.M.G.'s Department. Cords, switchboard, parts and accessories, measuring instruments and telegraph instruments. See "Official Notices" December 1st.

PERTH.—January 10th. P.M.G.'s Department. Telephone instruments and parts. See "Official Notices" to-day.

Aylesbury.—December 16th. U.D.C. Electricity Department. Paraffin oil for one year (800 gallons); Diesel lubricating oil for one year (500 gallons). See "Official Notices" December 8th.

Bridgend.—December 15th. Hospital Committee. Electrical wiring at the London Hospital, City Road. Mr. D. R. Jones, Clerk to the Wyndham Street.

Cape Town.—January 5th. Electric motors and starting panels, for the Corporation Electricity Department. Dock Road. Cape Town.*

Durban.—January 3rd. Corporation. One 3,000-KW. steam turbine, alternator, and condensing plant. Specification No. S 238 and drawing No. P 597, both at the office of the Borough Electrical Engineer, Municipal Buildings. Deposit £2 2s.

Johannesburg.—December 20th. Corporation. Automatic pressure regulators for the A.C. turbo-generators at the power station.*

January 3rd. Corporation. Iron axles and bushes.*

London.—**ENFIELD.**—Electric light installation, Ponder's End Congregational Church. Rev. J. H. Bennett, pastor.

December 16th. H.M. Office of Works. Materials for electric bell wiring. See "Official Notices" December 8th.

L.C.C.—December 19th. 325 tons of rolled-steel bars for magnetic brake shoes. Chief Officer, L.C.C. Tramways, 62, Finsbury Pavement.

New Zealand.—**DUNEDIN.**—January 24th. Motor-generator, accessories and spares. City Electrical Engineer, Market Street, Dunedin.*

TAURANGA.—February 12th. Borough Council. Supply of six three-phase transformers, 11,000-400 volts. Messrs. H. W. Clime and Sons, Consulting Engineers, Raetihi. *—N.Z. Shipping and Commerce.*

Sleford.—December 22nd. Best hard steam coal (about 250 tons), for the U.D.C. electricity works. Mr. G. Horry, Electrical Engineer.

Spain.—The municipal authorities of Santisteban del Puerto (Province of Jaen) have just invited tenders for the concession for the electric lighting of the town during a period of 10 years.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Department in London.

CLOSED.

Accrington.—The Corporation has accepted the tender of Messrs. W. T. Glover & Co. for 220 yards of 7/20 S.W.G. cable.

Ardley.—The U.D.C. has accepted the terms of the electrical supply company for putting down electrical plant at the Brodley sewage works.

Australia.—The following contracts have been placed:—Commonwealth Railways:

1,200 yards of 10/2 S.W.G. stranded copper cables, £180.—B.I. & Helsby

Cables, Ltd.

One 2-k.w. generating set for Darwin Jetty, £973.—A. H. McDonald & Co.

Victorian Railways Department:—

Electrically-operated hoist for Jolimont car-shed, £310.—Noyes Bros.

(Melbourne) Pty., Ltd.

P.M.G.'s Department, W. Australia:—

Automatic telephone material, £108.—Automatic Telephones (Australasia),

Ltd.

1,949 ft. paper-insulated, lead-covered telephone cable, 600 pairs, £580.—

J. R. W. Gardin.

7,915 ft. paper-insulated, lead-covered telephone cable, 800 pairs, £4,362;

672 ft. ditto, 400 pairs, £240; 2,470 ft. ditto, 300 pairs, £664; 1,338 ft.

ditto, 200 pairs, £227; 3,200 ft. ditto, 150 pairs, £391; 600 ft. ditto, 100

pairs, £37; 1,300 ft. ditto, 35 pairs, £26; 2,640 ft. ditto, 25 pairs, £40;

22 sounders, Morse American pony pattern, £21.—B.I. & Helsby

Cables, Ltd.

2,000 dry cells, rectangular, £338.—Diamond Engineering & Trading

Pty., Ltd.

3 miles of copper distributing wire, £102.—W. T. Henley's Telegraph

Works Co., Ltd.

N.S.W. Public Works Department:—

Sixteen d.c. motors and equipment, £2,688.—Harvey & Phillips, for Brush

Electrical Co. *—Tenders.*

Bath.—Messrs. Chamberlain & Hookham, Ltd., have

received the Corporation contract for electricity meters for the

coming year.

Bradford.—Tramways Committee:—

Hadfields, Ltd.—12 sets of manganese-steel points, £588.

Electricity Committee (subject to certificates of the Ministry of

Munitions being obtained):—

Brush Electrical Engineering Co., Ltd.—One 50-K.V.A. and two 300-K.V.A.

transformers.

Ferranti, Ltd.—One 50-K.V.A. and two 300-K.V.A. transformers.

Bury.—The Corporation has entered into an agreement with the Electrical Power Storage Co., Ltd., for the maintenance of the storage battery at the electricity works for a further period of five years.

Canada.—The Toronto Hydro-Electric System has awarded to Eugene F. Phillips Electrical Works, Ltd., Montreal, a contract covering approximately eight miles of 250,000 circular mils. three-conductor, paper-insulated and plain lead-covered cable for a working pressure of 13,200 volts, at a cost of approximately \$100,000, this being the fourth large order that it has placed with the Phillips Co. in the last two years for extra-high-tension cables.

Glasgow.—The Tramways Committee recommends the acceptance of the following:—

Scrap copper.—P. & W. MacLellan, Ltd.

Scrap armature coils, brass, brass turnings and borings, brass dust, copper

and mica turnings, rubber cables, dry cells.—R. M. Easdale & Co.

Scrap lead, lead-covered cables.—Trainer & Allison.

Scrap rubber.—Pegler Bros.

Rubber-insulated cables.—W. T. Henley's Co.

Newport (Mon.).—T.C. Accepted tenders:—

British Westinghouse Electric & Mfg. Co., Ltd.—Converting plant, £1,380.

British Thomson-Houston Co., Ltd.—Low-tension B.C. switchgear, £152

and extra-high-tension switchgear, £127 8s.

Sheffield.—City Council. Accepted tenders:—

A. Reyrolle & Co., Ltd.—Twelve 100-ampere, r.h.t., oil-break furnace switches, £220.
 R. White & Sons. Taking up and relaying train-road track, £487.
 A. Reyrolle & Co., Ltd.—30 panels of three-phase, r.h.t. sub-station switchgear, £5,156.
 Brush Electrical Engineering Co., Ltd.—25 double-decked, top-covered tramcars without electrical equipment, £1,060 per car, plus 5 per cent. for contingencies.

Walsall.—T.C. British Thomson-Houston Co., Ltd., r.h.t. switchgear, £315.

Wolverhampton.—Electricity Committee. Accepted tenders:—

British Thomson-Houston Co.—Steam-turbine-driven boiler feed pump, £421.
 Ransomes, Sims & Jefferies.—2½-ton "Orwell" electric lorry, £630.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, December 15th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, Westminster, S.W. Paper on "Variable-speed Gears for Motor Road Vehicles," by Mr. R. E. Phillips.

Illuminating Engineering Society.—Friday, December 15th. At 5 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. "Suggestions regarding War Economies in Lighting," by Mr. L. Gaster.

Electro-Harmonic Society.—Friday, December 15th. At 8 p.m. At Holborn Restaurant (King's Hall). Smoking concert.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, December 16th. At 4.30 p.m. At the Royal Technical College, Glasgow. Social evening.

(Midland Branch).—Saturday, December 16th. At 8.30 p.m. At the Midland Hotel, Mansfield. Discussion on the Report on "Electric Signalling with Bare Wires."

Faraday Society.—Monday, December 18th. At 8 p.m. At the Institution of Electrical Engineers, Victoria Embankment, W.C. Ordinary meeting.

Institution of Civil Engineers.—Tuesday, December 19th. At 5.30 p.m. At Great George Street, Westminster, S.W. Paper on "Experiments on Earth-Pressures," by Mr. P. M. Croshawale.

Royal Society of Arts.—Wednesday, December 20th. At 4 p.m. Paper on "Classical and Scientific Education," by Mr. A. C. Benson, Master of Magdalen College, Cambridge.

Chemical Society.—Thursday, December 21st. At 8 p.m. At Burlington House, Piccadilly, W. Ordinary scientific meeting.

Greenock Electrical Society.—Thursday, December 21st. At 7.45 p.m. At 22, West Stewart Street. Reading of papers submitted by junior members.

Belfast Association of Engineers.—Thursday, December 21st. At 7.45 p.m. At Municipal Technical Institute, College Square. Paper on "Water Power in Ireland," by Mr. A. W. Brown.

NOTES.

U.S.A. Central Station Output.—In August last, says the *Electrical World*, the output of U.S. electricity supply stations was larger than in any previous month on record, being 1,880,000,000 kw.-hours—300 millions in excess of that of August, 1915. The income was well over six millions sterling.

Foreign Trade.—THE NOVEMBER FIGURES. The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	Nov.,	Inc. or	Dec.	Inc. or	Eleven months, 1916
IMPORTS:—	1916.	dec.	1915.	dec.	
Electrical goods, &c.	£133,648	+	£2,314	+	£475,776
Machinery ...	628,266	—	124,398	—	675,170
EXPORTS:—					
Electrical goods, &c.	309,769	—	96,141	+	947,420
Machinery ...	1,889,431	+	286,868	+	854,448

Christmas Fire Risks.—The British Fire Prevention Committee has issued a free "Warning" regarding the dangers incidental to Christmas entertainments, due to the use of inflammable materials for decorations, &c. Copies may be obtained from the Committee (8, Waterloo Place, Pall Mall, S.W.), on written application, with the necessary return postage enclosed.

Sentence.—On December 7th, at the Central Criminal Court, Thomas Abasalom Jackson was sentenced to three years' penal servitude on a charge of having demanded money with menaces from Marconi's Wireless Telegraph Co., Ltd., and Mr. Godfrey Isaacs, and with offering to prevent the publication of certain matters (in the *Financial News*) with intent to extort money.

Fatalities.—On November 25th, as the result of a "practical joke," G. L. March, aged 22, was killed at a workman's cabin on the L. & N.W. Railway, near Loudoun Road Station, South Hampstead. At the inquest it was stated that someone had fixed an electric wire to the door-handle: the deceased was going to enter the hut, received an electric shock, and died almost at once. He was found, on post-mortem examination, to have heart disease and tuberculosis, so that a slight shock would suffice to kill him. Percy Brown, aged 15, confessed to having connected the door-handle to the lighting circuit. Such pranks are worse than foolish, and should be severely punished.

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place.—Orders for the week by Lieut.-Col. C. B. Clay, V.D. Commanding.

Monday, December 18th.—Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10, Signalling Class. Recruits' Drill, 6.25—8. Lecture, "On Telephones," 7.30.

Tuesday, December 19th.—School of Arms, 6—7. Lecture, 7.15, "Bridging," Company Commander E. J. Castell.

Wednesday, December 20th.—Instructional Class, 6.15. Platoon Drill, Platoon Nos. 1-2.

Thursday, December 21st, to Thursday, December 28th, inclusive.—Headquarters closed.

(By order) MACLEOD YEARSLEY, Adjutant.

Absenteeism at Electricity Works.—The case of a man employed at Neepsand generating station of the Sheffield Corporation electricity department, who had been summoned for being absent from work without leave, was mentioned in the Sheffield Police Court by the Deputy Town Clerk. The man, he said, had paid the money into Court, and therefore nothing more could be said in that case. But he was instructed to put before the Bench certain unpleasant facts concerning absenteeism at the generating station. There was now more time lost by workmen than ever before, and the man whose case had been mentioned, although he had only been summoned on account of one day, had been absent on other occasions. He asked the Bench to give public expression in reference to what was a serious state of affairs.

Mr. J. C. Clegg said that absenteeism was a matter of regret and serious consideration by all in authority. It was undoubtedly of the highest importance that regular attendance at work must be ensured. It was the duty of those responsible to take such steps as would bring about an improvement in the matter, and he hoped this public reference to the matter would make the men realise to the fullest extent what their responsibilities were.—*Sheffield Telegraph*.

Manchester and District Decimal Association.—At the debate on the decimal system at the Engineers' Club on the evening of Tuesday, last week, the Lord Mayor of Manchester (the first president of the Manchester and District Decimal Association) was in the chair, and the debate was very effectively opened by Mr. E. C. Barton, M.I.E.E. An animated discussion ensued, and Mr. Barton replied briefly to the principal points raised in the course of the debate. At the close of the meeting a practically unanimous vote (there being only two dissentients in a large meeting), was given in favour of:

(a) The early adoption of a decimal system of British coinage.

(b) The compulsory use, after a suitable transition period, of the metric system of weights and measures throughout the British Empire.

Police Flash Lamps.—A Huddersfield police constable, Albert J. Cashmore, has invented an electric signalling flash lamp for constables on point duty, and the Watch Committee last week decided to give the lamp a trial. The apparatus has two lights, one red and the other green. The red bulb is attached to the inside of one hand and the green bulb to the outside of the other hand, both being connected with an accumulator on the constable's belt. The lights do not show until the constable raises his arms. The inventor claims that this will be a great boon in the darkened streets, in which the point policemen can scarcely be seen.

America's Electrical Week.—Whilst we grope in darkness that may almost be felt, our friends in the United States have just been celebrating their great "Electrical Week" with a perfect orgy of electric lighting. The "Week" opened on December 2nd, and ended last Saturday; the principal event, by way of inauguration, was a reception to President Wilson, who witnessed the turning-on of the permanent "flood-lighting" illumination of the statue of Liberty, and took part in a parade of electric vehicles. The route was brilliantly illuminated and decorated, and was expected to "present an illumination spectacle unparalleled in the annals of lighting in America." Elaborate arrangements were also made for the celebration of the "Week" in all the principal cities of the States.

British Trade Bank.—Information will be eagerly awaited as to the action to be taken by the new Government in regard to the British Trade Bank scheme advocated by Lord Faringdon's Committee. The Central Executive of the Employers' Parliamentary Committee last week passed a resolution urging the Government to take immediate steps to establish such a bank, and expressing the opinion that the proposed capital, £10,000,000, would be quite inadequate.

Educational Notes.—The Bradford Technical Education Sub-Committee has resolved that the arrangement made last session for assisting the Leeds University in the matter of tuition in electrical engineering be again authorised for the present session.

THE RUSSIAN LANGUAGE.—The *Daily Chronicle* states that Captain H. Samman, a shipper, has given £10,000 to found scholarships for teaching Russian to Hull students, his object being to encourage commercial and other relations between Hull and Russia. The Hull Chamber of Commerce is to formulate the scheme. The excellent idea of establishing travelling scholarships, such as we have already referred to in respect of the textile, electrical, and engineering trades is also likely to be adopted.

Private Ernest A. Fossom, 40 B. Co., 1st Regt., Cavalry, 1st Div., 1st Army Corps, killed in action, at France.

East London Railway Co.—S. 91—paid up capital less £5,000 on “B” debenture stock for the year.

STOCKS AND SHARES.

TUESDAY EVENING.

Consolidation and other factors have embarrassed the Stock Exchange, but the fact that the Government has shown the ability to deal with the situation. The changes in the market have been good deal to both confidence, but their effect so far has been more sentimental than practical, except that they produced improvements in the Consol market and, therefore, had a strengthening influence upon gilt-edged and other investment markets.

The nearer the approach of the new year, the greater grows the disinclination, on the part of the investor to spend money that will denude his bank balance at the time when he likes to see the latter on a comfortable basis. One of the minor features has been a revival in the prices of Victoria Falls shares; the ordinary and preference have both improved, although the best prices were scarcely maintained.

The electric lighting market is dull and lumpy. Westminster ordinary receded to 6, Metropolitans to 2½, Counties and Cities to 10½ and 11½ respectively, and South Londons to 2½. There is some little disappointment at the official silence as to the hope that something might be done to turn up the lights of London, at all events during the Christmas week—which, if it had been permitted, might have proved the prelude to a relaxing of the lighting restrictions generally.

As we have pointed out before, there is in every market a certain supply of shares always coming in from deceased accounts, and also from people who, for one reason or another, are obliged to sell. Accordingly, when it happens that demand proves unusually coy or limited, the shares which the anxious sellers want to dispose of have an undue effect upon prices. This is what is happening at the present time in the electric lighting section; and the market looks as though it were going to wind up the year in about as dull a state as it has experienced during the whole of the twelve months.

Gossip runs in the City that one of the directions in which the vigour of the new Cabinet will manifest itself is an increase in the income-tax, 6s. 8d. in the £ being already mentioned as a possible next step. This rumour is accompanied by another to the effect that the excess profits tax is likely to be raised to 75 per cent., and reports of this sort obviously do not lend strength or stability to markets at a time when fresh investment shows itself shy.

Practically every day sees further declines in the list of Home Railway stocks. The Board of Trade warnings as to the strong desirability of curtailing Christmas travel, with the rider that private journeys are likely to be made as difficult as possible, is the latest bear point put forward. The proposal to increase season-ticket and other rates would no doubt have had a strengthening effect in the railway market in the ordinary way; but when it comes on top of such announcements from the Board of Trade as those already quoted, it acts in the opposite direction.

In the Underground group, Districts went back to 15½ and Metropolitans to 23; but Underground Electric Railways issues keep firm, the price of the income bonds being well maintained at 91 bid. The falls in Steam stocks are spread over all the various classes of Home Railways, and those with electrified systems have weakened with the rest. The lists of preference and other pre-ordinary securities are lower, and the whole of the market is in a friendless condition.

British Columbia Electric Railway stocks moved down on renewed efforts to sell. Some associate the weakness with the dull state of the market for Canadian railways, but this seems scarcely sufficient to justify the drop. It may be that the previous rise was too rapid, or perhaps foreknowledge of the next report has something to do with the steady decline. At any rate, there is considerable interest, tinged with anxiety, as to what that document is likely to show.

The Brazilian exchange is in a more hopeful state, having kept about 1s. to a trifle over for nearly a week. The steadiness had a partial effect in checking the drop in Brazilian Traction shares, but the usual quarterly nervousness expressed with regard to the maintenance of the 4 per cent. dividend led to a further fall in the common. The preferred remain about 8½.

British Electric Traction ordinary is changing hands on the basis of 34, and business was marked the other day in the 6 per cent. preference stock at 7½, while a buyer of London United Tramways paid 46 for the 4 per cent. debenture stock. Metropolitan Tramways 5 per cent. debenture stock has been negotiated on the basis of 80½ during the past week.

No recovery has occurred in the Mexican industrials, the shares and bonds of the Mexico Tramways and the Mexican Light & Power Companies being extremely weak. Pachuca Light & Power 5 per cent. bonds, which are guaranteed by the Mexican Light & Power Co., have fallen 3 points to 27½.

The Canadian-American power issues are mostly good. Pennsylvania Water & Power shares at 89½ and Shawingans 140, but Canadian Generals gave way a little to 123½. Victoria Falls preference rose to 22s. 3d., and the ordinary to 14s., before reacting to the extent of a few pence each.

The telegraph market continues to find more sellers than buyers, and Easterns dropped a point to 139½. As a whole, however, the market is a little steadier than it was. United River Plate Telephones eased off to 62. Marconis have gone back ¼ to 22, Americans and Canadians being sympathetically dull at 15s. 3d. and 9s. 6d. respectively. Globe ordinary and preference are a firmer market, and the industrial shares in the group are unchanged on the week. American Telephone 4 per cent. bonds fell 6 points to 105, and the 4½ per cents. are 7 lower at 111.

Edison & Swan fully-paid shares reacted to 1½, and Electric Constructions at 1 1/16 are the fraction down. The industrial market goes softly. British Aluminium remain active and firm at 30s. The iron and steel group is heavy, consequent upon the increase of wages granted to the miners in South Wales, and the uncertainty felt with regard to the effect of the Government's taking over the control of the field. A severe shake-out in the shipping market has not passed unnoticed by holders in other industrial companies the shares in which have recently been run up to high prices.

The rubber market is well maintained, in consequence of the strength of the raw material. The copper group experienced something of a flurry in New York by reason of the action of the British Government in restricting copper imports, but little effect was produced upon the prices of shares in British companies. Speculative enterprise here, as in other parts, is at a low ebb just at present.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.						
	Dividend	Price				
	1914.	1915.	Dec. 12, 1916.	Rise or fall this week.	Yield p.c.	
Brompton Ordinary	10	10	62	—	27 11	0
Charing Cross Ordinary ..	5	5	58	—	7 8	2
do. do. do. 4½ Pref. ..	4½	4½	8½	—	6 11	0
Chelsea	5	4	11	—	6 18	4
City of London	9	8	110	—	6 19	2
do. do. 6 per cent. Pref. ..	6	6	10	—	6 0	0
County of London	7	7	104	—	6 16	7
do. do. 6 per cent. Pref. ..	6	6	10	—	6 0	0
Kensington Ordinary	9	7	58	—	6 14	6
London Electric	4	4	13	—	6 10	5
do. do. 6 per cent. Pref. ..	6	6	4½	—	6 15	4
Metropolitan	3½	8	22	—	6 13	4
do. do. 4½ per cent. Pref. ..	4½	4½	23	—	7 4	0
St. James' and Pall Mall ..	10	8	62	—	6 8	0
South London	5	5	21	—	7 5	6
South Metropolitan Pref. ..	7	7	15½	—	6 7	8
Westminster Ordinary	9	7	6	—	6 16	8
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	6	6	96½	—	6 5	8
do. do. do. 50/6	50/6	50/6	25½	—	7 10	3
Cable Telephone	5	5	7½	—	6 12	8
Cuba Sub. Ord.	5	5	8	—	6 8	6
Eastern Extension	7	8	132	—	*6 16	6
Eastern Tel. Ord.	7	8	139	—	*6 14	6
Globe Tel. and T. Ord. ..	6	7	124	—	*6 12	0
do. do. Pref.	6	6	104	—	6 18	5
Great Northern Tel.	22	22	37½	—	6 17	4
Indo-European	13	13	51	—	6 7	8
Marconi	10	10	22	—	3 12	9
New York Tel. 4½	4½	4½	101	—	4 9	0
Oriental Telephone Ord. ..	10	10	2½	—	4 6	6
United R. Plate Tel.	8	8	62	—	*6 18	5
West India and Pan.	1	6d.	1½	—	2 4	0
Western Telegraph	7	8	14	—	*6 14	0
HOME RAIL.						
Central London, Ord. Assented	4	4	65½	—	6 2	2
Metropolitan	12	11	28	—	4 7	0
do. do. District	Nil	Nil	15½	—	—	—
Underground Electric Ordinary	Nil	Nil	67½	—	Nil	Nil
do. do. "A"	Nil	Nil	67	—	Nil	Nil
do. do. Income	6	6	91	—	*6 11	10
FOREIGN TRAMS, &c.						
A Isleside Sup. 6 per cent. Pref.	6	6	41½	—	6 1	6
Anglo-Afr. Trams, 1st Pref. ..	5½	5½	82	—	8 9	2
do. do. 2nd Pref.	5½	5½	82	—	—	—
do. do. 5 Deb.	6	6	67	—	7 9	3
Brazil Tractions	4	4	452	—	8 14	10
Bombay Electric Pref.	6	6	104	—	6 17	3
British Columbia Elec. Ry. Pref.	5	5	67	—	7 9	3
do. do. Preferred	Nil	Nil	46	—	Nil	Nil
do. do. Deferred	Nil	Nil	43½	—	Nil	Nil
do. do. Deb.	4½	4½	63	—	6 17	4
Mexico Trams 5 per cent. Bonds	Nil	Nil	32½	—	Nil	Nil
do. do. 6 per cent. Bonds ..	Nil	Nil	27½	—	Nil	Nil
Mexican Light Common	Nil	Nil	12½	—	Nil	Nil
do. do. Pref.	Nil	Nil	17½	—	Nil	Nil
do. do. 1st Bonds	Nil	Nil	32½	—	Nil	Nil
MANUFACTURING COMPANIES.						
Babcock & Wilcox	14	15	21½	—	6 2	0
British Aluminium Ord. ..	5	7	30½	—	6 0	8
British Insulated Ord. ..	15	17½	112	—	7 6	10
British Westinghouse Pref. ..	7½	7½	9½	—	6 8	0
Calenders	15	20	13	—	7 19	10
do. do. 6 Pref.	5	5	62	—	6 17	8
Castner-Kellner	20	22	83	—	6 6	8
Edison & Swan, 2½ Paid ..	Nil	Nil	—	—	Nil	Nil
do. do. fully paid	Nil	Nil	—	—	Nil	Nil
do. do. 4 per cent. Deb. ..	5	5	62½	—	8 0	0
Electric Construction	6	7½	1½	—	7 1	2
Gen. Elec. Pref.	6	10	10	—	6 0	0
do. do. Ord.	10	10	132	—	7 6	8
Henley	20	25	18	—	16	6
do. 4½ Pref.	4½	4½	4	—	6 12	6
India-Rubber	10	10	12½	—	*7 12	4
Telegraph Con.	20	20	38	—	*6 5	0

* Dividends paid free of income-tax.

THE USE OF LOW-GRADE FUEL.

As the result of investigations by the U.S. Bureau of Mines into the use of low-grade fuels some interesting, though, of course, not entirely new, particulars of work carried out along these lines were recently published in one of the official publications of the department. The subject is of some interest in this country, as was indicated in Prof. Fearnside's remarks quoted on page 621 of our last issue. Attention is

We illustrate an up-draught producer with mechanical tar extractor, and a down-draught producer; this type of plant has given good results, particularly with wood refuse.

Reference is also made to the use of by-product gas installations to utilise low-grade materials and colliery refuse, but in England it is considered that the tendency is always to use the material giving the largest by-product return, even though the plant was specifically intended to use only refuse material with a view to selling all high-grade fuel.

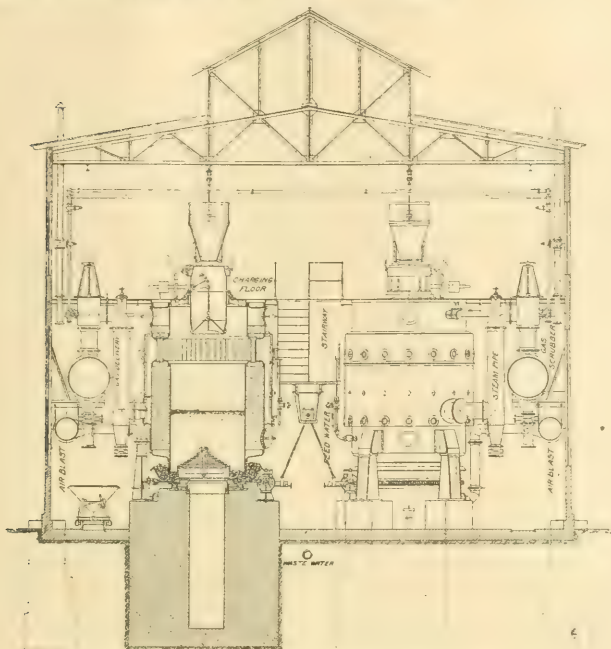
The subject of low-temperature distillation is discussed at some length, but it is remarked that little disinterested information was available.

The original intention of this process was to obtain a smokeless fuel for domestic use, and at the same time recover oil, motor spirit, and ammonia. Cannel coal, shale, high-ash coals, peat, and even briquetted sewage sludge were tested as fuels, but the results are not obtainable.

In a University lecture before a Manchester gas association, Mr. F. D. Marshall, referring to the subject of low-temperature carbonisation in vacuo, said that low-temperature distillation could not be completely successful if carried out under pressure, as with a temperature of only 900 deg. to 1,000 deg. F. the time of distillation would be too long, and the valuable oil constituent and the coke would be ruined. But low temperature, plus a complete, or nearly complete, vacuum in the retorts, enabled them to carbonise in three or four hours, and so save the light oils, and at the same time produce a hard, dense, easily ignitable coke or fuel containing 5 to 10 per cent. of volatile matter (probably methane) and over 80 per cent. of carbon free from all tarry and condensable matter.

The density of the coke was due to the compression of the coal between the annular spaces—a density which would effectively prevent the quick evolution of the gases were it not for the extreme vacuum employed.

By the time the gases had passed the vacuum pump, everything condensable under atmospheric and impact conditions had been removed; but tailing on to the vacuum pump was a compressor, in which the entire gas was compressed under a pressure of 50 to 60 lb. to the sq. in. By a mechanical arrangement the pressure was suddenly released, the result



REVOLVING ECCENTRIC-GRATE PRODUCER INSTALLATION

drawn to the successful use of certain fuels in Europe and the complete indifference to the possibilities of similar fuels in the United States.

Information was sought in regard to (a) the utilisation of high-ash coals, (b) the use of wood refuse, (c) recovery of by-products, (d) recent developments in the preparation and use of peat, (e) results of low temperature distillation of fuels, (f) possibilities of the slagging type of gas producer, and (g) use of powdered coal. Excessive clinkering with high-ash fuel, leading to interruptions and failure to develop rated capacity, is the main objection to the use of such fuel.

To handle this and other classes of fuel the revolving eccentric grate producer has been developed in Europe. With it the ash is automatically removed, operation can be continuous, the output per unit area is increased, and a more uniform quality of gas is claimed.

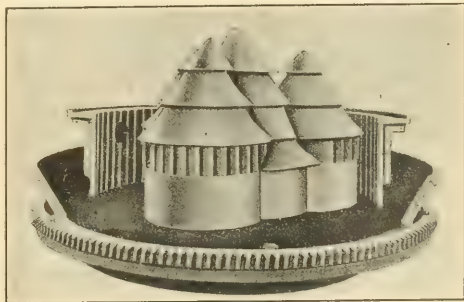
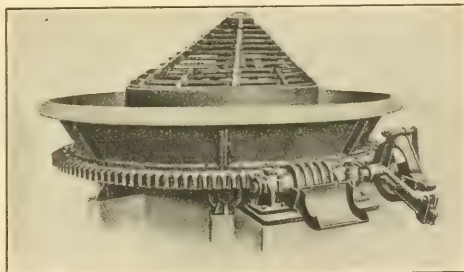
The degree of eccentricity can be varied to suit the fuel, the tendency being to grind the coarse ash and prevent clogging; the speed is also variable to suit conditions of fuel and output, and usually runs from $\frac{1}{2}$ to $1\frac{1}{4}$ revs. per hour, with 1- or 2-h.p. driving motors.

Experience has shown that an important factor in overcoming clinkering and fusing of the ash with the producer lining, is water jacketing the part of the producer shell surrounding the hot zone. In certain designs a variation is made in the height of the grate to correspond to the clinkering tendency of the fuels.

Either dry or wet bottoms are used, the former being sometimes regarded as desirable for extremely fine fuels burned with high air pressure, because of the depth of water necessary with the wet-bottom type.

The revolving grate producer is said to gasify two or three times as much fuel per sq. ft. of fuel bed as the fixed type; low percentage of carbon in the ash is also claimed, while the steam requirements are placed at about a fourth of those of the fixed grate jacketless type of producer. The total cost of a complete plant is said to be in favour of the revolving grate producer, which is claimed to handle 45 to 55 per cent. of ash with ease. An example is quoted of an English colliery and ironworks using an installation of eccentric grate producers, for which fuel is obtained by crushing and washing material from colliery refuse heaps, the fuel as used in the producers containing about 25 per cent. of ash.

Reference is made to the use of refuse fuel in gas producers, such as wood refuse, husks, nut shells, tan bark, &c.

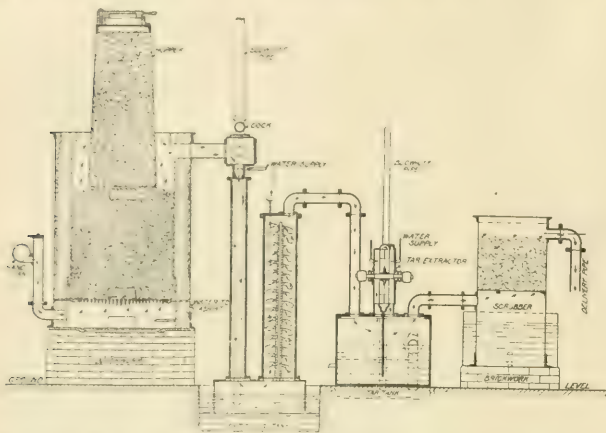


TWO TYPES OF REVOLVING ECCENTRIC-GRATE.

being that the gas parted with a vapour which, on speedily condensing, proved to be a spirit of high value. The yield from this portion of the plant was approximately one gallon

of spirit (specific gravity 0.816) per ton of bituminous slack, raised from the retorting plant, the gas, at this stage of the process, is then passed through a stripping plant, which reduced it to about 300 B.T.U. The choice of the crude oil for stripping purposes was important. The spirits must not be confused with benzols, as they were practically paraffins, or paraffinoids, and their homologues.

The yield of gas per ton of coal was approximately 5,000 cu. ft. of gas and 7,000 cu. ft. of tar, and was



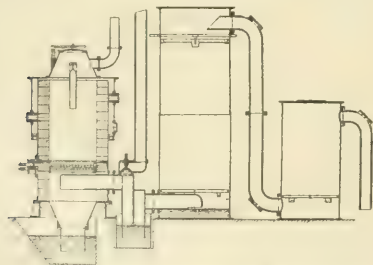
UP-DRAUGHT TYPE WOOD-REFUSE GAS PRODUCER AND MECHANICAL TAR EXTRACTOR.

partially consumed under the retorts and for running the works plant after it had been stripped of its valuable products.

Dr. Young, in a report, is said to have described the process as one of destructive distillation of coal at low temperature (900 deg. to 1,000 deg. F.) under a high vacuum (20 to 25 in. of mercury), resulting in the formation of products very different to those obtained by the usual gas-works practice of distillation at high temperatures. While the general nature of those products was the same whatever coal might be used, the amounts in which they were obtained varied with the class of coal, consisting generally of 70 per cent. of coke or residue and about 50 gallons of oil from a cannel coal, or 24 gallons of oil per ton from a bituminous coal. The process resulted also in the formation of ammonium in generally good amounts, but varying markedly with the coal employed.

The coke, or residue, was a dense but porous fuel; it was easily ignited, and could be burned in any ordinary open grate; it could also be used in the manufacture of suction gas, with the great advantage of yielding a gas entirely free from tarry matters.

In regard to their specific gravities, the "tarless fuel" oils lay between shale oil and gas-works tar, to the former of which they were much more closely related in their chemical nature, consisting of paraffinoid compounds and unsaturated derivatives. The benzenoid hydrocarbons, includ-



DOWN-DRAUGHT GAS PRODUCER FOR WOOD REFUSE.

ing the volatile solids, such as naphthalene and anthracene, which formed such a large proportion of gas tar, were entirely absent. Hence the light oils on a fractionation yielded solvent naphtha and a motor spirit which resembled petrol rather than benzol. The total light oils, obtained partly by fractionation of the condensates and partly by stripping the gas, averaged 3.5 gallons per ton of coal.

Mr. Marshall suggested instead of charging generators with the crude coal direct from the collieries, first to treat it by a low-temperature plant, recovering the oils, gas, and

what ammonia was produced by such a process, and then to feed the generators with the resultant clean and pure carbon coke.

The Bureau of Mines investigator finally refers to the use of the slagging gas producer and the use of powdered fuel, in regard to which several articles have already appeared in our pages.

In a paper read before the American Peat Society, Mr. B. F. HAANEL discussed the subject of peat for power production. He pointed out that peat in the bog contains usually 87 per cent. water, 7 per cent. combustible matter, and a varying percentage of ash, so that more than 100 lb. of raw material must be handled in various ways before 10 lb. of combustible matter is available. The moisture can be separated by the application of artificial heat, hydraulic pressing, or sun heating. The first method of reducing moisture is shown to be impossible; all efforts to reduce the moisture below 75 per cent. by means of presses alone have not met with economic results, and a change in the chemical constitution of the peat is required before a further reduction of moisture can be obtained. The Ekenburg wet carbonising process was devised for this, but has not up to the present proved feasible. The only successful system has been sun and wind drying, and several million tons of peat fuel are manufactured annually in Europe by this method.

When by-product recovery in connection with the gasification of fuel is considered many important factors arise. Peat fuel cannot compete with reasonably priced coal for steam generation by means of boilers. The only large plant of the kind is at Wiesmoor, in Germany, of which the author gives some data. It is stated that with peat fuel costing 58. per ton, the plant generates steam more cheaply than from coal costing 14s. 6d. per ton.

In actual service, about 6 to 6½ lb. of peat (30 per cent. moisture) per kw.-hour is required, which represents practically the same fuel cost as if coal were used. With peat fuel used in a well designed gas producer plant, it has been found that 1 B.H.P.-hour can be produced from 2 lb. of peat containing 25 per cent. moisture; this compared with 1½ lb. of coal. The value of peat as a fuel depends on the nearness to the plant of the raw fuel and the availability of ample storage.

ECONOMIC POWER GENERATION AND DISTRIBUTION.

In an address delivered under the auspices of the American Society of Mechanical Engineers, early in the present year, Mr. SAMUEL INSULL dealt at length with the above subject, taking as an example the progress made in electrical genera-

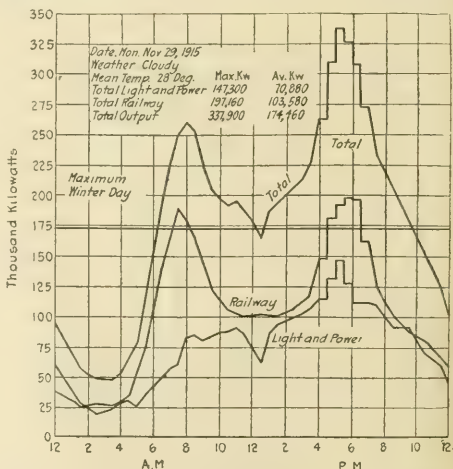


FIG. 1.—LOAD DIAGRAM, MAXIMUM DAY, WINTER, 1915 AND 1916, CHICAGO.

tion and distribution in Chicago. As showing the diversity of demand, he pointed out that in November, 1915, on the day of coincident maximum data, the light and power busi-

ness took 147,300 kw.; the railways took 190,600 kw., giving a combined total of 337,900 kw. The non-coincident maxima for the winter came on December 22nd, in the light and power business which then took 155,670 kw. For railway business the non-coincident maximum was 203,500 kw. on January 6th, 1916, so that they took care of the non-coincident maxima of the two branches of business (359,250 kw.) with a total coincident maxima of 337,900 kw., showing a diversity of 21,330 kw. Chicago doing a wholesale and retail business combined showed a 43 per cent. load factor in 1915; the street and elevated railway demand was 35 per cent. greater in winter than summer.

Next to the inventions of the original D.C. distribution system and A.C. system, the development of the large turbine had had the greatest influence on the industry.

But it did look as though many managers were installing

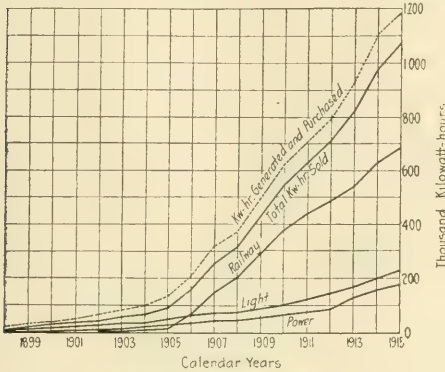


Fig. 2.—KW.-HOURS PRODUCED AND SOLD, CHICAGO.

turbines of a size out of all proportion to their requirements and having no relation to the load to be dealt with. He did not think it safe to order a unit for much more than 10 to 12, or, at the extreme, 15 per cent. of the total demand on any one system. This referred to existing systems, and new undertakings were in a different situation.

At the present time about 35,000 to 40,000 kw. was the largest size obtainable; 50,000 kw. had been mentioned, but before this size was adopted they would need higher boiler pressures and many experiments with apparatus.

The progress of the next few years would be better made if it was slower made.

The total business in Chicago in 1915 was almost \$21,000,000; light accounted for \$11,000,000, and power and transport

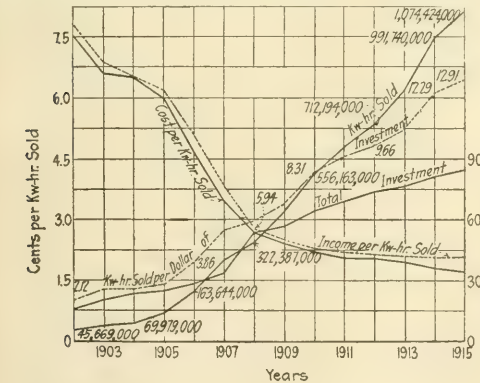


Fig. 4.—FINANCIAL CHART, COMMONWEALTH EDISON CO., CHICAGO.

halved the remainder. The wholesaling of energy for transportation showed a steady income; as the business developed the price dropped in 1906, and that price had continued up to the present; it was on a lower basis than it was possible for the local transportation companies of Chicago to produce energy themselves.

An interesting chart shows the steam economy tests of various sized turbines installed by the company during past years; the curve for the 25,000 kw. relates to a "reaction" type machine (which may be recognised by English readers).

As regards future possibilities, the light and power business of the Commonwealth Edison Co. was approximately 338,000 kw., that of isolated plants was 264,500 kw., and that of the steam railroads was 125,700 kw., making a total of 728,200 kw.

It was estimated that the company was doing about 46 per cent. of the total possible business; if it had the entire business, instead of a load factor of 40 or 41 per cent., it would probably have a 50 or 60 per cent. load factor. That meant that the cost of carrying the necessary investment for a city of two and a half million people, that was the interest and depreciation cost, if all the energy was produced by one organisation would be reduced approximately 33 per cent. That indicated that it was an economic waste for the individual to spend money in producing energy in a small way, and that the true function of the large electric light and power companies was to produce all the energy required in the community.

He was inclined to think that the day would come when one of the regulating bodies would step in, insist on all energy being produced from central generating plants, and

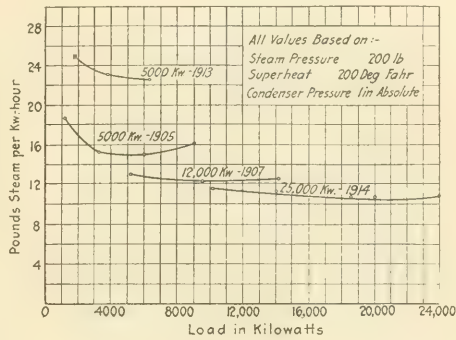


Fig. 3.—STEAM ECONOMY TESTS OF STEAM TURBINES.

tell people who were guilty of economic waste that they must stop it.

If equipment was employed unnecessarily, if fuel and labour were used wastefully, all these things must be harmful to the general wealth of the State.

If they took all the settled areas of the United States wherever there was a great density of population, and worked out the data on the same basis as it was worked out for the city of Chicago, and assumed that the electricity supply business was all put under a series of central organisations, they found that it took about 68 to 70 million h.p. of non-coincident demand; that the coincident demand would be about 47 million h.p., and that the diversity would be upwards of 20 million h.p. Capitalising the labour and fuel saved and

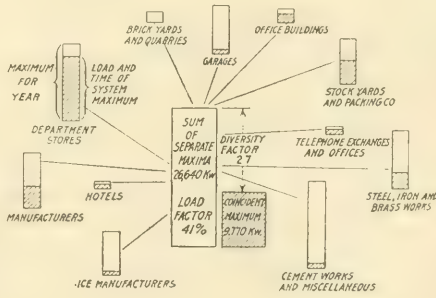


Fig. 5.—DIVERSITY OF LARGE OR WHOLESALE LIGHT AND POWER CONSUMERS.

the investment cost on 20 million h.p. would result in staggering savings.

Some people would tell them that such a system would produce a combination that might be dangerous to the State. It was not dangerous to the State to let its money go to waste, to waste its resources and its capital, but it was said to be dangerous to the State to allow an organisation to double its size, even though that organisation was regulated by a Commission of the State appointed or approved by the State Legislature.

He thought that that kind of danger was to the highest possible advantage to the State; that it was a real contribution to the better management of the country's affairs.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

"Overseas" Small Lighting Sets.

THE OVERSEAS ENGINEERING CO., LTD., of 75, Curtain Road, E.C.4, are offering a small self-contained, automatic electric lighting plant for supplying thirty 20-c.p. lamps, shown in fig. 1.

It consists of a 3-in. bore, $\frac{1}{2}$ -in. stroke, four-cycle, water-cooled petrol engine connected direct to a 750-watt, 32-volt motor-generator on a 20-in. by 32-in. base, together with switch box and a 12-cell storage battery. The plant is arranged to operate either automatically or non-automatically: in the former case the withdrawal of energy from the battery, due to lamps being switched on, &c.,

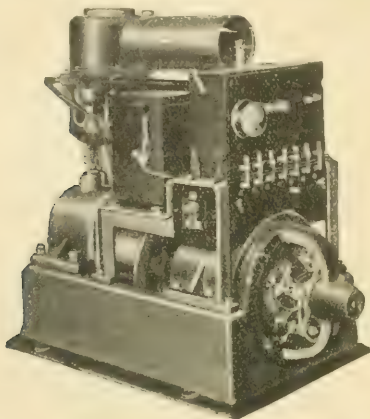


FIG. 1. "OVERSEAS" AUTOMATIC ELECTRIC LIGHTING PLANT.

automatically starts up the engine (the generator functioning as a motor until the engine begins to fire) and the recharging of the battery commences.

With the switching-out of the lamps the plant comes to rest, ignition circuit open, oil feeding stopped, compression release latched, &c., and battery completely charged, provided the set has been working 15 minutes or so.

This particular plant is standardised and known as the "Home" size, being most in demand; it is especially suitable for houses, farms, workshops, &c.

Another Mazda Revolving Shade.

About a year ago THE BRITISH THOMSON-HOUSTON CO., LTD., introduced an ingenious advertising novelty in the form of a revolving shade. This was intended for use with table, desk, and other fittings in which the lampholder was in an upright position. When the lamp was switched on, the shade rotated owing to an upward current of air, heated by the lamp, impinging upon a fan



FIG. 2.—MAZDA PENDANT REVOLVING SHADE.

disk attached to the upper part of the coned shade and pivoted upon the tip of the lamp. The company has now produced an adaptation of the design that permits of its attachment to plain pendants.

From the accompanying illustration it will be seen how the revolving shade appears when in position. Any existing shade

having been removed from a lampholder hanging from ordinary flexible cord, it is replaced by a specially designed wire frame, which is held in place by the shade-carrier ring. When the frame has been attached, it is turned upside down, and the flexible wire threaded through the hook at the apex of the coned frame and two loops that are formed at the top and bottom of one side. The frame will then hang vertically, with the holder in an upright position. The ends of the curved shade of stout coloured paper are then brought together, a cardboard disk with metal centre to fit over the lamp tip is inserted near the top of the shade, and the complete shade is placed on the lamp tip so that it is free to rotate within the wire frame. When the lamp is switched on, it illuminates the coloured shade, which immediately commences to revolve, the effect being both striking and attractive. If the adapted pendant be placed in a sunny position, its shade will rotate during the hours of sunlight without the lamp being lighted.

Readers in the Trade who have not received one of these revolving shades can obtain them upon application to the Publicity Department, The British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, E.C.

Mining Bells and Relays.

Mining bells and safety relays with parallel-wound coils, made by the STERLING TELEPHONE AND ELECTRIC CO., LTD., of 210-212, Tottenham Court Road, W., were tested by Dr. Wheeler and Prof. Thornton in their recent investigation of the subject of bare-wire signalling in mines, and found to be safe with all pressures up to the maximum permitted by the regulations. The company consider this method of preventing dangerous sparking to be the most practical and efficient of those suggested, and have put on the market a series of bells and relays of this type, which comply with the new requirements of the Home Office. We illustrate in fig. 3 the relay, which is enclosed in a separate compartment in a cast-iron case, with a machined-surface flame-proof cover; the terminals

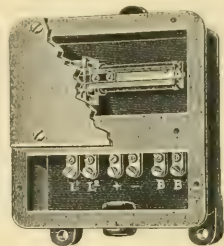


FIG. 3.—STERLING SAFETY RELAY.

are fixed in a lower compartment with a separate cover, which can be removed for wiring without exposing the relay to damp and dirt, and the wires connecting the relay to the terminals pass through a trough in which they are sealed with bitumen before leaving the makers' works. The relays are made with resistances of 20, 100, and 500 ohms, and, as an example, the 100-ohm relay with 15 volts works well through an external resistance of 280 ohms. The safety bell is also enclosed in a cast-iron case, gas and watertight, the motion of the armature being transmitted to the hammer through a metal diaphragm.

THE DETERMINATION OF TRANSFORMER LOSSES.*

By PERRY A. BORDEN.

WHEN determining the efficiency of a transformer by the method of direct loading, it is usual to read the input and output on separate wattmeters, the ratio of these slightly differing quantities being the efficiency of the apparatus. The actual losses are thus represented by a very small portion of the scale, and the difference of two quantities both subject to the errors of the instruments used.

In what follows, a method is described wherein the total losses taken collectively are directly read on an independent wattmeter. The apparatus for making the measurements includes:—

1. A single-phase wattmeter of suitable scale to measure the losses (say 100 volts, 0.5 amp.).

2. A variable load, preferably of the potentiometer type, to give full scale on this meter.

3. A polyphase wattmeter or watt-hour meter free from interference troubles, carefully adjusted to "buck on zero," i.e., to have zero torque when the two elements are measuring quantities of equal and opposite magnitude. The circuits of the polyphase meter will be (usually) 100 volts, 5 amp.

* From the *Electrical World*.

The accompanying diagram shows the arrangement for measuring total losses in a 10-kw. 2,200/110-volt transformer. The instrument transformers are so chosen that the constants of the two elements of the polyphase meter are equal. In this case the primary voltage is measured with a 2,000/100 potential transformer, while the secondary current passes through a 100/5 series transformer, the constant of each phase of the meter being 20. The polyphase instrument is connected in such a way that while the input gives a positive deflection, the output tends to oppose it.

The single-phase meter is then placed in circuit as shown, receiving its potential from the same source as the output element of the polyphase meter, and its current from any source approximately in phase with the potential. If the source of supply for the auxiliary current be not electrically connected to the main supply, the auxiliary meter A may, if desired, be connected to the input element of the wattmeter S. The adjustable current of meter A passes with the load cur-

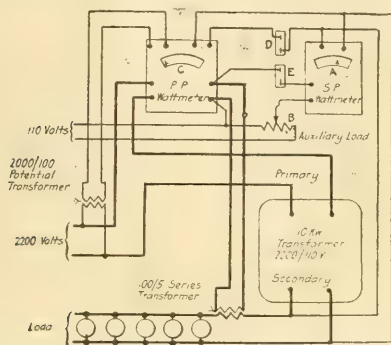


DIAGRAM OF CONNECTIONS FOR DIRECT MEASUREMENT OF TRANSFORMER LOSSES.

rent through the polyphase instrument in such a direction as to give a small additional negative torque. It is, of course, understood that sufficient grounding or interconnection will be made to prevent dangerous voltage between parts of the polyphase wattmeter.

The method of operation is as follows: With switches D and E open, the transformer is loaded until the desired input is read on the scale of meter A. Switch D is then closed, and the indication falls to the small value representing the difference between input and output (i.e., losses). Switch E is then closed and the auxiliary current is carefully adjusted until meter B indicates exactly zero. The reading of the auxiliary meter multiplied by the metering constant represents then the total losses in the transformer under test, and the efficiency may be accurately determined by the usual formula.

This method is particularly suitable to the testing of large numbers of similar transformers, and will be found suited not only to transformers, but to any class of electric apparatus in which both the incoming and outgoing energy are carried on two-wire circuits.

TRADE STATISTICS OF JAPAN, 1915.

THE following statement, showing the imports into and the exports from Japan of electrical and similar goods during the year 1915, is taken from the recently-issued official trade statistics; the figures for 1914 are given for purposes of comparison, and notes of any increases or decreases are added:—

	1914. Yen.	1915. Yen.	Inc. or dec. Yen.
Galvanised iron wire.—			
From Great Britain	262,000	146,000	— 116,000
„ Germany	1,486,000	39,000	— 1,447,000
„ Belgium	66,000	—	— 66,000
„ Austria	8,000	—	— 8,000
„ United States	304,000	2,969,000	+ 2,665,000
„ Other countries	2,000	21,000	+ 19,000
Total	2,128,000	3,175,000	+ 1,047,000
Posts and materials for electric lines.—			
From Great Britain	2,000	—	— 2,000
„ Germany	24,000	—	— 24,000
„ United States	580,000	2,000	— 578,000
„ Other countries	6,000	—	— 6,000
Total	612,000	2,000	— 610,000

	1914. Yen.	1915. Yen.	Inc. or dec. Yen.
Copper (pipes and tubes).—			
From Great Britain	105,000	37,000	— 68,000
„ Germany	31,000	—	— 31,000
„ Other countries	16,000	1,000*	— 15,000
Total	152,000	38,000	— 114,000
* United States.			
Insulated electric wire.—			
From Great Britain	160,000	6,000	— 154,000
„ Germany	235,000	94,000	— 141,000
„ United States	48,000	13,000	— 35,000
„ Other countries	1,000	—	— 1,000
Total	444,000	113,000	— 331,000
Steam turbines.—			
From Great Britain	22,000	—	— 22,000
„ Germany	139,000	—	— 139,000
„ United States	2,000	24,000	+ 22,000
Total	163,000	24,000	— 139,000
Cranes.—			
From Great Britain	150,000	20,000	— 130,000
„ Germany	124,000	—	— 124,000
„ United States	35,000	21,000	— 14,000
„ Sweden	24,000	—	— 24,000
Total	333,000	41,000	— 292,000
Pumps.—			
From Great Britain	209,000	182,000	— 27,000
„ Germany	240,000	9,000	— 231,000
„ United States	182,000	57,000	— 125,000
„ Other countries	34,000	19,000	— 15,000
Total	665,000	267,000	— 398,000
Gas engines, petroleum engines, and hot air engines.—			
From Great Britain	114,000	42,000	— 72,000
„ Germany	118,000	—	— 118,000
„ Sweden	31,000	85,000	+ 54,000
„ United States	88,000	35,000	— 53,000
„ France	2,000	—	— 2,000
„ Italy	2,000	—	— 2,000
„ Other countries	11,000	1,000	— 10,000
Total	366,000	163,000	— 203,000
Steam engines.—			
From Great Britain	244,000	51,000	— 193,000
„ Germany	181,000	—	— 181,000
„ United States	17,000	3,000	— 14,000
„ Belgium	10,000	—	— 10,000
„ Other countries	1,000	—	— 1,000
Total	453,000	54,000	— 399,000
Steam boilers.—			
From Great Britain	654,000	499,000	— 155,000
„ Germany	192,000	17,000	— 175,000
„ United States	13,000	52,000	+ 39,000
„ Belgium	2,000	2,000	—
Total	861,000	570,000	— 291,000
Dynamos, electric motors, &c.—			
From Great Britain	667,000	316,000	— 351,000
„ Germany	808,000	32,000	— 776,000
„ Switzerland	56,000	3,000	— 53,000
„ United States	1,211,000	390,000	— 821,000
„ Sweden	91,000	7,000	— 84,000
„ Other countries	10,000	1,000	— 9,000
Total	2,843,000	749,000	— 2,094,000
Water turbines and Pelton wheels.—			
From Great Britain	9,000	24,000	+ 15,000
„ Germany	206,000	18,000	— 188,000
„ France	—	15,000	+ 15,000
„ Switzerland	14,000	10,000	— 4,000
„ Sweden	18,000	30,000	+ 51,000
„ Belgium	7,000	—	— 7,000
„ United States	—	21,000	+ 21,000
„ Italy	5,000	—	— 5,000
Total	322,000	118,000	— 204,000
Incandescent electric lamps.—			
From Great Britain	4,000	2,000	— 2,000
„ Germany	379,000	23,000	— 356,000
„ United States	8,000	6,000	— 2,000
„ Other countries	—	11,000	+ 11,000
Total	391,000	42,000	— 349,000

	1914. Yen.	1915. Yen.	Inc. or dec. Yen.
From Great Britain	29,000	8,000	- 21,000
Germany	117,000	5,000	- 112,000
United States	36,000	62,000	+ 26,000
Other countries	11,000	43,000	+ 32,000
Total	193,000	118,000	- 75,000

Switzerland, Yen 42,000.

Ampere meters and voltmeters.—

	1914. Yen.	1915. Yen.	Inc. or dec. Yen.
From Great Britain	7,000	2,000	- 5,000
Germany	13,000	—	- 13,000
United States	57,000	43,000	- 14,000
Total	77,000	45,000	- 32,000

Accumulators.—

	1914. Yen.	1915. Yen.	Inc. or dec. Yen.
From Great Britain	93,000	39,000	- 54,000
Germany	18,000	—	- 18,000
United States	4,000	1,000	- 3,000
Total	115,000	40,000	- 75,000

India-rubber and gutta-percha, crude.—

	1914. Yen.	1915. Yen.	Inc. or dec. Yen.
From British India	447,000	941,000	+ 494,000
Straits Settlements	1,357,000	1,727,000	+ 370,000
Dutch India	3,000	226,000	+ 223,000
Great Britain	319,000	394,000	+ 75,000
Germany	2,000	1,000	- 1,000
United States	16,000	118,000	+ 102,000
Other countries	3,000	25,000	+ 22,000
Total	2,147,000	3,432,000	+ 1,285,000

EXPORTS.

Electric machines and parts thereof.—

	1914. Yen.	1915. Yen.	Inc. or dec. Yen.
To China	268,000	255,000	- 13,000
Kwantung Province	130,000	150,000	+ 20,000
Philippine Islands	2,000	4,000	+ 2,000
Siam	1,000	5,000	+ 4,000
Australia	15,000	65,000	+ 50,000
Hong-Kong	13,000	31,000	+ 18,000
British India	9,000	25,000	+ 16,000
Straits Settlements	4,000	6,000	+ 2,000
Germany	6,000	—	- 6,000
Other countries	4,000	41,000	+ 37,000
Total	452,000	582,000	+ 130,000

Insulated electric wire.—

	1914. Yen.	1915. Yen.	Inc. or dec. Yen.
To China	132,000	399,000	+ 267,000
Kwantung Province	191,000	193,000	+ 2,000
Hong-Kong	9,000	61,000	+ 52,000
British India	—	9,000	+ 9,000
Dutch India	—	10,000	+ 10,000
Asiatic Russia	—	43,000	+ 43,000
Great Britain	—	160,000	+ 160,000
France	—	13,000	+ 13,000
Other countries	62,000	12,000	- 50,000
Total	394,000	900,000	+ 506,000

Yen = 2s. 0½d.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Notices of applications for this journal by Messrs. W. F. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and Liverpool and Bradford.

- 16,357. "Telephone systems and apparatus." J. W. DINGLEY & C. I. Kesting. November 27th.
 16,363. "Electrically-operated bells." F. G. BEE and THE STEERING TELEPHONE & ELECTRIC CO. November 27th.
 16,390. "Electric tractors." E. C. R. MARKS (Mercury Manufacturing Co.) November 27th.
 16,392. "Electric controller." E. C. R. MARKS (Mercury Manufacturing Co.) November 27th.
 17,001. "Evacuated electric discharge devices." BRITISH THOMSON-HOUSTON CO. & W. T. MUNRO. November 27th.
 17,003. "High-frequency signalling." WESTERN ELECTRIC CO. November 27th. (U.S.A., November 29th, 1915.)
 17,011. "Automatic control apparatus for electric motors." H. V. JAMES. November 27th.
 17,043. "Electric heating and gas heating apparatus." J. H. FARTHING. M. I. REID & F. W. WILSON. November 28th.
 17,060. "Latching devices for alternating current electromagnets." AKT GES. BROWN, BOVERI ET CIE. November 28th. (Switzerland, January 10th.)
 17,061. "Pivotal connection between alternating-current magnet and its armature." AKT GES. BROWN, BOVERI ET CIE. November 28th. (Switzerland, January 10th.)
 17,068. "Electric resistances." H. SNOWDON. November 28th.
 17,074. "Electric battery lamp." J. E. HAMILTON. November 28th.
 17,087. "Electric water pump." H. C. BROWN. November 29th.

- 17,095. "Circuit for protection of motor works." F. E. TPALE-DORAN. November 29th.
 17,101. "Incandescent lamps." J. LANE & G. HENWOOD. November 29th.
 17,102. "Incandescent lamps." D. LILL, L. HAMBURGER & NAAM. November 29th.
 17,170. "High-frequency signalling." WESTERN ELECTRIC CO. November 30th. (U.S.A., December 1st, 1915.)
 17,189. "Protection of electric supply or distribution systems in which split or parallel conductors are employed." J. O. CALLENDER, CALLENDER'S CABLE & CONSTRUCTION CO. AND ELECTRIC MICROMOVEMENTS, LTD. November 30th.
 17,206. "Circuit interrupting systems." BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO. (WESTINGHOUSE ELECTRIC & MANUFACTURING CO.) November 30th.
 17,209. "Electric switches." H. H. BERRY & W. J. MARKHAM. November 30th.
 17,212. "System for controlling electric apparatus by wireless transmission." E. H. WIDGEREN & K. WIDGEREN. November 30th. (Sweden, December 20th, 1915.)
 17,231. "Trolley pole heads for electric cars, &c." H. E. WARSOP. December 1st.
 17,242. "Holders for arc lamp carbons, &c." D. C. WILLIAMSON. December 1st.
 17,244. "Non-flashing electric trolley arm." D. BRANSON. December 1st.
 17,260. "Portable telephone and signalling apparatus." H. C. CREWS. December 1st.
 17,261. "Method of controlling electrically governors, valves, gates, planes, stopcocks, &c." T. B. CAMPBELL, A. J. CAMPBELL & A. MARTIN. December 1st.
 17,271. "Electric switches." L. J. NORTON. December 1st.
 17,273. "Cells for secondary batteries." G. PEARSON. December 1st.
 17,275. "Flashlamps." H. J. CLOVEY (C. S. CLOVEY). December 1st.
 17,277. "Electric switches." H. C. WIDGEREN. December 1st.
 17,281. "Make-and-break switch for electric circuits." JOHNSON & PHILLIPS & E. A. LEOPARD. December 1st.
 17,286. "Appliances for attaching shades to holders of electric light fittings." W. CASBON & J. DORLE. December 1st.
 17,292. "Electric motors." T. L. R. COOPER. December 2nd.
 17,321. "Electrical contacts." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. December 2nd. (U.S.A., January 21st.)
 17,334. "Time-limit relays." AKT. GES. BROWN, BOVERI ET CIE. December 2nd. (Germany, January 3rd.)
 17,340. "Polarised relays." M. B. RODRIGUEZ. December 2nd.
 17,347. "Treating marble so as to impart electric insulating and weather-resisting properties to it." W. E. WINDSOR-RICHARDS. December 2nd.

PUBLISHED SPECIFICATIONS.

1915.

- 8,489. TELEPHONE TRANSMITTERS AND TRANSMISSION. W. A. YEWEN. June 8th. (November 8th, 1915.)
 11,332. INCANDESCENT ELECTRIC LAMPS OR/AND IN THE METHOD OF MANUFACTURING SAME, ESPECIALLY APPLICABLE TO THE MANUFACTURE OF SO-CALLED HALF-WATT LAMPS OR GAS-FILLED GLOW LAMPS. C. O. BASTIAN. August 5th.
 11,560. APPARATUS FOR DISPLAYING ADVERTISEMENTS, SIGNS, NOTICES, OUTLINE MOVING PICTURES, OR THE LIKE, OR FOR COMMUNICATING MESSAGES OR SIGNALLING BOTH DURING LIGHT AND DARKNESS. J. P. NAYLOR & Naylorgraph, Ltd. August 10th.
 15,842. ELECTRICALLY-DRIVEN ADDING AND LISTING MACHINES, COPYING MACHINES, TYPEWRITING MACHINES, ADDRESSING MACHINES, OR OTHER MACHINES HAVING KEYBOARDS. J. DE QUATE. November 4th.
 15,878. ELECTRIC SWITCHES. British Thomson-Houston Co. (General Electric Co., U.S.A.). November 10th.
 15,930. ELECTRIC CELLS. C. FREY. November 11th.
 15,985. ELECTRIC LAMP HOLDERS FOR VEHICLE HEAD LAMPS. F. E. WILSON, W. A. SHEPHERD and POWELL & HAMNER, Ltd. November 12th.
 15,986. ELECTRICAL CONNECTIONS FOR USE IN THE ELECTRIC LIGHTING OF AUTOMOBILES. F. E. WILSON, W. A. SHEPHERD and POWELL & HAMNER, Ltd. November 12th.
 16,112. OHMMETERS AND LIKE ELECTRICAL MEASURING INSTRUMENTS. H. E. TRENT. November 13th.
 17,302. ELECTRIC LAMP HOLDERS. E. A. WELCH. December 9th. (Cognate application, 6,867/16.)
 17,475. RAILWAY SIGNALLING. W. R. SYKES Interlocking Signal Co., R. R. HARPER & F. J. SYKES. December 14th.
 18,166. ELECTRICAL RELAYS. S. G. BROWN. December 30th.

1916.

- The numbers in brackets are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.
 191. MICROPHONES FOR USE AS TRANSMITTERS OR RELAYS FOR TELEPHONIC AND SIMILAR PURPOSES. H. SMITH. January 4th, 1916. [102,067.]
 425. ELECTRICAL HEATING APPARATUS. A. H. TAYLOR (H. BURGESS). January 11th, 1916. [102,070.]
 1,596. ELECTRIC HEAT RADIATORS. A. F. BERRY. February 2nd, 1916. [102,077.]
 3,515. ELECTRIC HEATING APPARATUS. M. J. RAILING & J. H. FARTHING. February 22nd, 1916. [102,084.]
 2,915. RAILWAY SIGNALLING. W. R. SYKES Interlocking Co. & R. W. TARRANT. February 26th, 1916. [102,087.]
 3,099. ELECTROLYTIC PRODUCTION OF SODIUM PERBORATE. Deutsche Gold und Silber-Schenkelstahl vorm. Roessler. March 1st, 1916. (Addition to 3,084/16.) [102,089.]
 5,606. ELECTRICAL MEANS FOR INDICATING OR TRANSMITTING MOVEMENTS. H. R. WRIGHT. April 17th, 1916. [102,104.]
 6,031. ELECTRIC DEVICES FOR AUTOMATICALLY TURNING LIGHTS ON OR OFF. E. STEIGER. April 28th, 1916. [100,365.]
 7,009. COMBINED ELECTRIC LAMP HOLDER AND LAMP LOCK. A. H. SHORT. May 17th, 1916. [102,111.]
 9,113. METHODS AND APPARATUS FOR HEATING LIQUIDS. British Westinghouse Electric & Manufacturing Co. June 30th, 1916. [100,796.]
 10,234. TELEPHONE DIRECTORY. W. H. ASTON. July 20th, 1916. [102,127.]
 10,297. DEVICES FOR ATTACHMENT TO SPARKING PLUGS FOR AUTOMATICALLY CLEANING AND COOLING THEIR SPARKING POINTS. A. E. LAMKIN. July 21st, 1916. (Addition to 8,470/16.) [102,128.]
 12,169. VAPOR ELECTRIC CONVERTERS. British Westinghouse Electric and Manufacturing Co. August 28th, 1916. [101,346.]
 15,419. FERROULE OR SLEEVE FOR BRAIDED WIRE COVERINGS EMPLOYED ON CABLES. F. E. WILSON, W. A. SHEPHERD and POWELL & HAMNER, Ltd. November 12th, 1915. (Divided application on 15,986/15.) [102,137.]

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THE ORGANISATION OF TRADE AND INDUSTRY.

WE referred in our last issue to the proposals of the Federation of British Industries respecting the setting-up of suitable machinery for facilitating the reinstatement of Labour after the war. We have several times emphasised the importance of this particular problem, because we recognise that unless we make all the preparations possible within the wit of man to secure industrial peace within our own borders, many of our other schemes will come to naught. But important as is industrial harmony, it is obvious that we cannot permanently secure it unless we see to it that our industries themselves are placed upon a satisfactory basis. We cannot have contented employes unless we have prosperous industry. To secure the best interests of industry in face of the new situation due to the war, and to provide for adequate expansion, better organisation both at Home on the manufacturing and trading side, and abroad on the business promotion side, is essential. On both sections of this subject we have written much for many years past, but since the war we have dealt more particularly with various aspects of the whole subject of national industrial organisation as it presents itself to us in considering the requirements of the future. Whatever may have been the faults and failings arising from the conditions of the past, we have now to face a totally new set of conditions, and if while we try to secure harmony between employers and employed we can also attain to something like workable harmony in the troubled ranks of employers, we shall pave the way for a better state of things. But we must remove grounds for suspicion and friction, and be rid of all thoughts of a style of Prussian domination and interference in our methods of dealing with each other, or our efforts will not be successful, and any element in or connected with associations which gives rise to suspicion as to motives is harmful, and should not be permitted. We have repeatedly asserted our conviction that in these days strong and discreetly-managed trade associations are essential, and in this issue we publish a full contribution which serves to emphasise some of the points that must be considered by the electrical industry if it desires to maintain a world-wide reputation for quality, and to secure reasonable return on the capital invested. It is not suggested by us that the writer covers the whole ground, but we think that only good can ensue from a serious study of his arguments.

Organisation at home, however, will not secure the future success that we all desire unless we also look to organisation and methods for bringing into line with present-day requirements the machinery which assures a free and constant inflow of business from abroad. It might be imagined that this matter had been worn threadbare in our pages during the last 10 years, but the case is one that has to be restated again and again. It has been summarised anew for us in a series of recommendations that have

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has issued by the Federation of British Industries, already known, in English, as "The Promotion of British Trade in Foreign Countries." We welcome this statement of 16 conclusions, because it is opportune to the present situation, and because we agree with the Council of the Association that it deals with a matter of "urgent and vital importance to the future prosperity of the country." As a proof of it we find a list of the membership of this powerful Federation. We confess that, from our study of its development, we had expected to find electrical and engineering organisations in greater number and strength. The wisdom of classing big associations of firms and private firms side by side as members may not be quite apparent—that is by the way—but the only electrical Associations that we find in the list of "association" members are the British Electrical Federation, Ltd., which we believe does not stand on all fours with the other associations, being a group of connected concerns, really one undertaking, and the "Electric Detector Fuse Trade Associations." Neither the British Engineers' Association nor the B.E.A.M.A. appears. In the list of "firms and individuals" we find the names of a considerable number of the best known electrical manufacturing concerns, so possibly those two Associations have left it for their own members to decide for themselves whether or not they will link up in this Federation. The recommendations advanced by the Federation are those of its Council, on which there are only two electrical names of any weight, but the value of the conclusions is not lessened by reason of their being advanced by some 40 representatives of all kinds of industries, for the case that they set out to study was that of all British industry rather than that of any specialised section.

We have not space to spare this week to do justice to the recommendations. At the moment we must be content with briefly indicating their general purport. It is proposed that all Government activities in connection with the promotion of trade abroad should be concentrated in one Department—the Foreign Office. The Commercial duties of this department should direct all services abroad, collect and distribute suitable foreign industrial information, promptly and vigorously support British efforts to secure contracts, &c. A large increase in funds for foreign trade expansion will be needed, and the Council sets out a scheme for the establishment of a large commercial branch of the Foreign Office which will keep in close and intelligent touch in various ways with the industrial and commercial community. Commercial Counsellors are suggested for each Embassy or Legation, to be in sole charge of commercial work. A large scheme of rearrangement and increase of the Consular service; the sending of a large number of technical and commercial experts to investigate the industrial and commercial conditions and opportunities in particular countries and markets; and the ensuring that those who hold any office whatsoever in connection with the Commercial Organisation Service advocated shall be natural-born British subjects, are all parts of the Federation scheme.

Seeing that this programme is so largely in accord with the spirit and character of suggestions that we have made in these columns during the past ten or fifteen years, we profoundly hope that the Federation will be able to secure the sympathetic ear of the new National Government for its trade expansion propositions, and that suitable action will not be long deferred.

In the first place, a decree was issued at the end of November which practically vested in the State the control of the electricity supply works. The first clause prohibited, without the sanction of the Minister for War, the conclusion of a new contract for supply or an increase in an existing contract for supply, in connection with all distributing networks which serve either Government establishments or establishments, works, and undertakings working for national defence. The second clause provided that, in the case of a network being inadequate to assure the simultaneous supply of energy necessary for works engaged on national defence, the public services, and private consumption, the Minister should be empowered to impose upon the supply company or undertaking an order of priority among these classes of customers, either continuously or only for certain hours of the day. In the event of the Minister being induced to requisition one or several of the Sectors concerned, all consumers will have to pay a price on the basis of the cost price to the State and *pro rata* to the amount of energy consumed by them.

As we go to press we read in the *Times* that at Paris on Tuesday a Council of Ministers decided, in connection with its measures for meeting the scarcity of coal, to introduce a sweeping change in private and public lighting throughout France. It is stipulated now that all municipalities must effect a two-thirds reduction on the normal consumption of the winter of 1913-14. Previous measures restricting private consumption of gas and electricity are now cancelled and each individual will be allowed his normal consumption, provided it does not exceed daily a cubic metre ($35\frac{1}{2}$ cubic feet) of gas and three hectowatt-hours (300 watt-hours) of electricity. Beyond this, minimum the consumption is restricted according to a progressive table.

Linking-up. THE discussions which have taken place in the I.E.E. on Mr. Peck's timely paper

have revealed the existence of two distinct schools of opinion, consisting respectively of those who doubt whether it can be done, and those who know it can—the latter being fortified in their opinion by the fact that it is. Let it be granted at once and freely that there are difficulties to be overcome in operating stations of different frequencies, voltages, and phase in parallel; it is equally indisputable that there are material advantages to be gained by linking-up, and we decline to accept the view that the existence of difficulties is a serious argument; rather, it should act as an incentive to accomplishment, and stimulate electrical engineers, who are always achieving the impossible, once more to demonstrate their capabilities. Let them take their cue from the national movement, which has abolished the "Wait and see" policy in high quarters and substituted for it the policy of "Push and go," with results which are already becoming manifest. These may be but popular catch-phrases—they are full of significance for all that, and there is a weighty moral to be drawn from them. Those who "wait" will surely be left behind by those who "go" ahead.

We have no sympathy with the idea that the managers of the smaller stations will suffer any detriment from either the adoption of parallel operation or the introduction of bulk supply. Which is the better, to be at the head of a one-horse undertaking barely keeping its head above water, perhaps even showing a margin on the wrong side, paying inadequate salaries, and unable to develop beyond its narrow limits, or to be in charge of a thriving concern which, thanks to a cheap supply of electrical energy, is enabled to offer an attractive tariff, double the number of consumers, and quadruple its output within a few years, whilst showing a substantial annual profit which admits of the payment of good salaries to the staff? Surely there is here no room for doubt, and those who endeavour to persuade the central-station men to stand aloof are doing them an ill service.

Lighting Restrictions in France.

As a result from the compulsory closing of shops throughout France at 6 p.m., except in the case of pharmacies and of shops dealing in food products, further measures have been adopted by the Government to secure a fresh reduction in the consumption of electrical energy. In

NATIONAL INDUSTRIAL ORGANISATION.

By O. N. LOOKER.

THE war has served to direct our attention to the marked differences in the methods adopted by the leaders of public policy in Britain and Germany respectively.

On the one hand we have seen a chivalrous desire scrupulously to observe the requirements of humanity and of international law (even to our own detriment), while on the other we have learned to expect the callous adoption of *any* measures—no matter how reprehensible—which have appeared likely to give our enemies a chance of securing even a temporary advantage.

This difference of outlook appears to be fundamental, since its effects are as marked in our commercial as in our military rivalry, although *evidence* of Germany's unscrupulousness in her trade campaign is naturally less strikingly apparent than in the activities of her army and navy.

It will be admitted, for instance, that whereas all the world instantaneously recoiled in horror from the authors of the *Lusitania* and other crimes, it has taken years for us to begin to appreciate at its proper value the insidious nature of Germany's "peaceful penetration" (!) into our commercial markets.

Yet it should have been obvious that both these classes of outrage are but the natural result of a fixed policy having a common origin in Germany's sinister materialism, although the fact that we are constantly urged to introduce German methods into our business life proves that, even now, there is no widespread recognition of the dangers inseparable from such a course.

In common fairness to those who advocate our adoption of German business standards, it must be admitted that they frequently do so, not so much from any profound belief that German methods are the *best* methods, but rather from an acute recognition of the defects in our own trading habits, which they rightly assume would benefit from an infusion of more scientific control and organisation.

This awakening to our own shortcomings as a trading nation is of distinct national benefit, and it is reassuring to find that, in contrast to our former apathy, many able minds are to-day focused on problems connected with trade development and security.

One of the immediate results of this mental activity has been the formation of a variety of trade associations and federations of manufacturers, all of which base their proposals on a candid recognition of the axiom that a united industry can achieve much more as a body than could possibly result from the individual and unorganised efforts of its members.

In some quarters there is a tendency to direct attention to the possibly pernicious effects of combined action by manufacturers, but, however much or little foundation there may be for such fears, there is certainly insufficient appreciation of the benefits which accrue to the consumer as well as to the producer from the co-operation of manufacturers *for the maintenance of the quality of their goods*.

It must be remembered that from the commencement of competitive industrialism, *i.e.*, ever since there existed more than a single source for any one class of goods, all manufacturers have been controlled by the inevitable law which has forced them to seek the favour of the potential buyer by constantly reducing their selling prices.

The operation of this law in its early stages is always highly beneficial to the community, in so far as it compels the manufacturer to adopt all available means of cheapening the cost of production;

but, after exhausting all legitimate methods—such as the reduction of profits to the minimum and the introduction of improved designs and processes—some hard-pressed manufacturers succumb to the temptation to achieve their object by employing inferior or insufficient materials in the manufacture of their goods, and at that stage the public suffers.

With uncurbed competition this parting of the ways occurs, and will continue to occur, in every industry. There comes a time when the manufacturer of any article has to recognise that he cannot further reduce the selling price of his goods except by reducing their quality.

He has to make up his mind whether he will maintain the quality and demand a comparatively high price, or reduce the price *and the quality* of his goods to those of his competitors.

The former course is only possible in very few trades, and the result is so difficult to foresee that an incorrect decision would generally mean ruin.

The difficulties inherent to the alternative course can only be overcome by all manufacturers in a particular trade recognising these inflexible laws and mutually undertaking that the *quality* of their manufactures shall not fall below an agreed standard.

Such arrangements generally lead to agreed prices, which have been so much feared in the past, but it is now recognised that such agreed prices, if honestly arrived at, are an advantage to the whole community.

Cut-throat competition, with its attendant deteriorating influence on quality, is the only alternative, and such a policy not only ruins the producer and disgusts the consumer, but also necessarily throttles progress. Uncontrolled manufacturers become demoralised and, in time, lose the art of making reliable goods. They, furthermore, have no funds for the prosecution of research, which is admittedly more prolific of early results if carried on in the manufacturers' laboratories than in any purely scholastic institution yet conceived.

Parenthetically, it may be noted that the question of research is now receiving attention at the hands of the Government. The President of the Privy Council, when recently announcing the formation of the Imperial Trust for the Encouragement of Scientific and Industrial Research, laid great stress on the necessity for the creation of large industrial associations, on the ground that it was futile to attempt to forward this important matter by negotiation with individual firms.

Bearing in mind our opening reference to the fundamental difference of outlook held by British and German people respectively, it is not surprising that British manufacturers have characteristically striven for *quality*, whereas their German competitors have striven for *cheapness*, which—considered apart from any assistance given them by tariffs, subsidies, financial co-operation, &c.—can only be achieved by lowering the quality of their goods.

Trade control has indeed become a *sine qua non* of successful British industry, and it may be said that no experienced capitalist would to-day enter into a competitive manufacturing business without some assurance that, by co-operation with his competitors, such trade would be controlled.

Consequently, we have to-day in England manufacturers' associations arising on all sides for the maintenance of the quality of every kind of goods. *e.g.*, boots, bedsteads, tubes, rivets, nails, machine tools, motor-cars, tires, saddlery, tanks, wire netting, ironmongery, jewellery, paints and varnishes, brushes, dynamos, incandescent electric lamps, electric cables, accumulators, cast-iron pipes, bird cages, chains, tinned sheets, steel rails, carriage lamps, garden rollers, glazed tiles, sporting guns, ordnance guns, plate-glass, oil, files, &c.

By way of illustrating the widespread recognition of the good work accomplished by such trade associations in maintaining quality and general control.

it may be assumed that impartial bodies, such as the Engineering Standards Committee, turn to these associations (and not to individual firms) for information and guidance before setting up standard specifications for the various goods they describe.

Mr. Asquith, in the House of Commons on August 2nd, 1916, when dealing with the White Paper on the proceedings of the Paris Economic Conference, drew special attention to the extraordinary enterprise and resourcefulness shown by a large number of British industries since the war broke out, and laid particular emphasis on two tendencies, saying:—

The first is the development of trade associations for co-ordinated action at home and abroad, raising the average standard of production.

The second is the recognition of the leeway which we have to make up as regards scientific research, and the utilisation of its results and its application to technical and industrial purposes.

Government departments now negotiate with associations on points which they will not even discuss with individual firms, and the recommendations of the Faringdon Committee regarding the establishment of a British Trade Bank provide further evidence that the Government's advisers appreciate the necessity for co-operation in matters pertaining to trade.

A perusal of the addresses delivered at the commencement of the Session 1916-17 to the members of the Institution of Civil Engineers and of the Institution of Mechanical Engineers by their respective Presidents shows that both of these eminent gentlemen lay special stress on the necessity for the encouragement of the "association" movement amongst all British manufacturers.

Again, the Institution of Electrical Engineers, when recently giving evidence before the Electrical Trades Committee appointed by the Board of Trade, stated that "*some combination of British electrical firms, especially for foreign trade, is desirable.*"

It may interest our readers to review the history of their branch of the engineering industry, more especially as its entire existence practically falls within the lifetime of the present generation, and its evolution provides a concrete example of the bitter experiences suffered by British manufacturers before our leading institutions arrived at their present appreciation of the advantages of co-operation.

At the close of the 19th century, the electrical industry, which, it is generally acknowledged, has never experienced prosperity adequate to the capital, enterprise, and ingenuity expended upon it, reached the lowest stage of its depression, in which it continued for many years.

It seemed as if the legislation of this country and the competition from abroad would prevent it from ever again holding up its head.

The public generally had no experience to guide them when purchasing electrical equipment, and, accordingly, the price was the chief and often the only consideration.

Any manufacturer desirous of improving the quality of his goods was further hampered by the circumstance that in many cases his superior, and consequently more expensive, goods differed in appearance very slightly from those of his less scrupulous competitor, whose object was to make immediate profits rather than an enduring reputation.

A striking demonstration of the disastrous effects of this policy occurred some years ago in the dynamo and electro-motor trade, when, it will be remembered, the competing manufacturers were tempted to starve their machines by cutting down the weights of iron and copper employed in their construction, thereby increasing the maintenance cost and risk of failure by breakdown.

The inevitable result was that the manufacturers were brought to the verge of ruin by their cut-

throat competition, and the consumers slowly came to realise that the policy of accepting the lowest price was not free from serious drawbacks.

No arguments or experience can prevent such result. It occurs time after time, to-day in one trade and to-morrow in another. As long as consumers demand the cheapest, it is only human nature for manufacturers to reduce the quality in order to reduce the price.

Latterly, the general situation in the electrical industry has been improved, owing largely to the efforts of the British Electrical & Allied Manufacturers' Association (B.E.A.M.A.), whose members have learned that, while competition in quality benefits the maker and user alike, unrestrained competition in price must be disastrous to both.

In addition to its achievements in the above direction, this Association has done much towards establishing the electrical trade on an equitable basis by setting up standard "Conditions of Contract," which have been formally approved by the Institution of Electrical Engineers and accepted by all the principal municipalities and other large consumers throughout the country.

The B.E.A.M.A. has further provided, in many instances, for Parliamentary representation for the redress of different evils, and to-day it is most active in making preparations for trading after the war.

So broad are its views in such matters that it is not working solely in the interests of its particular members, but on behalf of all British traders.

Valuable pioneering by way of maintaining quality was years ago accomplished by the cable makers of Great Britain, who were, perhaps, the first of all English manufacturers to realise that the control of quality was absolutely essential to the welfare of the nation.

In fact, it may be said that the success of the B.E.A.M.A. is largely due to its appreciation of the value of the principles laid down by the Cable Makers' Association many years earlier.

The cable makers were particularly susceptible to the inevitable law referred to above (regarding cost-reducing expedients) in the manufacture of their goods, since the quality of a cable is so obscured that the difference between a cheap and a costly cable is only ascertained by the life test, *i.e.*, a good cable, of course, lasts longer than a poor cable, but there may be no appreciable difference in their appearance to guide the consumer when they are both new. Indeed, under some circumstances, it so happens that the inferior cable, when new, has a better appearance than the more costly article.

On the broad question of the relationship between quality and price, it may be said that once standards of quality are set up, the adoption of standards of price is an obvious and necessary sequel, and the public, accordingly, has for years been able to rely upon buying goods from any member of the Cable Makers' Association, at the same price, and of at least the same minimum and sufficient standard of quality.

To-day, thanks to such initiative, there are no cables to be found throughout the world to compare in quality with those manufactured in Great Britain, and the expression "Association Grade" is universally accepted as the hall-mark of quality.

By first organising each section of the engineering industry on the above lines, and then co-ordinating all these sections in one central association, it should be possible to bring the combined weight of the whole engineering industry to bear on any problem affecting its interests.

Similarly, other industries might form their sectional trade associations and thus pave the way for the creation of a Federation of United British Industries, on whose governing council representatives from all such organised British industries could meet and determine whatever joint action they

might deem advisable in the general interests of British trade.

It is admitted that the welfare of the British nation is dependent upon the prosperity of her principal industries; and all reasonable measures for fostering and safeguarding the interests of her producers are accordingly deserving of whole-hearted support.

Once our industries are thoroughly organised and alive to the urgent needs of the time, we need have no fear that "Trade After the War" problems will find us unprepared.

COAL MINING AND ELECTRICAL ACCIDENTS IN MINES FOR 1915.

THE annual report of the Chief Inspector of Mines for 1915, which has just recently been issued, also includes the reports of the Divisional Inspectors, which hitherto formed separate reports, and which are very considerably reduced owing to the war, and hence we are unable to give any figures bearing upon the use of electricity in mines, or the amount of coal obtained by machine mining.

In view, however, of the vast importance of mining to the country to-day, and the very unsatisfactory attitude of the miners, it is interesting to note the results for the year 1915. In the first place, the total output of minerals is less by 14,588,210 tons, the amount for the different districts being :—

	Coal.	All minerals, including coal.	Total output of minerals for year 1914.
Scotland Division ...	35,596,856	39,690,127	43,686,414
Northern " ...	47,030,285	52,122,007	58,431,037
York, and North Mid- land Division ...	67,504,130	67,983,983	67,374,083
Lancashire and North Wales ...	24,923,976	25,110,278	26,445,277
Ireland ...	84,577	84,579	93,040
South Wales... ..	50,452,600	50,587,907	54,037,575
Midland and Southern	27,587,042	28,918,382	29,018,107
Total tons ...	253,179,446	264,479,263	279,085,473

The total output of coal for the year 1914 was 265,643,030 tons. (These figures do not include coal obtained in open quarries, which for 1915 was 26,635 tons), so that the reduction in the coal output is 12,463,584 tons.

Turning next to the number of persons employed, we find in 1914 there were 1,133,746 up to the end of July, but in December of that year this was reduced to 981,264, or 152,482 less. For the year 1915 there were 995,642 persons employed, or only 27,622 less than in December of 1914, or approximately $2\frac{1}{2}$ per cent. less, yet the output was 14,588,210 tons less, which is more than 5 per cent. reduction of output for a $2\frac{1}{2}$ per cent. reduction of *personnel*. There have been many serious complaints—and we regret there are yet—of slackness on the part of the miners, South Wales, the North of England and Scotland being the worst in this respect. An examination of the foregoing figures shows a reduction in output of approximately four million tons for Scotland, six million tons for the North of England, one million for Lancashire, and three and a-half million for South Wales, whilst Yorkshire and the North Midland Counties have actually increased their output, and the Midland and Southern have very nearly maintained the same output as for 1914. The pity of it is, there is no sign of any improvement in those four areas, although every effort has been made both by the Government and the labour leaders themselves.

In regard to accidents, we regret to note there was an increase of 78 in the total number of accidents in coal mines over the number in 1914, although a less number of persons were employed. We also regret that 12 persons met their death through the use of electricity. Of these, 8 occurred underground and 4 on the surface. There were 3 fatal accidents underground in the Scotland Division; 2 underground and 1 on the surface in the Northern Division; 2 underground and 2 on the surface in South Wales Division; and 1 underground and 1 on the surface in the Midland and Southern Division.

As to the accidents themselves, the Inspector for the Scotland Division says :—"The three deaths due to electricity should *not* have occurred. In one case an apprentice, aged 15, probably from curiosity, opened the door of a switch panel, where the pressure of the current was 2,750 volts, and touching live metal, was electrocuted. In the second case, where a fall from the roof had occurred and covered a cable carrying current to a coal cutter, two men were set to work to clear the *débris*, although the current was not cut off. Such an ordinary precaution does not appear to have been thought necessary by the officials, if they thought about it at all, who set the men to work. One of the men received a shock by way of his shovel which either penetrated the cable or touched the conductor owing to the outer covering having been injured by the fall. The third case was due to the absence of a locking pin to cause efficient contact between the frame of a coal-cutting machine and the earth conductor in the trailing cable. As remarked, it will be seen that each of these three accidents could easily have been prevented."

Amongst the miscellaneous surface accidents, a manager was fatally injured when assisting to remove a drum of armoured cable. He was steadying the drum on its way from the store house to the power house down a slight incline, when he slipped and the drum ran over him.

In the Northern Division and the South Wales Division no particulars of the accidents are given. In the Midland and Southern Divisions the Inspector reports :—"Two fatal accidents from electricity were reported to me during the year, one underground and one above ground, each causing one death.

"The underground accident occurred to a haulage corporal, who received a shock from a current of about 350 volts through a 6-in. wire nail, which had been driven through the insulation of an unarmoured three-core cable, and had come in contact with one of the cores. There was no conclusive evidence to show whether he had been inserting or withdrawing the nail.

"The accident above ground occurred to a boiler smith's labourer, who was engaged on some repairs on a coke-quenching machine. He was removing an electric lamp, which had been temporarily put on to a circuit carrying a 500-volt alternating current by a fitter's labourer, unknown to the electrician or other responsible person."

In the Northern Division the Inspector reports a singular accident in connection with the use of electric safety lamps. "An unusual accident, fortunately not a serious one, although it involved the loss of considerable property, happened to a man in charge of the safety lamps at the Easington Colliery, Durham. This man was burnt about the arms while attempting to extinguish the flames from the burning celluloid cases of electric safety lamp accumulators. The origin of the fire is not definitely known, but it is suggested that in the process of charging, liquid may boil out of one cell and creep down the sides and across to the outside of an adjacent cell, thereby causing a short circuit and an arc. As may be imagined, with such a material as celluloid, unless immediate attention is at hand, a conflagration of considerable dimensions is soon inevitable. In this case, the batteries of some 1,200 lamps were rapidly involved; in fact, the celluloid was consumed in about 10 minutes or less. The fittings in the lamp room were chiefly of wood; the roof was also partly of wood, so that the whole interior, including the roof, was rapidly gutted. Work was resumed at the mine after a stoppage of one day only, as owing to so many men having left the neighbouring collieries, a sufficient number of oil safety lamps were available.

"If liquid cells are charged with strong acid, it may boil out during the recharging process. With proper attention and supervision, however, it is quite possible to charge these batteries properly without danger arising in the manner indicated above."

In the Yorkshire Division there were no fatal accidents, but a rather serious fire, with fatal results, broke out, which is reported as follows :—"On June 4th an underground fire occurred in a main haulage road, and caused death by asphyxiation of a deputy and a pony driver, whom it was found impossible to rescue after the fire broke out. The fire occurred in the main intake, about 1,000 yards

from the pit bottom. The roadway dipped inbye, and was about 12 ft. wide and 7 ft. high; an electric cable for supplying current to a series of lamps of a total of 130 W.P. was suspended in the roof supports, which, for the most part, consisted of timbers and covering wood supported by posts. The covering wood took fire, and it was some hours before the fire could be subdued, notwithstanding that the supply of water was plentiful.

Investigation showed that at about 3.30 in the morning a set of 20 full tubs ran away, through a stop catch being either put temporarily out of action by being spragged to allow empties to pass, or by dirt accumulating in the catch-box, and by damaging the electric cable referred to, caused the fire through arcing. The cable was a twin-core dielectric insulated, armoured with single wire."

"The view of Mr. Charlton, H.M. Electrical (Temporary) Inspector of Mines, was that by the accident the cable was torn rather than cut in two: that at first there was not a dead short: that the two conductors were not fused, and an arc was probably established and maintained, taking a gradually increasing current after the metallic covering had been removed. He was also of opinion that had the protective device been actuated by leaking current, instead of the main feeding current, the fire would not have occurred."

"The cause of the fire could not, however, be laid to contraventions of the Electricity Regulations, and the owners, on being asked to install a leakage-current protection device, agreed to do so."

Time after time we have pointed out that most of the accidents in mines should not have occurred, and it is satisfactory to note that at least one Inspector quite concurs with these views. The cause is, undoubtedly, inefficient management—not always, however, on the part of the colliery manager—who, though legally responsible, has neither the time nor the necessary technical knowledge to thoroughly undertake this work, and too often has to make the best of such technical staff as his owners will allow him. What is wanted, as we have so often repeated, is a certificated engineer, with direct responsibility. Rules and regulations, fool-proof plant, and protective devices are of no use, unless there is a trained mind to understand the rules, and direct the use of the plant in a common-sense way, even if it is "guaranteed." Fool-proof things have a nasty habit of going wrong sometimes.

NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

INTERESTING figures showing how this country is faring during the war in regard to her trade, appear in a recent issue of the "Weekly Bulletin" of the Department of Trade and Commerce.

The total value of imports and exports of merchandise, in millions of pounds sterling, are approximately as follows for the years given, for the 12 months ending—

	Aug., 1913.	Aug., 1914.	Aug., 1915.	Aug., 1916.	
Imports	137	110	83	131	£ x 10 ⁶
Exports	79	94	101	203	
Total	216	204	184	334	

Canada's exports to Australia have almost doubled in value since 1913, and to the United Kingdom they have increased about 350 per cent, those to France have risen to almost 15 times the value, while those to the United States are of about 1½ times the value of the same period.

To British manufacturers the value of the imports classed under the heading of "electric apparatus" will be of interest, especially the comparison of figures relating to the United Kingdom and the United States.

During 1915-16 for the twelve months ending August, the total value of imports under the heading just referred to was about £1,070,000. The United Kingdom supplied goods worth about £42,000, and the United States £1,023,000 worth. The ratio between the values supplied by the two countries named is usually about 1 to 7, at present it is about 1 to 24. The home firms will need to be very active after the war is over even to restore the *status quo*.

It seems pertinent to remark here that it is possible that the Hydro-Electric Power Commission of Ontario may consider the question of providing itself with the means for properly approving of all classes of electrical supplies, materials, &c., in much the same manner as is now done by the Underwriters' Laboratories of Chicago. If this be so, British manufacturers should be able to secure more ready approval of their products than is possible with

the Underwriters' Laboratories, since this is British territory. At the same time they will have to recognise that, to some extent at least, they will have to cater properly for the market, and that they cannot expect readily to sell goods of a new and unusual style, or even to have them instantly approved of, however good they may be.

Until war broke out and even at the present time people here are assumed to have a preference for articles with a high finish and plenty of ornamentation, at least one would judge so from the fact that it is seldom possible to buy perfectly plain, though good, fittings, &c.

Many articles, not merely electrical but of all kinds, plainly made, yet of good quality and often really much more handsome in appearance than the nickelled, coppered, or gilded and beflowered ones, are obtainable in Europe at reasonable prices, whereas for a far cheaper looking article one pays much more here without being able to obtain the less elaborate and really better ones at all.

Possibly when the war is over, things may be somewhat changed, and the plainer goods at lower prices will be obtainable, as, if the cost of living keeps up and the present great wave of trade prosperity dies down, the public will be compelled to buy the cheaper goods with fewer frills about them.

An illustration may here be given as to what is meant by the foregoing.

The writer some time ago wished to secure an inverted glass shade for lighting a small room in a plain house, and looked around to see what shades were available.

The cheapest to be found were sold at 16s. or 20s. and were made of thick glass with elaborate patterns on and heavy brass chains: finally he bought an ordinary 14-in. conical opal shade of glass about ¾ in. thick, made some neat small brass clips and suspended it upside down with neat brass chain. The whole thing cost about 2s. and (except that it had a hole at the apex of the cone) was perfectly satisfactory and amply good enough for tens of thousands of homes of people who, though they may possibly buy the far more expensive articles found in the shops, yet are not really in a position to afford them.

One of the local (large) manufacturers of electrical glassware was approached on the subject as to the possibility of supplying a really cheap article such as has been described, and the reply given was that it would be quite impossible to sell such a "cheap-looking" article which had no fancy work on it at all. Other instances of this kind could easily be given.

It is open to doubt, however, whether undecorated and lighter articles at much lower prices than those usually asked, could not find a fairly ready market, were they on sale.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Large Gear Wheel.

We illustrate in fig. 1 a large split-gear wheel in process of being cut at the works of the WESTINGHOUSE BRAKE CO., 82, York Road,

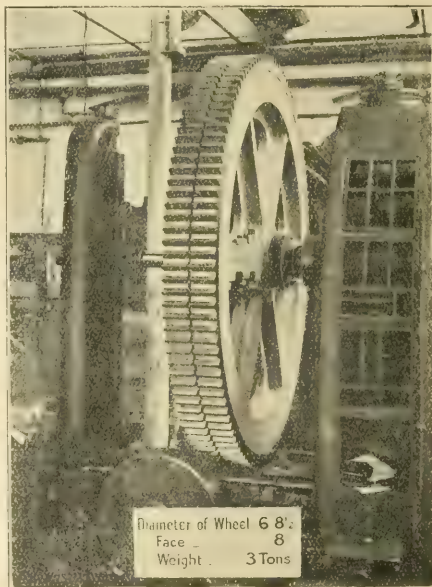


FIG. 1.—GEAR WHEEL FOR CHAIN-DRIVE.

King's Cross, N. This is destined for the St. John del Rey Mines, Brazil, and forms part of a 80-H.P. Westinghouse-Morse rock-joint chain-drive from motor to air-compressor. The wheel has 126 teeth, is 8½ in. in diameter by 8 in. face, and weighs 3 tons.

Electric Cooking at Dursley.

Through the courtesy of MESSRS. R. A. LISTER & CO., LTD. of Dursley, we are able to illustrate an electric cooking installation at their works, which supplies 100 mid-day meals and a similar number at midnight, as well as teas and light refreshments. The cooking equipment is supplied from a 10-kw., 110-volt Lister-Bruston automatic plant, which, of course, responds automatically to any demand for energy. When this canteen was opened, tests were conducted by cooking in both gas and electric ovens. Two legs of mutton were cooked simultaneously, one weighing 8 lb. 1 oz. being put into the gas oven, and the other, weighing 8 lb., being electrically cooked. The joints were subsequently weighed, that cooked by gas showing a loss of 1 lb. 15 oz., as against a loss of

emitted by a heated body at a point depending upon its thickness and the temperature; it is therefore moved so as to intercept more and more of the light until the image entirely disappears, a point which can be determined closely after practice. The error may, with experience be brought as low as 1° C. which at 1,400° is sufficiently accurate in practice. The distance of the heated body makes no difference to the reading. As a workshop instrument it should prove very useful. It was invented by Messrs. Cochrane and Co., a well-known firm of ironfounders at Middlesbrough, for use in their own works, and their expectations were fully realised; each instrument sent out is calibrated by the inventor himself.

Reyrolle's Switch-type Fuse Boxes.

Fig. 4 shows an ironclad fuse-box of the switch type manufactured by MESSRS. A. REYROLLE & CO., LTD., of Hebburn-on-Tyne. These fuses are of simple and robust construction, special attention being given to cable inlets, and no sharp bends being required. They can be supplied for 50 or 100 amperes, suitable for 500 volts and



FIG. 2.—ELECTRIC COOKING PLANT AT MESSRS. R. A. LISTER'S WORKS.

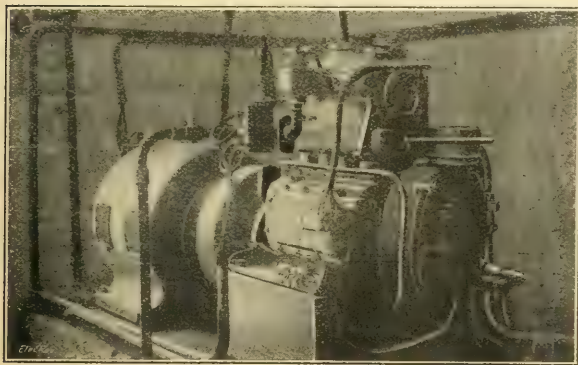


FIG. 3.—LISTER-BRUSTON PLANT SUPPLYING ELECTRIC COOKING INSTALLATION.

only 9½ oz. in the electrically-cooked joint. The value of the saving in meat alone in the latter case more than paid for the fuel used in running the plant, although all the vegetables were also cooked electrically.

As the Lister-Bruston automatic plant can be connected to any existing private installation without adding to the number of cells in use or altering the lighting arrangements, even when a higher voltage is required for cooking purposes, Messrs. Lister maintain that it represents the solution of the country-house cooking problem, which has been hindered in the past owing to the large batteries necessary.

The Wedge Optical Pyrometer.

THE OPTICAL PYROMETER SYNDICATE, of 182, Temple Chambers, E.C., have brought out a simple and convenient type of pyrometer depending upon the colour of the heated object, when above 500° C. The instrument is calibrated for any range of temperatures desired between this limit and 2,100° C., and the scale usually extends over a range of 400° C., being divided into intervals of 20°. It can, however, be made for a range of 800° C., in steps of 50° C. It consists of a brass tube fitted with a small telescope, which focuses the image of the heated body on a movable prism inside the tube. A shield prevents extraneous light from reaching the eye. At one side of the tube is a milled head, actuating a rack and pinion, which moves the prism through the field of vision. The prism is made of a special dark glass, which cuts off the light



FIG. 4.—SWITCH-TYPE FUSE BOX.

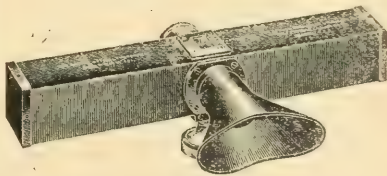


FIG. 5.—THE WEDGE OPTICAL PYROMETER.

1,000 volts. The cases have fireproof linings, and the fuse wire is contained in a fireproof tube, thus enabling short circuit to be satisfactorily dealt with, whilst the fuses can be renewed with ease and safety.

The simplicity of the construction renders them particularly suitable for wiring installations necessitating quick handling. This make of switch fuse is also suitable for use as a simple and effective L.T. isolating switch.

Electrician Sentenced.—For having matches in his possession whilst in works where explosives were being manufactured, John Freeman, a Huddersfield electrician, was sentenced to one month's imprisonment in the second division. Defendant pleaded guilty. He was in a drunken condition when the offence was committed.

Board of Trade Changes.—It is understood that the Board of Trade is being completely reorganised. The Labour Department should eventually pass under the control of the Minister of Labour, who will at once take over important functions from the Ministry of Munitions. Offices have been set aside for the Minister of Labour at the Ministry of Munitions in Whitehall Gardens.—*Times*.

LEGAL.

RAILWAYS & ELECTRIC TRAMWAY LINES.

L.C.C. APPEAL.

At the Court of London Quarter Sessions, on December 12th, Mr. A. P. LITTLE, K.C., Deputy-Chairman, and another magistrate considered the hearing of the appeal by the London County Council against the assessment of their tramway lines in the boroughs of Holborn and Finsbury.

The case for the Assessment Committee of the Holborn Union terminated with the evidence of Mr. A. L. RYDE, surveyor, of Parliament Street, S.W., who arrived at a rateable value of £29,575 compared with the assessment of £13,818 appealed against and £16,960 claimed by the County Council. In witness's opinion, the earnings of the tramways in Holborn and Finsbury were greater than on the routes outside, and he had added 1½d. per car-mile to the average receipts of each route. There were half-penny fares in the Holborn Union, but not in the country districts, and while the maximum penny fare on the system was nearly two miles, the maximum halfpenny fare was 930 yards. In cross-examination, Mr. Ryde admitted that there was a substantial difference in the amount he had allowed for repairs and renewals of cars and lines, and the amount which had been allowed by witnesses for the County Council. It might be true that 10 per cent. of the cars had been added within a period of five years, but he thought he had allowed sufficient to enable the Council to go on renewing piecemeal.

MR. CLAVELL SALTER, K.C., M.P., addressing the Court in support of the assessment, submitted that there was no comparison between the central district in question and boroughs like Woolwich, Camberwell and Lewisham, where the rateable value had been agreed. The Holborn Union was like "the fat middle" of provincial towns, though in the latter the tramways ran right through, whereas in London they had to come to a stop. The County Council officials informed them that the average number of passengers per car-mile over the whole system was 9.32, and that the average takings were 9.5d. per car-mile, showing a fraction over a penny per person. People who used tramways and buses did not ride anything like the full distance; on an average they rode about three-quarters of the distance they could go. He submitted that the receipts in the Holborn Union were far above those outside. Figures given by a witness for the Council showed that on four services at Holborn Town Hall there was an average of 15 persons, and evidence for the Assessment Committee showed that at the Moorgate Street termini the numbers were about double the average of the system.

The DEPUTY-CHAIRMAN: Assuming there is a larger traffic on the cars in the Holborn district, has that not got the necessary result of increasing the expenses of every kind in that district? There are more stopping-places, both compulsory and voluntary, when behind carts and when stopping at ordinary stopping-places. There is much slower running than one gets in less crowded districts, and, consequently, there is more wear and tear. The brakes, I understand, are some of the most damaged parts. In addition to that there are more tickets issued and more punches worn out. The six dead-ends (the termini) also take my eye a good deal, although the figures Mr. Clavell Salter has quoted show that sometimes they are not as dead as they might be. Then there is the extra labour which is necessary at the dead-ends for the purpose of switching on to lines. Taking all those things into consideration, and there may be a great many more, it would seem to me that in all probability that would balance, and perhaps more than balance, the extra receipts taken from extra passengers.

MR. CLAVELL SALTER admitted at once that cars running full and doing a brisk business involved more expense than cars running comparatively empty. But he should have thought that the additional expense would be very small compared to the additional profit, and that it would, in fact, be almost negligible. The case was one of considerable importance, as provincial centres would doubtless point to the decision of that Court.

MR. WALTER RYDE, K.C., on behalf of the County Council, submitted that the Court could never consent to a departure from the system which had been adopted in the case of seven south-eastern metropolitan boroughs in the rating of the County Council tramways. The rateable value of the whole system must be taken together, and the various parts when taken together must not exceed the value of the whole. If the Court was satisfied—though it was not definitely proved—that Finsbury and Holborn were above the average, the Court might yet regard the figures as so much guesswork, and not feel justified in putting a higher value on the tram-lines in question.

The DEPUTY-CHAIRMAN: You may leave that branch of the subject, because we are agreed upon it. I am satisfied, in my own opinion, that, assuming there is a larger number of people travelling on the lines in the Holborn Union, that is amply set off by the additional expenditure necessitated. On the facts put before us, we are quite clear as to that.

MR. RYDE, proceeding, urged that it was impossible to ignore the existence of the war in making a rating valuation. The war had affected this property enormously, because every contract had to be made under war conditions. Conditions had altered very materially for the worse.

The DEPUTY-CHAIRMAN: At the same time, if you invest money to-day you surely expect, when the time comes to realise it, that it will be appreciative, and not depreciable, unless the war is going on for ever.

His LORDSHIP announced that the Court would give judgment on the appeal on December 21st.

BRITISH THOMSON-HOUSTON CO., LTD., v. DURAM, LTD.

TUNGSTEN WIRE PATENT LITIGATION.

(Continued from page 655.)

On December 12th, Mr. Ballantyne was cross-examined by Mr. WALTER, K.C., for the plaintiffs. Replying to questions, WITNESS said he did not believe that drawn wire was easier to make than sintered filaments. He thought it was largely used because the metal suitable for sintered filaments was no longer obtainable, as it was made in Germany. He had had experience of the lasting power of lamps. Comparing drawn-wire lamps with sintered lamps, he found that the drawn-wire filament became brittle in a few hours as compared with the other.

DR. J. E. STEAD, metallurgical and consulting chemist and vice-president of the Iron and Steel Institute, was also examined, by Mr. KERRY, who asked: What does the patent that we are trying here tell you beyond what you find in Moissan?—Nothing at all.

On Wednesday, Mr. KERRY, summing up the defendants' case on the question of validity or invalidity, said the defence was three-fold:—

(1) the patent was bad, because the claim was too wide; (2) because it had been completely anticipated; and (3) in view of the existing knowledge of the time, there was no subject-matter. The existing knowledge, counsel said, which he relied on, apart from general metal-working knowledge, was the known parallel of osmium, which had been shown to be pliable, and the Siemens patents of 1902 and 1904, which assumed as common knowledge, as indicated to any instructed person, everything that was indicated in the plaintiffs' specification. He also relied on insufficiency. As to his point that the claim was too wide, counsel contended that it was purely a claim for working tungsten hot. He could put it that it was for working tungsten coherent hot, but that made no difference, because there was really nothing whatever in the suggested limitation of coherency. It included the ordinary workshop methods. In ordinary language, it told one that one had to make the tungsten hot. Therefore, by implication it told one that the tungsten must be got into a form in which it could be worked hot. The claim was too wide, as he had said, because it included the working of tungsten hot, and therefore it was a claim to a bare principle; and a claim to a bare principle was generally bad. Then the claim was merely routine; heating a metal for the purpose of operating on it was an ordinary everyday proceeding in a workshop, and had been the ordinary method of dealing with metals since metals were first dealt with.

The case was proceeded with on December 13th and 15th, and the defendants were permitted to call certain witnesses before the plaintiffs' witnesses, as they were engaged on urgent Government work.

MR. JOHN ROBERT PARRY, foreman in the employment of Messrs. James Brown & Co., Preston, wire drawers, described certain experiments in wire drawing in 1905-1907. He drew steel wire through a steel die, having dipped the wire in graphite.

MR. JOHN GUSTAV ADOLPH RHODIN, chief chemist of the Muntz Metal Co. from 1903 to 1905, gave evidence as to drawing zinc wire at a temperature of 150° C. to 120°.

MR. JOHN WADE, of Messrs. E. and A. Smith, wire drawers, Cleckheaton, was also examined.

DR. PASSMORE, chemist and metallurgist, gave evidence in support of the plaintiffs' specification.

MR. JUSTICE ASTBURY expected to finish the hearing on Monday, December 18th, but his Lordship was unable to come to Court that day, as he was suffering from influenza.

His LORDSHIP, on Tuesday, gave judgment. With regard to the first patent of 1906, relating to an apparatus for the treatment of metallic tungsten and for the manufacture of electric lamp filaments therefrom, his Lordship said an admission had been made which rendered it unnecessary to consider the question, except on a very narrow consideration, and the real question was the validity of the patent—want of novelty, want of subject matter, and insufficiency being alleged against it. The substantial invention, if there was one, made by the patentee was the production of a wire-drawn electric lamp filament of tungsten, but he had not been content to so limit the claim. The claim was a wide one for the working of pure coherent tungsten hot, and was not limited to any specific degree of working to any defined end provided the working was commercial working for commercial purposes. The description coherent tungsten included other forms in addition to that produced by the patentee's process. The patent was therefore bad for want of subject-matter, and was invalid. As to the second patent of 1911 for improved methods of wire drawing, his Lordship said, on the objection of prior user, he had come to the conclusion that it was impossible to escape the consequences of the user of Messrs. Brown & Co., Preston, which was proved to have taken place in 1905 and 1906. This patent was also invalid, and the action must be dismissed.

DUNLOP RUBBER TYRE CO. v. HUMPHRIES.

In the Dublin High Court, before Mr. Justice Barton, Mr. J. Humphries, electrical engineer, &c., Enniskillen, agreed to an injunction being given against him, at the suit of the Dunlop Rubber Tyre Co., and undertook that no irregularity would occur in his sale of the company's tires. It had been alleged that he sold for 10s. a tire, the standard value of which was 11s., and the company held that the case involved thousands of pounds to them. Plaintiffs did not ask for costs.

MR. JUSTICE BARTON said the agreement was not in restraint of trade, and it was only right to warn traders of their obligations in regard to such contracts.

WAR ITEMS.

Controlled Works.—The number of establishments now controlled by the Ministry of Munitions is 4,585.

Allied Conference.—The General Technical Conference of the Allies, the formation of which was decided upon at the Allied Economic Conference last June, met for the first time last week in Paris. The object of the Conference is to prepare for unity of legislation in the Allied countries regarding patents, trade marks, and kindred trade subjects.

Training Disabled Soldiers.—The governors of the Royal Technical College, Glasgow, at the request of certain donors, offer prizes, amounting to £70, for essays on the best methods of training and employing in industries, other than agriculture, returned soldiers and sailors, maimed or otherwise. Essays must be sent in by March 1st, 1917, addressed to The Director, the Royal Technical College, Glasgow.

The Use of Railway Wagons.—An Order in Council has been issued stating that the Board of Trade may, for the purpose of making the most efficient use of railway plant or labour, with a view to the successful prosecution of the war, make orders for all or any of the following purposes, namely:

(a) For enabling the Board of Trade to take possession of any private owner's wagons and to use those wagons in such manner as they think best in the interests of the country as a whole, on such conditions as to payment, use, and otherwise as may be provided by the order.

(b) For enforcing the prompt loading or unloading of wagons, by making failure to load or unload in accordance with the order an offence.

(c) For curtailing any statutory requirements as to the running of trains or affording other facilities on certain lines or at certain stations, or for requiring the disuse of any such line or station, in cases where the curtailment or disuse appears to the Board of Trade to be justified by the necessity of the case.

(d) For restricting or prohibiting certain classes of traffic (including the carriage of passengers' luggage) on railways either absolutely or subject to any conditions for which provision is made by the order.

(e) For modifying any statutory requirements with respect to the maximum amount of passenger fares.

Any order may be made so as to apply generally to all railways or to any class of railways or to any special railway.

To be Wound Up.—The Board of Trade has ordered the following business to be wound up:—

Decauville & Co., 31 and 32, Broad Street Avenue, London, E.C., late 10, Eastcheap, E.C., makers of portable railways. Controller: G. S. Pitt, 140, Leadenhall Street, E.C.

Exemption Applications.—At Westminster Tribunal, the Tudor Accumulator Co. applied for the exemption of 23 men, one single and 21 years of age passed for C1, and the others married, their ages ranging from 32 to 40. The Military Representative said the Advisory Committee had been unable to come to an agreement with the firm. Although they were in certified occupations they ought to be able to let some of the employes go, for Class A men were badly wanted. There were altogether 16 A men in the list. A representative of the firm said the men were indispensable to the maintenance of important London and provincial tramway and electric lighting undertakings. The lighting of London's principal buildings, including the Houses of Parliament, depended upon the company and its staff. They were all in certified occupations. The Military Representative said that some of them ought to be given up now, but there would be great changes on January 1st in the lists of certified occupations, and they might be out of them next time. Exemption for a period of four months was granted.

At the Hull Tribunal, a tramcar driver claimed exemption. It was stated on his behalf that tram drivers over 25 years of age and married were in a certified occupation. The instructions were that the list of certified occupations should be strictly observed by Tribunals and the Military Representatives, the Government Department having prepared the list in consultation with the Army Council. The fact that the Corporation had decided not to appeal for tram drivers did not affect the position so long as the men were over 25 and married. The Tribunal said it was the first time the point had been raised, and granted the man exemption.

At Bromley (Kent), an appeal was made by Mr. A. C. Edwards, electrician. He said that as he had received no notice to go before the Medical Board he had not been medically examined as ordered. The Tribunal decided to treat him as one passed for general service, and refused exemption.

On the appeal of the Military, exemption allowed to Mr. S. J. Nettleingham (24), electrician to the Thames Portland Cement Works Co., Higham (Kent), has been withdrawn, and substitution ordered.

Crediton Rural Tribunal has granted six months' exemption, with the assent of the Military, to W. Drew (40), electrician to Mr. A. Tremayne Buller, of Downs, having charge of eight motors for agricultural purposes.

Reigate Rural Tribunal has granted temporary exemption to January 15th to W. Adams (29), electrician, of Galton, with no further appeal without leave.

The West Kent Appeal Court has refused a claim for exemption filed by Mr. F. G. Jones (39), electrical engineer, of Gravesend, passed in Class B1.

Before the East Kent Appeal Court, Mr. H. T. A. Curtis (33), electrical engineer, of Ramsgate, appealed, and stated that he was responsible for the running of a public lift, and the maintenance of machinery at military and naval hospitals. The appeal was rejected.

At Bath, Messrs. J. Lambert & Sons sought exemption for G. Clark (34), electrical wireman, passed for C1. Clark had been before the Rural Tribunal, and had received two periods of exemption. The Tribunal decided that they had no jurisdiction in the case, and referred it to the Rural Tribunal.

Mr. J. Hutt, electrical engineer, applied to the Coventry Tribunal for renewed exemption, and stated that he was engaged entirely on work for local factories, and had had to refuse private work. In his spare time he had done Special Police work. It was mentioned that there was a great scarcity of electricians in the city. Two months were allowed.

At Aldershot, the Traction Co. appealed for eight employes, with the following results:—Mr. Webster (secretary), two months; night foreman-fitter, three months; three fitters, three months each; works foreman-engineer, six months; tin-smith, six months; and a driver, three months.

At Worthing, the borough electrical engineer appealed for a meter reader, and said that he doubted the ability of a woman to do the work accurately. Three months were allowed, subject to substitution. Three months each were also conceded to a cable jointer and his mate, an engine driver at the generating station, a machine fitter, the assistant electrical engineer, and a switchboard attendant (final). The permanent staff has been reduced from 23 to 10.

Exemption granted to Mr. T. H. Escott (28), manager for Messrs. Brooking & Co., electricians, Weymouth, was appealed against by the Military Representative. The borough electrical engineer and a number of business men of the town wrote as to Mr. Escott's skilled work and indispensability. The Tribunal cancelled conditional exemption, and gave until March 31st, with no further appeal without leave. The Chairman intimated that they expected the firm in the interval to train a substitute.

At Lindfield (Sussex), an electrical engineer in business at Hurst, aged 41, and passed in Class C2, and who has lost his manager, leaving him with only a man with a short exemption and a lad, had his period of exemption extended for six months.

At Broadstairs, the Military Representative applied for a review of exemption granted to the chief clerk (41) and a motor and tram driver (40), with the Isle of Thanet Tramways Co., on the ground that they were no longer in certified occupations. The company's representative stated that the former was the only clerk left, and that the driver could not possibly be spared owing to the great depletion of the staff, which compelled him to work seven days per week. The exemptions were confirmed, and will continue whilst the conditions remain the same.

On the appeal of Sir Wm. Vernon, the Chester Rural Tribunal has given six months' further exemption to his electrician, passed in Class C2, and who is engaged on hospital work.

At Lewisham, the Military asked for a review of exemption granted to F. G. Howard (24), a draughtsman with Messrs. Johnson & Phillips, Ltd., of Charlton. Respondent, who had stated that he had a conscientious objection, handed in a badge and a certificate showing that he was engaged on war work, and the Military Representative said that he should try to get the badge withdrawn. The application was not proceeded with.

The Military applied at Lewisham for conditional exemption held by an electrical engineer, aged 32, and passed for general service, to be withdrawn. It was stated that certain of respondent's employes had been badged. The Tribunal substituted six months' exemption.

Chatham Tribunal have granted six months' exemption to A. H. Laraman (19), electrician, appealed for by the Kent Electric Power Co., and passed for C3.

Hereford City Tribunal have granted exemption to March 1st to J. Hoskins, fireman at the municipal refuse destructor.

At Sutton-in-Ashfield, exemption on business grounds was claimed by Mr. A. E. Hough (36), managing director and electrical engineer for Messrs. Cinevars, Ltd., a theatre concern. Three months were conceded.

Worcester Tribunal has granted a certificate of conditional exemption to G. Harris (40), public lamp attendant and emergency man, applied for by the Corporation Electricity Committee.

Warwickshire Appeal Court has refused further extension of time to a charge-band at the refuse destructor of the Rugby U.D.C. It transpired that the man's wages were 30s. per week, and the Chairman said it was a disgraceful wage; charge-hands at the Coventry destructor were earning £3 10s. per week.

Torquay Tribunal has granted exemption to January 15th (final) to Mr. P. T. Narracott (36), electrician, passed in Class C1; but has refused time to F. J. Hammett (24), electrician at the Picturedrome.

Mr. D. R. A. Millman, electrician, passed in Class C1, appealed at Newton Abbot, and a month was granted for him to obtain a post of national importance.

At Bath, appeals by the Electric Tramways, Ltd., resulted as follows:—Body builder (41), three months; coach painter (37), three months; blacksmith (39), appeal withdrawn without prejudice; engine driver (38), conditional exemption; car driver (39), three months. It was stated that 202 employes had enlisted; the pre-war staff was 282 men, nine boys, and 21 women; and now there were 136 men, 23 boys, and 75 women.

At Windermere, an appeal was made by Mr. J. K. Thornborough (34), electrical engineer, partner in the firm of Thornborough Bros. He is passed in Class B1, and his younger brother is serving. Three months' temporary exemption was conceded.

At the Aberdeen City Military Tribunal, the Military Representative appeared against conditional exemption granted to A. B. Gillespie, electrical engineer. It was pointed out that there was a serious dearth of electrical engineers in the city. The case was continued so as to give the man an opportunity of increasing the work of national importance.

ELECTRICITY SUPPLY.

Mr. J. A. ROBERTSON, borough electrical engineer of Salford, gave the opening lecture of the session to the Technical Section of the Westinghouse Club. In the course of his address Mr. Robertson gave a short summary of the early supply of electricity in this country, and referred in detail to the question of centralisation and interconnection of electricity supply. He said:

We have learned many lessons from the war, but the greatest of all is that we cannot allow ourselves to drift along in the same haphazard way that we have been accustomed to in the past. It has become evident that if we are to maintain our position as a manufacturing and commercial nation during the trying years immediately subsequent to the war, we must begin at once to organise our national resources in material, labour, and brain power so as to produce the highest possible degree of national efficiency.

It must always be remembered that primarily we are a manufacturing nation. Our position in the world has been earned not so much by military or naval conquest, as by the fact that we were the first to sell the product of our skill and industry in the markets of the world. Cheap supply of power is one of the first essentials of the manufacturer, and if by centralising its production we can substantially reduce the cost, it will not only reduce the cost of manufacture, but at the same time conserve the national supply of fuel. To achieve this object, no existing interest, be it municipal or company, should be allowed to stand in the way.

Chiefly as a result of the steam turbine, a modern power station can be erected and equipped to-day at a cost per kW. less than one-fourth of what obtained 15 to 20 years ago. At the same time, the operating costs have been reduced by 50 to 60 per cent., or if allowance be made for the increased price of fuel, it may be said that the operating costs are about one-fourth of what was achievable in the old reciprocating plant stations.

Corresponding with the change brought about by the steam turbine in the power stations, the adoption of high-tension multiphase transmission has completely altered the conditions of distribution. Whereas with low-tension current an economical area of supply was seven or eight square miles, the area which can now be supplied from one station may be reckoned in hundreds of square miles.

It has been suggested that a national board should be set up with powers to erect new super-stations on modern lines, to sell energy in bulk to existing supply authorities.

Another proposal is that the State might find the capital to finance a national supply scheme, leaving supply companies to operate it. In this way the benefit of State credit would be obtained without the disadvantages of State administration. Mr. Robertson is of the opinion, however, that such a proposal is open to serious objections, and would meet with the most strenuous opposition from existing authorities.

Mr. Robertson proceeded to deal with the movement recently inaugurated in Lancashire, in which he is keenly interested, for the interconnection of electrical undertakings.

It is not claimed that "linking-up" existing stations forms a complete solution of the electricity supply problem; it is claimed, however, that it offers an immediate solution of the more pressing problems and that it can be carried out at a minimum of cost in a reasonable period of time, thus opening up the way for a more comprehensive scheme of centralisation as soon as conditions become normal.

In the first place, by "pooling" all the plant in the various stations, the necessity for each station keeping spare plant of its own would be obviated.

Secondly, "linking-up" would provide within certain limits a valuable safeguard against interruption of supply. The value of "linking-up" from this point of view can hardly be over-estimated.

In the third place, considerable saving in fuel would be effected.

A further advantage of "linking-up" is that it would enable a certain number of stations to be shut down at week-ends and on holidays. Under existing conditions the 20 stations in the Manchester district have 20 staffs working every week-end; if the "linking-up" project is carried forward, four or five stations will suffice for the supply of the whole district during week-ends.

* Abstract, from *The British Westinghouse Club News*, by permission.

The technical difficulties may be passed over; it is undoubted that these can be surmounted. In two cases only frequencies other than 50 cycles per second have been adopted. The real difficulty is that of the "human factor," in which category certain engineers must be included as well as members of local councils, boards of management, &c.

It is the opinion of the lecturer that co-operation between existing authorities can only come about through pressure from outside; in other words, the assistance of the Government will be necessary.

The proposal in regard to the Lancashire and Cheshire scheme is that the Board of Trade should set up a district joint board or committee for the whole district, which would include representatives of the several organisations concerned in the scheme. It would be possible for a single municipal supply authority, whose area was situated adjacent to several others, to wreck the whole scheme if it refused to allow interconnecting mains to pass through its area. Such a refusal could be indirectly counteracted, however. The Local Government Board, being the sanctioning authority for all moneys spent by local councils, could refuse to sanction loans to the particular authority refusing to enter into the scheme, and in that manner practically force it to co-operate with the other authorities in the district.

In order to obtain the maximum economy, the joint board, or its committee, would have powers to determine the running hours of the stations on the system. The board would, of course, have power to raise capital to provide mains and transformers, and would also act in an advisory capacity to the Local Government Board in regard to extensions of existing stations. That is to say, they would have the power to decide which stations should be extended, and where new plant should be put down, having in mind the question of maximum economy.

The joint board should have absolute authority in settling prices. Provided the working costs and load factor of each station are known, it will be an easy matter for a technical committee of the board to decide what, under the circumstances, is a fair and proper price.

The scheme is for the benefit of the district as a whole, and the very greatest injustice that could possibly happen to an individual authority would be a trifling matter compared with the tremendous advantage to be gained by reducing the present wastage.

The principal advantage of such a scheme is that it would provide an easy road to centralisation. With such a scheme in operation it would be found beneficial for the small undertaking to take all its supplies from the common system and eventually shut down its own generating plant. One by one the inefficient stations would cease to generate electricity and would act instead as transforming and distributing centres.

If the scheme is put into operation now, it will probably be found 10 years hence that the whole of the area now supplied by 21 stations will be supplied by only four or five generating stations, which are favourably situated as regards coal supplies and condensing facilities. The authorities whose generating stations will be closed down will be able to sell energy in their districts at a price which could never have been realised if they had continued to operate their own plants.

This appears to be the direction of future progress in regard to electricity supply, and the plan offers a comparatively easy and efficient method of obtaining the advantages of centralisation without the financial burden which would have to be supported if all the existing stations were closed at once in favour of a new system.

Another advantage which the joint board will exercise will be the bulk purchase of materials, while standardisation of price over a large area will also be possible.

In the past we have suffered severely from an epidemic of cheapness—cheapness that has cost us, as a nation, infinitely more than the difference between the price we paid and the price we should have paid to ensure a fair profit to the manufacturer. It is sincerely to be trusted that the price of electrical plant for British stations will never again be fixed in Germany or in the United States.

BUSINESS NOTES.

Correction.—In the advertisement of the KLAXON CO., LTD., appearing on page 14 of the Supplement of our last issue, the words "without flex and push" at the side of the block should not have appeared. The horn is supplied *with* flex and push.

Holidays.—The premises of the STERLING TELEPHONE AND ELECTRIC CO., LTD., will be closed for business from December 22nd to December 26th inclusive.

Electrolytic Copper in Germany.—After discussing for some time past the question of establishing a German quotation for electrolytic copper in substitution for the London quotation, a recent conference of merchants and consumers held at the Berlin Chamber of Commerce decided to form an Association especially for this purpose. The chairman is Herr Peierls, of the A.E.G.,

and the vice-chairmen are Herr Dietz, of the North German Refinery, Hamburg, Norbert Levy, of H. Levy & Co., Berlin and Herr Aschaff, of Basse & Seloe, Altona.

Private Arrangements.—THE TYLER APPARATUS CO., LTD., Banister Road, North Kensington, London, W., electrical engineers, &c.—In reference to this matter, particulars of which have already appeared in our columns, the following are creditors:—

Montmorency	£100	Cable Accessories Co.	£15
Walker, J. F.	108	Cable Electrical Co.	46
Brit. Insu. & Helsio Cables, Ltd.	139	Canning, W. & Co.	74
Walker, J. F.	100	Finnis, Downey, Lunnell and	
Walker, J. F.	115	Chesher	368
Essex Telegraph Co.	31	Brash, G.	20
Walker, J. F.	100	Baker, J. & Sons	40
Sun Electrical Co.	46	Brit. Insu. and Helsio Cables	229
Sun Electrical Co.	46	Brook, E.	74
Brown Bros.	100	Carl, J. W. & Co.	20
Walker, J. F.	100	Callender's Cable and Con. Co.	39
Dickson	212	Selson Engineering Co.	25
Carr, J. & W.	16	Sun Electrical Co.	36
Macnab, J.	254	Smith, H. & Co.	24
Walker, J. F.	100	Vacuum Oil Co.	22
Macnab, J.	200	Walters & John	26
Walker, J. F.	100	Robertson's Motors, Ltd.	39
Walker, J. F.	100	Hall & Pickles	111
Walker, J. F.	120	Willis, N. W.	63
Temple Press	3	General Rates	31
Metro. Mfg. and Eng. Co.	17	Willenden T. E. & Co.	40
Mathews, F. C. & A.	84	Atoll Garage, Ltd.	32
Mathews Bros.	21	Brach, W. J.	53
Moss & Gamble Bros.	19	Hart, F. G.	25
North British Rubber Co.	22	Jee, J. J.	1,775
Smith, W.	29	London United Tramways	750
Tyler Industries (Parent Co.)	205	Nicholas, E. J.	290
Farrer & Co.	30	Pearson, G. W.	201
Haywood, W. G., & Co.	25	Richard's Anti-Rust, Ltd.	30

Norway.—As a branch of their business, the Aktie Selskab-Elektrisk Industri have decided to set up a factory for the manufacture of conduits and fittings on the English system. The machinery has been ordered, and it is expected that the factory will be working in three months. The output capacity is 6 tons of pipe and fittings per day, which is expected to satisfy the whole requirements of the country.

Sweden.—Mr. Carl Rossander, the chairman of the Swedish Elektricitets-Verksforening, has advised the municipal members of his Union not to place their orders for electric cable and other accessories either in Great Britain or in Germany. He is obviously an advocate of absolute neutrality. The United States will, consequently, secure these orders.

Belgium.—H.M. Consul-General at Rotterdam reports that an agent at Bergen-op-Zoom, who formerly represented in Belgium and elsewhere a German electrical firm, desires to secure the representation in Belgium after the war of United Kingdom manufacturers of electrical material.—*Board of Trade Journal.*

Book Notices.—We note with interest in our esteemed contemporary *La Lumière Electrique*, that from January 1st that journal will combine with *La Revue Electrique*, and the two will appear in future as the *Revue Générale de l'Electricité*. The new weekly review will be the official organ of the Union des Syndicats de l'Electricité, and will be published at 12, Place de Laborde, Paris (8e), the subscription price being 40 fr. a year in France and 50 fr. abroad.

The fourth number of the *Journal of the British Science Guild* has now appeared. The *Journal* contains the recommendations of the Guild with regard to the establishment of a National Statutory Board of Science and Industry, a Report on the Reforms necessary in National Education, a Memorandum on the Encouragement of Teaching and Research in Science in British Universities, &c. Copies may be obtained from the Secretary, British Science Guild, 199, Piccadilly, W. Price 6d. each.

How to Avoid Accidents is the title of a handy pocket brochure issued by the British Dominions General Insurance Co., Ltd., of Royal Exchange Avenue, London, E.C., with the sub-title, "Instructions to Motor Drivers in Scotland"; it contains an excellent detailed set of instructions based upon official regulations and Acts, law cases, &c., which appear to cover all imaginable contingencies, and are so clearly worded, together with reasons why they are necessary, that they should prove invaluable to all owners of cars, drivers of motor-buses, and others responsible for the control of mechanically-propelled vehicles on public roads, and should afford effective aid in the development of the "Safety-first" campaign which has been inaugurated. A copy of the pamphlet is issued to the driver of every motor in Scotland that is insured with the company, and any interested reader can obtain one by applying to the author (their Edinburgh manager), Mr. W. T. W. Wells, 23, Danube Street, Edinburgh.

"Proceedings of the American Institute of Electrical Engineers." Vol. XXXV. No. 12. December, 1916. New York: The Institute. Price 81.

"Memoirs of the College of Engineering, Kyoto Imperial University." Vol. I., Nos. 6 and 7. Kyoto: The University.

New Aluminium Works in Bavaria.—It is reported that negotiations have been concluded which aim at the establishment in Bavaria of a large aluminium works, with the co-operation of the firm of Giulini, of Ludwigshafen. The undertaking which will bear the title of the Bavarian Aluminium Works Co., is to produce one-third of the total German consumption, and is to utilise the water powers of the Inn, where plant of 55,000 H.P. will be installed. The expenditure is estimated at £1,500,000, and the work of erection and equipment will occupy two years.

Machinery Users' Association (Inc.).—This Association held its annual meeting on Tuesday at the Windsor Hotel, Westminster, Sir Algernon Firth presiding.

British Industries Fair, 1917.—Application forms for space at next year's Fair are being issued by the Board of Trade. The event will be held from February 26th to March 9th, and as increased space is necessary, it will take place partly at the Victoria and Albert Museum, as last year, and partly in the Imperial Institute Building. The Fair will be confined to the same trades as last year. The Glasgow Municipality is, with the support of the Board of Trade, organising a Fair in Glasgow for the same time, but a few trades not covered in London will be included there.

Calendars.—From the SUN ELECTRICAL CO., LTD., of 118-120, Charing Cross Road, W.C., we have received one of their desk calendars for 1917. Under the difficult conditions now prevailing, the number available is limited, but applications on trade letter paper from those in the trade, who are not on the company's mailing list, will be attended to as far as possible. Sets of 1917 refill slips have been issued for the use of those already having the Sun base.

THE BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, has prepared its customary large wall calendar, showing three months on each page, the current month always appearing in larger form than the preceding and following ones. Each sheet carries a view of the works at Rugby and a half-tone illustration of some of the company's plant.

Roller Bearings.—MESSRS. BROOM & WADE, LTD., have received a contract for 350 Hyatt flexible roller bearings for line shafting, for installation in the new works in course of erection for the Daimler Co.

Catalogues and Lists.—THE BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, London, E.C.—Quotation No. 53,210 tabulates and prices a great variety of wiring accessories, the prices for small and large lots being shown. Electrical contractors and others who are on the firm's mailing list will receive these quotations showing the prices ruling at the time of receipt. Other readers can have copies on application.

STERLING TELEPHONE AND ELECTRIC CO., LTD., 210-212, Tottenham Court Road, London, W.C.—Publication No. 252 (16 pages) contains full descriptions, with illustrations, of the Sterling shaft signalling systems, with visual indicators, the apparatus being designed to comply with the new Home Office regulations in respect to electric signalling equipment in collieries.

Trade with Russia.—The paper by MR. W. H. BEABLE on "Russian Trade Opportunities and Methods," recently read before the Sales Managers' Association, together with the discussion thereon, is reprinted in pamphlet form (3d.), and copies can be obtained from the secretary, Mr. S. F. Talbot, 60, Wilson Street, Finsbury Square, E.C. The paper was fully abstracted in our issues of November 24th and December 1st.

Dissolutions and Liquidations.—ELECTRO-FLEX STEEL CO., LTD.—Creditors must send particulars of their debts, &c., to Mr. B. A. Fitzgerald, 82, Collingwood Buildings, Newcastle-on-Tyne, the liquidator, by January 31st.

W. W. OLDHAM & CO., electrical engineers, 7, Market Street, Hyde.—Messrs. W. W. Oldham and T. Bennisson have dissolved partnership. Mr. Oldham will attend to debts and continue the business on his own account at the same address. Mr. T. Bennisson will carry on business in his own name.

Bankruptcy Proceedings.—J. R. WHITEHOUSE, managing director of an electrical company, Golder's Green.—Application for debtor's discharge is to be heard at Barnet on January 23rd.

Trade Announcements.—The sole address of the PHONOPORE CONSTRUCTION CO., LTD., is now Phonoport Works, Southall, Middlesex. Concentration of the war-depleted staff at the factory will facilitate operations.

The firms of RATCLIFF & CO., of Marble Arch and North Audley Street, and RIDOUT & CO., 124, Regent Street, are amalgamating as Ridout & Ratcliff, Ltd., and will carry on business as electrical engineers at 42, Upper Baker Street, for the duration of the war. The firm will remove to larger premises in the West End on the conclusion of peace.

Owing to the present difficulty in obtaining supplies, it has been mutually agreed upon by the WANDSWORTH ELECTRICAL MANUFACTURING CO., LTD., Birmingham, and Mr. T. A. NUNWICK, of 4, Carr Street, Blackfriars, Manchester, to dissolve the agreement existing between them. This agreement will expire on 31st inst., after which date Mr. Nunwick will cease to represent them as their agent in Lancashire and Yorkshire.

LIGHTING AND POWER NOTES.

Arklow (Co. Wicklow).—The Town Commissioners are making an electric lighting installation on the northern quays; a petition has been extensively signed to extend the lighting to the southern quays. This, if undertaken, will involve the laying of a cable to bring the current across an arm of the bay.

Ashton-under-Lyne.—PRICE INCREASE.—The Corporation has given notice that after the current quarter the charges for electricity for lighting purposes will be increased by 1d. per unit over the pre-war rates.

Birmingham. **PLANT EXTENSION.**—The Electric Supply Corporation has ordered a further 600-kw. turbine set, and it is expected that the requirements of ordinary consumers and the tramways will in future be met.

Bognor.—The U.D.C. has decided to send to the B. of T. a protest against the decision of the Gas and Electricity Co. to increase the charges on all consumers of electricity per quarter, on the ground that it is a direct incentive to extravagance to charge for current whether used or not.

Bray (Co. Wicklow).—The L.G.B. auditor has reported that there are considerable arrears in the Urban Council's electricity department, and he urges that more stringency should be observed.

Continental. **FRANCE.**—It is reported that the closing of the shops at Paris on a particular day has not made a 5 per cent. difference in the consumption of electricity. Already several Paris companies have warned their consumers that henceforth the consumption of electricity charges must be reduced by 50 per cent. The increased demands of the factories for electricity for power will render necessary strong measures if these are to be satisfied.

The Minister of the Interior recently announced that the restriction of public lighting had resulted in a saving in coal of 44 per cent. as to regulated houses, inasmuch as a decree has been issued imposing on all municipalities a two-thirds reduction in public lighting as compared with the normal in the winter of 1914-15.

NORWAY.—The Ramnes District Council has decided to expend 200,000 kroner on the establishment of an electric power station. The Fredrikshald Town Council has decided to develop its recently-acquired waterfall near Brekke and Krappeto; 9,300 h.p. is to be generated at the turbine shaft. The total estimated cost of the undertaking, including the construction of a canal, is 2,174,000 kroner.

Croydon.—**PRICE REVISION.**—The T.C. has adopted recommendations of the Electricity Committee to the effect that all consumers of current for power, whether using a time switch or not, taking less than 2,400 units a year, be charged for the first 600 units consumed each calendar year at 2½d. a unit, and all excess units at the rate of 1d. a unit, and that all time switches be removed where the consumption of at least 2,400 units during the year is not guaranteed by the consumer. In this way (the Committee explained) a large number of time switches will be rendered available to meet the requirements of large consumers for some time to come, and the work of the department lessened.

Dorking.—**PRICE INCREASE.**—The U.D.C. has received an application from Messrs. Edmundson's Electricity Corporation, Ltd., asking for the Council's sanction to a continuation of the 10 per cent. increase in the rates for electricity for the six months ending June 30th, 1917, and also that for such period a further increase of 10 per cent. should be allowed. The Finance Committee recommended a further increase in the rates of 5 per cent., making in all 15 per cent. Mr. Moore asked if the increase would apply to power users, as they already paid a 20 per cent. increase. Eventually the Committee's resolution, with the addition of the words, "for lighting only," was agreed to.

Dublin.—Mr. Andrew J. Sargent, in a letter on the Gas Co.'s action in raising the hiring charge of gas stoves, suggests that the company is influenced by the fact that the Corporation cannot at present obtain cable for the supply of would-be users of electricity. In several instances gas stove users have decided to substitute electric stoves and heaters.

Edinburgh.—The Corporation has been notified that the Ministry of Munitions is unable to grant permission to proceed with the electricity extension scheme at Portobello, or to alter the existing tramways system.—*Daily Express.*

Featherstone.—**PROV. ORDER.**—The U.D.C. has consented to a prov. order being granted by the B. of T. to the Electrical Distribution of Yorkshire, Ltd., for the supply of electricity, &c.

Fort William.—**PUBLIC LIGHTING.**—The Fort William E.L. Co., not being prepared to agree to the Council's suggestion that a rebate of 20 per cent. instead of 10 per cent. should be allowed on the account for public lighting under restricted conditions, the Council has agreed to the company's terms.

Glasgow.—The police stationed at two of the busiest crossings in the central parts of the city are being provided, as an experiment, with helmets to which are attached small electric lamps, energised by a battery carried in the pocket. The lamp shows the constable's position, and indicates to which of the lines of traffic the crossing is clear.

Grimsby.—The Electricity Committee has decided not to recommend the Council to insure against loss of revenue from the Corporation electricity undertaking arising from possible damage by military operations.

Haslingden.—The inter-supply of electricity between Accrington, Haslingden and Rawtenstall has been inaugurated. Originally the Accrington undertaking supplied Haslingden, but owing to shortage of plant, the arrangement has now been extended so that Rawtenstall can assist in meeting the demands of Haslingden.

Hebburn-on-Tyne. **STREET LIGHTING.**—The U.D.C. has decided to discontinue the lighting of the street lamps until further notice.

Heywood.—**WAR BONUS.**—A war bonus of 2s. per week has been granted to the stokers, drivers, and motor and meter inspectors in the employ of the Corporation electricity department.

Huddersfield.—**PRICE INCREASE.**—Owing to the increasing cost of coal, the Electricity Committee has increased the price of electricity by another 12½ per cent. on the pre-war rate, the increase to come into operation on and as from date which the meters were last read for the current quarter expiring at the year end.

Kilmarnock.—**PROPOSED EXTENSIONS.**—The Corporation electrical engineer reported that Sir Alex. Kennedy had proposed installing a further 3,000-kw. turbo-alternator, but he (Mr. Bexon) advised that a 5,000-kw. machine be installed, so as to give a reasonable margin to spare. Mr. Bexon also points out that there is insufficient boiler capacity to deal with the load, and recommends that two or three Lancashire boilers be disposed of and that one Babcock & Wilcox boiler of 25,000 to 30,000 lb. capacity be procured. It has been decided to confer with Sir Alex. Kennedy on the subject.

Liverpool.—The Mersey Docks and Harbour Board has acquired 60,000 sq. yards of land adjacent to the wool warehouses abutting on Love Lane. It is suggested that electrical works in connection with the docks may possibly be constructed thereon.

London.—**ISLINGTON.**—The Lighting Committee has reported that the public street lighting was unsatisfactory, due to the difficulty of screening the powerful arc lamps. Experiments were made in the early part of this year with a view to substituting high-power incandescent lamps in certain thoroughfares. The Committee regrets that it will not be practicable to convert the greater number of the arc lamps in the borough, but steps have already been taken to ascertain whether it would be possible to use coloured glass shields in conjunction with the existing globes.

The Electric Lighting Committee has recommended a further increase of 10 per cent. in the charges for electricity, making a total increase of 25 per cent. on pre-war charges.

FULHAM.—The Finance Committee of the L.C.C. has recommended the Council to sanction the borrowing of £11,000 by the Fulham B.C. for the extension of the boiler plant.

POPULAR—ELECTROLYTIC DISINFECTANT.—The Health Committee of the B.C. reports having considered the position of the electrolytic disinfectant undertaking. It appears that 51,120 gallons of the disinfecting fluid were distributed during the period from January 1st to November 30th, 1916. Payment was received in respect of 1,019 gallons supplied to local firms at 8d. per gallon and 868 gallons supplied to the works department at 1d. per gallon. The Committee does not consider it desirable to interfere with the free use of the disinfectant by residents, and at the Council Schools and military guard-rooms, but is of opinion the supplies to the Poplar Guardians, the baths, the libraries, and the works department should be charged at the rate of 8d. per gallon, in order that the cost may be debited to the appropriate account, and the disinfectant account credited accordingly. For the quarter ended September 30th, the units sold by the electricity undertaking have increased, as compared with the corresponding period last year, by 170,000, and the net income by £2,946. The working expenses, however, show an increase of £3,442, owing largely to the higher price of coal. The net surplus of income over expenditure for the quarter is £1,579, which the Electricity Committee considers, in view of present circumstances, to be highly satisfactory.

Loughborough.—**PRICE REVISION.**—The Electricity Committee recommends that, as from December 31st, a further increase of 12½ per cent. be made to all consumers' accounts, including consumers under special contracts; the question of making a special charge to small consumers has been deferred till the end of the financial year.

Lowestoft.—The Electric Light Committee recommends that the Tramways and Electric Lighting Committee be amalgamated, and to include the whole of the members of both Committees, under the title of the Electric Works Committee. The Council adopted the recommendation.

Nottingham.—According to the *Nottingham Guardian*, the city electricity undertaking was severely criticised recently at the University College. The *Guardian* says that the plant is out of date, and ought to be scrapped, but that the Committee is limited financially owing to having surrendered much of its profit each year, instead of building up a larger reserve. The cost of electricity at the present time is said to be a hindrance to the prosperity of the city, against which the rate relief obtained from profit has to be considered.

Otley.—**E.L. PROPOSALS.**—The U.D.C. has decided to support the application of the Electrical Distribution of Yorkshire, Ltd., for a provisional order to supply Otley and district with electricity, and has instructed its representatives accordingly. One reason for the sudden reversal of the policy adopted in the past is said to be the poor quality of the gas now supplied in the town.

Paisley.—**YEAR'S WORKING.**—The accounts of the Corporation electricity undertaking for the year to May 25th last show that 4,504,593 units were sold, 1,793,000 being supplied to the tramway company and nearly as much for power and heating. The maximum observed load was 2,302 kw. The gross revenue amounted to £31,349, and the gross profit to £12,223; and after meeting financial charges, there was a surplus on the year's working of £337.

PRICE INCREASE.—The T.C. has decided to increase the charge for electricity for lighting by 1d. per unit; a new scale of charges for power supply has also been approved.

South Africa.—According to the annual report of the Government Mining Engineer, the total value of new machinery and plant introduced during 1915 amounted to £606,682. Included in the chief items are boiler plant, other than that of locomotives, traction engines, or steam wagons, £7,348; electric generators and engines, hoists, locomotives, and motors, £90,143; power lines, transformers, bells, telephones, &c., £79,180. The most important items comprise stamp mills and tube mills for the new mines on the Eastern Rand, winding plants for these mines, electric winders for other mines, and increases in the electrical plant at central power stations.

The following table shows the total units disposed of during the year by the power stations of Corporations and Municipalities, and by public supply companies in the S.A. Union. The units used for mining purposes, out of the total shown in the table, amount to 533,546,468 electrical and 147,928,535 compressed air units. The outputs of the power plants on the mines are not included in the table.

	Direct.	Alternating.
Transvaal... ..	22,820,266	707,212,164†
Cape... ..	17,356,943	22,426,823
Orange Free State... ..	599,186	1,834,063
Natal... ..	8,086,758	12,047,905
Total for 1915... ..	48,863,153	743,520,055
Total for 1914... ..	46,168,510	693,286,880‡
Total for 1913... ..	42,490,911	555,181,027*

† Includes 147,928,535 units of compressed air.

‡ Includes 121,014,096 units of compressed air.

* Includes 123,081,136 units of compressed air.

—*South African Mining Journal.*

Sunderland. **PLANT EXTENSION.** At a meeting of the T.C., it was reported that the Electricity Committee had accepted tenders for the ensuing year for the supply of coal of a much better quality than they had been using lately, and he believed that the improvement in quality of fuel would prove a remedy to the nuisance caused by the emission of smoke. The Treasury had agreed to the Corporation undertaking an extension of the Hylton Road works at a cost (estimated) of £15,000, and the Committee had accepted a tender for the supply of a new turbine set, which formed part of the scheme. The cost, however, would be substantially higher than pre-war prices. The report was adopted. It was also decided to extend the E.H.T. mains.

The Electricity Committee has recommended that the T.C. contribute £50 towards the cost of the action brought against the Hackney B.C. by the Gas, Light, and Coke Co. in connection with the charges for the supply of electricity.

Swansea.—The borough treasurer and the borough electrical engineer have been considering the best means of encouraging the supply of electricity to houses and premises where the occupiers are unable or unwilling to bear the initial cost of installation, and have now decided upon a scheme. It has been resolved that a fee of 5s. be charged in the following cases:—(1) Connecting up a supply after the same has been disconnected through non-payment of account; (2) for testing meters if, when such test is made, it is found that the meter is correct. The Public Health Committee is to install at the hospital electrical apparatus for cooking and heating, at an estimated cost of £20. The installation is expected to be of great assistance in times of stress and shortage of labour.

Thirsk.—**STREET LIGHTING.**—The Northern Counties Electric Lighting Co., in view of the Council's notification that there would be no public lighting required for the 1916-17 season, has asked the Council to make an allowance on the basis of a one year's contract. The Council has pointed out that the three years' contract was subject to the necessary money being voted by the parish meeting, which had decided against it.

U.S.A.—**THE NIAGARA POWER SITUATION.**—With further reference to this question, which was discussed in our issue of September 1st last, it is evident from a recent *Electrical World* article, that the threatened diversion of Canadian Niagara exported power from American to Canadian use is coming to pass. The journal states that about three months ago the Ontario Government was asked for additional power by several Canadian factories, and a demand was made upon the Canadian Niagara Power Co. for a larger supply. The company agreed to furnish 50,000 H.P. after a threat had been made to stop all exportation. The Canadian Niagara Co. is only supplying 35,000 H.P. and the Commission has demanded the additional 15,000 H.P. at once. Already an embargo has been placed on more than 18,000 H.P. formerly sent to Buffalo and other western New York cities, with the result that American generating companies have been unable to fill the increased demands made upon them. The maximum

supply received in Buffalo is 78,500 H.P., but it was estimated that some 90,000 H.P. would be demanded this month, and it is expected that the first unit of the Buffalo General Electric Co.'s steam plant, of approximately 25,000 H.P., will be operating this month. In order to meet the immediate demands, the Secretary of the U.S.A. War Department has authorised the Niagara Falls (N.Y.) Power Co. to divert an additional 1,400 cb. ft. of water per second from the river during the peak load hours in the morning and afternoon; this permission expires on January 1st next. It is stated that many Buffalo industries have had to close down, and that both public and private lighting has been restricted.

According to the *Central Station*, the number of ranges on the Boston Edison lines is nearing the 1,000 mark, and the company's cooking load is approximately 5,000 kw. Many of the finest apartments are being electrically equipped throughout.

Worcester.—The Town Council has decided that, in order to furnish a local firm with a three-phase supply up to 250 H.P., additional mains be laid at a cost of £270, in addition to the purchase of the 100-kw. transformer at £180. An increase in revenue of £160 to £200 per annum is expected, and if the scheme which it was understood was under consideration for largely increasing the electrification of the works was proceeded with, the revenue would be increased by £500 per annum. An application was received from another firm for a considerably increased supply of electricity, and they have been informed that the Committee could not spend £2,500 for temporary work, but owing to the increased demand in other directions, if the firm will undertake to contribute £1,800 towards the necessary expenditure, the Committee would be prepared to recommend the Council to undertake the work. The proposal was to be brought before the Council at the next meeting.

TRAMWAY and RAILWAY NOTES.

Australia.—The official opening of the Melbourne, Brunswick and Coburg electric tramway took place recently. A portion of the system has been in operation for some time, but the official opening had been deferred until the completion of the whole scheme. The cost of the undertaking is approximately £150,000, borrowed from the Commonwealth Bank at 4½ per cent. The journey from terminus to terminus takes 28 minutes, and a six-minutes' service will be maintained during the busy portions of the day.

Birmingham.—It has been decided to give a curtailed tramway service on Christmas and Boxing Days.

Continental.—**GERMANY.**—According to a London daily, all the German tramway lines are to be placed at the disposal of the War Department for the transport of goods needed by that department. Hitherto the tramways in practically all the German cities have stopped running for public use at 10.30 p.m., and have been used from 11 o'clock p.m. till 5 a.m. by the War Department. It is probable that in some of the large cities like Berlin the time limit will be made earlier.

NORWAY.—The Committee of Stavanger has issued an instruction for the laying of a coast railway to start from Hinna and end with a junction with the Jæder line at Næbo. The line is to be built for electric driving, and will be undertaken as soon as possible.

Darlington.—**HALFPENNY FARES.**—Halfpenny fares on all routes are to be suspended after 1 p.m. on Saturdays.

Doncaster.—**WAGES.**—The Corporation tramway employees (members of the Tramways and Vehicle Workers' Association) have applied for an advance of 1d. per hour; the offer made by the Corporation of a slight increase on the minimum rate has been rejected.

Edinburgh.—According to the *Glasgow Herald*, the T.C. has resumed its negotiations for the purchase of the Edinburgh and District Tramway Co.'s rolling stock at the termination of the lease. The company has now offered to sell its 250 cars for £50,000, and to be responsible for the upkeep of the tramway for six months after the termination of the lease.

Hull.—**HALFPENNY FARES.**—The Tramways Committee on Wednesday last decided to discontinue halfpenny stages as a war time economy. The working expenses since the commencement of the war have gone up £20,000 and the bonuses amount to £10,000.

Preston.—**COLLISION.**—As a result of a collision between two cars, through one jumping the rails on Saturday, 10 persons were injured and required treatment at the local infirmary.

Rochdale.—The tramway workers have been agitating for a substantial increase of wages for all grades, and notices were tendered to expire on December 16th, but the men have since agreed to submit the matter to arbitration by Sir Geo. Asikwith. Similar applications have been made to various tramway authorities in Lancashire and Cheshire, and Rochdale has joined a conference of these in asking the Committee on Production to arbitrate on the demands.

Salford. **STRIKE.** The appointment of women inspectors to the Corporation tramways has led to a strike of drivers. The Corporation has decided to cease work at midnight on Monday, December 18th, after negotiations which lasted all day. The dispute over the Tramway Committee's suggestion that the Committee's proposals should be referred to arbitration by the Corporation is prolonged, and that pending the decision of the arbitrators the women inspectors should be withdrawn from the Corporation. The men agreed to report for service on Tuesday morning, and the bus service, it was officially announced, would be then resumed.

Sheffield. **ELECTRIC VEHICLE ECONOMY.**—Councillor Roberts, in moving the minutes of the Health Committee, stated that the cost per mile of collecting refuse by electric vehicles was £1.50 as compared with £1.00 by horse labour. Electric vehicles are a great economy at the present time, especially as the cost of horse-feed had risen considerably in price.

Southport. **WAGES.** The tramway wages question has been referred to the T.C. who agreed to an all round advance to both driver and conductors.

South Lancashire. The tramway services in Manchester and surrounding districts were greatly disorganised on Friday and Saturday, owing to the dense fog which prevailed.

TELEGRAPH and TELEPHONE NOTES.

Glasgow. At a meeting of all grades of postal, telegraph, and telephone supervising officers, it was unanimously agreed to press for a substantial all-round increase of salaries.

Newcastle. Local shipowners have offered to subscribe £2,000 towards the establishment of a school of wireless telegraphy.

Wireless Patents in the U.S.A.—According to the *London Review and Western Electrician*, on October 12th a perpetual injunction was issued against the Marconi Wireless Telegraph Co. of America, prohibiting it from infringing the patents owned by the De Forest Radio Telephone and Telegraph Co., covering the De Forest Audion detector or amplifier. The litigation involved particularly Claims 4 and 6 of Patent No. 841,387 for "Improvements in devices for amplifying feeble electric currents," issued January 15th, 1907; also Claims 2, 3, 6, 11, 18, and 21 of Patent No. 879,532, entitled "Improvements in space telegraphy," also issued on January 15th, 1908. Both these patents were found valid and sustained.

Wireless for U.S. Transmission System.—The Southern States Power Co., operating in Southern California, has adopted wireless service between its different generating plants and substations. The company's system extends from Bishop to Calexico, a total distance approximating 100 miles; five hydro-electric power plants are located in the vicinity of Bishop, with a steam turbo-generating station of 11,000 H.P. capacity at San Bernardino. The northern plants are located in rugged country, subject to severe weather conditions, and causing considerable difficulty from time to time in maintaining communication over metallic circuits. Two sets of radio equipment have been installed in important stations on the main transmission system with highly satisfactory results, and it is planned to provide all the other stations with similar apparatus, in order that radio communication may be effected with every necessary point throughout the system. — *Electrical Engineer*.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—January 2nd. Small pea or bean coal (1,600 tons) for the U.D.C. Electricity Department. Mr. F. Garside, 1, Limes, Limes Road.

Australia.—**SYDNEY.** January 22nd. Electrical plant (converter, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.

February 19th. Municipal Council Meters, maximum demand indicators, feeder regulators. Specification from E.L. Department, Town Hall.

January 1st. P.M.G.'s Department. Cords, switchboard parts and accessories, measuring instruments and telegraph instruments. See "Official Notices" December 1st.

PERTH.—January 10th. P.M.G.'s Department. Telephone instruments and parts. See "Official Notices" December 15th.

Cape Town.—January 5th. Electric motors and starting panels, for the Corporation Electricity Department. Dock Road, Cape Town.

Durban.—January 3rd. Corporation. One 3,000-KW. steam turbine, alternator, and condensing plant. Specification No. S 238 and drawing No. P 597, both at the office of the Borough Electrical Engineer, Municipal Buildings. Deposit £2 2s.

Johannesburg.—January 3rd. Corporation. Iron axles and bushes.

Liverpool.—December 28th. Electrical supplies for three months, for the Tenthack Park B. of G. Mr. R. A. James, Clerk 15, High Park Street.

Manchester.—December 28th. Corporation Electricity Committee. Water-tube boilers and induced-draft plants for Stuart Street station. Specifications, &c., one guinea (returnable), from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

New Zealand.—**DUNEDIN.**—January 24th. Motor-generator accessories and spares. City Electrical Engineer, Market Street, Dunedin.

TAVRANGA.—February 12th. Borough Council. Supply of six three-phase transformers, 11,000/100 volts. Messrs. H. W. Cline and Sons Consulting Engineers, Rasthii. *N.Z. Shipping and Commerce*.

Spain. Tenders have lately been invited by the municipal authorities of Montijo (Province of Badajoz) for the concession for the electric lighting of the town during a period of eight years.

Wigan.—January 8th. Tramways Committee. 30-H.P. motor tower-wagon. Mr. Frank Buckley, General Manager, Market Place.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Department in London.

CLOSED.

Government Contracts.—List of new contracts placed during November, 1916:

WAR OFFICE.

Motor-alternator. Phoenix Dynamo Mfg. Co., Ltd.
Electric light fuse boxes and carriers.—Dorman & Smith, Ltd.; W. White and Co.

Bridge jacks.—Evershed & Vignoles, Ltd.

Electric cables.—General Electric Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph & India Rubber Works, Ltd.

Electric coils.—J. C. Fuller & Son, Ltd.; Siemens Bros. & Co., Ltd.

Motor-cumulators.—Brace Peckles & Co., Ltd.

Electric rod and sheet.—Bristol Ebonite Co., Ltd.; I.R., G.P. & Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.

Fans (extracting).—Sturtevant Engineering Co., Ltd.

Electric light fittings.—General Electric Co., Ltd.; S. Heath & Sons, Ltd.; Electric Co., Ltd.; Imperial United Lamp Co., Ltd.

C. H. Parsons, Ltd.; G. Roe & Sons, Ltd.; Sun Electrical Co., Ltd.; Verity, Ltd.

Generating sets.—Austin Motor Co. (1914), Ltd.; Coventry Engineering Co., Ltd.; Keighley Gas & Oil Engine Co., Ltd.

Electric lamps.—British Thomson-Houston Co., Ltd.; Crysco, Ltd.; Dick, Kerr & Co., Ltd.; Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.; Imperial United Lamp Co., Ltd.

Telephone poles.—Cook, White & Co.

Switches.—Berry & Hayward, Ltd.; Park Royal Engineering Works, Ltd.; Sperryn & Co., Ltd.; W. White & Co., Ltd.

Electrical instruments, terminals.—Automatic Standard Screw Co., Ltd.; Davis & Timmins, Ltd.; D. Gilson & Co., Ltd.; Ingram & Kemp, Ltd.; W. McGeech & Co., Ltd.; Sperryn & Co., Ltd.

Electric torches and parts.—British Ever-Ready Co., Ltd.; Edison Swan Electric Co., Ltd.; Elftand & Co., Ltd.; Siemens Bros. Dynamotube Works, Ltd.; C. Twigg & Co.; Vulco Battery Co.; Westwood Electrical Co., Ltd.

Works services.—Electric light installation at Bramham Moor; G. E. Carr. Electric light installation at Yarborough, Ellis & Ward, Ltd. Electric lights, &c., at Turnhouse; A. Arther & Ure.

INDIA OFFICE STAFF DEPARTMENT.

Pots.—General Electric Co.

Superheater parts.—Superheater Corporation.

H.M. OFFICE OF WORKS.

Engineering works.—Supply of engineering labour in day-work during a period of one year from January 1st, 1917, in Bristol. The Colston Electrical Co.

Electric wiring.—Foots & Milne, Ltd.

POST OFFICE.

Protective apparatus.—Phoenix Telephone & Electric Works, Ltd.

Telephone apparatus.—I.R., G.P. & Telegraph Works Co., Ltd.

Telephone apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; Peel-Connor Telephone Works Co., Ltd.; Western Electric Co., Ltd.

Tubular telegraph arms.—Siemens Bros. & Co., Ltd.

Submarine cables.—Telegraph Construction & Maintenance Co., Ltd.

Pole brackets.—Bullers, Ltd.

Telephone cables.—B.I. & Helsby Cables, Ltd.; Craigpark Electric Cable Co., Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; I.R., G.P. & Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.

Insulators.—New Gutta-Percha Co., Ltd.; Taylor, Tunncliffe & Co., Ltd.

Solder.—E. Austin & Sons.

Insulator spindles.—Bayliss, Jones & Bayliss, Ltd.

Stat swivels.—Bullers, Ltd.

Bronze wire.—B.I. & Helsby Cables, Ltd.; F. Smith & Co. (incorporated with London Electric Wire Co. & Smiths).

Tinned-copper wire.—B.I. & Helsby Cables, Ltd.

Galvanised iron wire.—Whitecross Co., Ltd.

Steel wire.—Whitecross Co., Ltd.

London.—**CAMBERWELL.**—The B.C. has extended for one year, from March 31st next, its contract with the Private Telephone Co. for the maintenance of private telephones.

BARNES.—U.D.C. Laying 600 yards of cable. Macintosh Cable Co., £289.

New Zealand.—**WELLINGTON.**—Public Service Stores Tender Board. Accepted tenders—

2,000 cords (4-conductor) for microtelephones, without switch, £178; 1,000 ditto, with switch, £88; 3,000 ditto, with switch, £270.—P. R. Baillie and Co.

1,500 switchboard plugs, £212; 2,500 ditto, £348.—B. L. Doune.

2,000 red and 2,500 white conductor cords, £609.—P. R. Baillie & Co.

1,000 extension bells, 1,000 chms. £406.—B. L. Doune.

New Zealand Shipping and Commerce.

NOTES.

Christmas, 1916.—We have received a specimen of the greetings card which is being sent to all members of the I.E.E. who are on active service. It reads as follows:—

"The President and Council and the Members of the Institution of Electrical Engineers send hearty greetings to all members of the Institution on Active Service, and wish them God-speed and a Happy Return."

"Christmas, 1916."

THE ELECTRICAL REVIEW also wishes to tender appropriate good wishes for Christmas and the New Year to all of its readers with the Forces on land and sea, far and near, as well as to the host of munition workers in electrical works who have been rendering strenuous service to the nation for so long, and have well earned the few days of rest that the holidays will afford them.

Visit of Journalists to Liverpool and Manchester.

The visits of journalists to Leeds and Sheffield which took place in October, and which were most successful, were supplemented on December 10th-13th by visits to Liverpool and Manchester. A reception of the representatives of the Manchester journalists on the evening of the 10th was followed on Monday, the 11th, by a visit to the University of Liverpool, where the party were received by Prof. Herdman (in the absence through illness of Vice-Chancellor Sir A. Dale), who, in a concise address, enlarged upon the importance of the work that was being carried on by scientific journalists, and also stated that the value of research work had been specially brought to the notice of the Government, and the latter (represented by Lord Crewe) had expressed great readiness to forward the views of the deputation. Prof. Herdman laid special stress upon the importance of research work with regard to the unforeseen results which might accrue from it, the value of which could not be foretold, but which were bound to be important: the help which scientific journalism could give in the matter was very considerable. The party were then conducted over the University, and shown the various technological and other departments; that of tropical medicine excited special interest, the bearing which it had upon the possibility of carrying out industrial enterprises in districts, where malaria had hitherto prevented the importation of labour, being pointed out.

Proceeding to Manchester the same day, the party received representatives of the Manchester Press, and next day were received at the University of Manchester by Vice-Chancellor Sir Henry Miers, and conducted over the buildings, the magnitude and completeness of which in regard to the scientific subjects dealt with from an educational point of view were very striking. The party were then entertained at luncheon by the Lord Mayor, who, in welcoming the journalists, stated that the union of scientific journalism with University technological teaching was to be strongly advocated. A visit to the Technological School followed. The comprehensiveness of the equipment of this school in reference to the number of industrial trades dealt with was very noteworthy. The day's proceedings terminated with a dinner given by the University authorities.

A marked interest in the proceedings was unmistakably evinced by the University authorities, and a full recognition of the help which trade journalism could give to the technological side of the Universities was shown. Whether the technology teaching is taken advantage of to the full extent desirable may be questioned, in view of the fact that the attendance at either Liverpool or Manchester previous to the war was but little over 1,000, although the annual fees for a complete course do not exceed £21. For the son of a working man, however, this amount may be prohibitive, and at Birmingham something is being done to bridge over the difficulty. The help which trade journalism may give to the Universities in enabling increased grants to be obtained from the Government, so as to enable fees to be reduced, and scholarships be provided, may be very considerable; certainly a good start has been made.

On Wednesday most interesting visits were paid to the British Westinghouse Co.'s works, and also to the works of the Ford Motor Co., the organisation of the latter being especially noteworthy.

A tribute should be paid to the chairman of the party, Mr. Leon Gaster, who is working most energetically for the promotion of University research and technological work, and who is also enabling technical journalists to know more of each other.

Electrical Music.—The "America's Electrical Week" Committees included music in the scope of their activities, and co-operated with manufacturers of electrically-driven musical instruments in arranging electrical concerts. Mr. E. A. Sperry, president of the New York Electrical Society, estimated that the connection of the two million pianos in America with the supply mains would represent a possible demand of some 200,000 h.p.

Industrial Organisation for After the War.—Some months ago, some 300 firms in the Scottish iron, steel, and allied industries met in Glasgow, and passed a resolution in favour of bringing these industries together in a strong central organisation to deal with post-war questions "in a comprehensive and Imperial manner." A Committee was appointed to consider what should be the nature, scope, and object of the organisation.

This Committee, according to the *Times*, has now issued a report. It points out that increased production will be the greatest factor in national prosperity after the war, and that it can be attained only by a more cordial co-operation between employers and workpeople; by efficient equipment and organisation on the one hand, and on the other, by the abolition of all restrictions and practices

limiting output. To secure mutual confidence, some form of payment by results, with basis rates, will be needed; and the workman should have some security that increased earnings following increased production will not be made a ground for rate-cutting. At the outset, therefore, any organisation of the industries should be prepared to co-operate with labour. Subject to these general considerations, continues the *Times*, the following are indicated as the objects of any central organisation:—

To direct the attention of the Government and its Departments, for their information and guidance, to matters requiring consideration and action in the interests of the industries concerned, and to initiate and review legislative proposals on commercial, industrial, and economic matters.

To deal with questions affecting the labour conditions and internal organisation and disabilities of the industries concerned, with a view to securing increased efficiency from an Imperial and national point of view.

To educate and inform public opinion."

The report sets out many examples of the questions which might have to be dealt with, among them being the question of means of giving workpeople a continuing interest in the prosperity of the industry which employs them, and the question whether some method of making Associations of employers and employees responsible for their members should be adopted.

The central organisation, the Committee suggests, should be a national advisory Council of Industry, consisting of a body of elected representatives of employers and a body of elected representatives of employees who might meet separately or jointly. The joint meeting should be presided over by a Minister of Industry.

Local Councils, the report states, might be desirable for the large industrial areas. Finally, the Committee recommends that a further Committee should be set-up to carry these general principles into effect, and that it should proceed step by step in consultation and conjunction with representatives in other districts of the industries concerned.

Tramway Employees' Wages.—An application put forward by employees in the traffic section of the London County Council Tramways for an increase of 15 per cent. on all current rates of wages formed the subject of arbitration proceedings at the Chief Industrial Commissioner's Department, Westminster, last week. The claim was based on the ground of the higher cost of living, and over 5,000 workers were affected, including drivers, male and female conductors, and pointsmen. A concession of 2s. a week, in addition to the existing war bonus of 3s. and 6d. for each employee's child under 14 years of age, was offered by the L.C.C., but this offer was declined. Evidence on both sides was heard at considerable length. The proceedings were conducted in private. The decision of the arbitrators will be communicated to the parties interested after a full consideration of the evidence.—*Morning Advertiser*.

Sweden's Electrical Industry.—The rise of Sweden's electrical industry was the theme of an address by Mr. C. A. Rossander before a recent joint meeting of the Swedish Electricitetsverkforenning and the Norse Electricitets-verkers Forening. The industry, said the speaker, divided itself into two groups—(B) Electricity works supplying lighting and power within a limited sphere, and (A) Power stations which generated and distributed at high pressure over wide areas. At present, of Sweden's 101 towns, nine only, and those among the smallest, were without an electric station, and with those the question was even now on the orders of the day for early settlement. Dealing with the (B) statistics in detail, the figures for the years 1905 to 1914 show that the works aggregate capacity rose from about 21,000 kw. in 1905 to about 125,000 kw. in 1914; the total installation costs from about 17,000,000 to about 69,000,000 kroner, or an average of about 550 kroner per kw.; the energy production from about 20,000,000 to something over 140,000,000 kw.-hours; while the total gross income rose from about 6,000,000 to nearly 17,000,000 kroner, or about 24.6 per cent. of the installation costs. In ten selected towns, the consumption per head advanced from under 20 to about 47 kw.-hours. The latest figures show a tendency to approximate to the possible maximum of 50 to 55 kw.-hours per head. One feature in connection with these works is worthy of special mention—the increase in the employment of water power. Of the 79 electricity works in the statistics for 1914, only 18 did not employ water power either alone or in conjunction with thermal power. Sweden's leading municipal power station—that of Stockholm—has hitherto produced all its energy by steam; but it is now taking steps to meet its needs from the water-power installation on the Dal River.

In the period under review—1905 to 1914—the price charged for electric lighting fell from about 41.5 öre per kw.-hour to 34.5 öre, or 17 per cent.; for motive power, from about 26 öre to below 19.25 öre, or about 26 per cent. At the same time, the receipts rose from less than 9,000,000 kroner to about 16,000,000 kroner.

Passing to the large power generating installations, or "A" works, the power transmitted, as well as the pressure, increased rapidly; 1907 saw an installation at 40,000 volts, and 1909 one at 50,000 volts, and an installation with a pressure of 80,000 volts has been put in operation. Up to 1914 concessions had been granted for a total of nearly 7,000 kw. of high- and medium-pressure lines, among which were included lines belonging to electric works not delivering energy for sale. In 1914 the total plant capacity installed was about 160,000 kw., and the annual energy production was about 465,000,000 kw.-hours. Installation costs stood at about 73,000,000 kroner, or an average of 445 kroner per installed kw. Taking A and B works together, the figures worked out at—total installed capacity 285,000 kw. and total energy production 550,000,000 kw.-hours. Most of the energy produced by A works goes to industries.

Cost of Electric Welding.—The accompanying data on repair work done by electric welding have been compiled by the Westinghouse Electric and Manufacturing Co. from the shop records of railroad companies. One company which has kept complete records of electric welding recently reported that the cost of welding by this process during one week was \$100.62, while the total cost of the same work if done by other means would have been \$1,779.04, representing a net saving of \$1,678.42 in favour of arc welding. In addition, a great saving in time was made. In another case, where an entire firebox had to be taken out, the work, including 35 ft. 7 in. of linear cutting, was done in 18 hours with approximately 500 amperes.

REPAIR WORK DONE BY ELECTRIC WELDING IN REPAIR WORK IN RAILROADS

Nature of work	Electric welding.				Old method.			
	Energy, kwh.	Labour, hrs.	Material, lbs.	Total.	Labour, hrs.	Material, lbs.	Total.	
Cracked door sheet on locomotive	7.5	0.5	0.12	0.1	30.00	21.00	34.00	
Cracked crown sheet on locomotive	—	—	—	—	—	—	—	
Fireboxes	—	—	—	4.23	—	—	24.35	
Cracked crown sheet	—	1.36	—	0.96	30 hr.	—	75.00	
Worn boiler plate	—	7.86	—	3.29	12 hr.	—	14.73	
Worn boiler plate	0.10	0.75	0.15	1.00	—	—	35.00	
Cracked crown sheet	0.03	0.42	0.75	0.71	—	—	34.00	
Cracked guide yoke	0.07	0.45	0.10	0.62	—	—	47.00	
Cracked boiler plate	0.27	1.36	0.37	2.59	10.20	13.00	18.20	
Cracked boiler plate	1.30	1.15	0.18	2.63	—	—	122.20	
Broken cylinder	0.80	0.65	0.11	1.56	9.80	4.00	13.85	

Electrical World.

Lighting the Statue of Liberty.—The idea of flood-lighting Bartholdi's Statue of Liberty, New York, was conceived in 1915, and a fund was raised for the purpose by subscription. Mr. H. A. Magdick, who was responsible for the flood-lighting of Woodworth Building, was entrusted with the task of designing an appropriate scheme of illumination, and Mr. R. F. Carbutt, of Henry L. Doherty & Co., took charge of the structural and electrical designing. The actual work of assembling equipment began late in October, and it was decided to inaugurate the permanent flood-lighting on December 2nd, the opening day of America's Electrical Week. It was decided to intensify the torch light. It was decided to transform the dull lantern into a flaming torch effect, and Mr. Gutzon Borglum was engaged to supervise the remodelling. The somewhat rude steel work which supported the range light, was removed, and in its place sheet bronze was used to re-design the torch in the shape of a "flame" of the form and size originally intended by Bartholdi. When the restored torch-flame was completed, all the bronze plates were cut out, leaving as a skeleton riveted lines about an inch in width. These plates were then used to construct moulds upon which 600 pieces of glass were bent; these pieces, when fitted in place, forming a glass torch held together by the bronze skeleton.

Mr. Borglum selected three tones of yellow cathedral glass. A dull surface was preferred, to avoid the blinding noon-day glare of a highly reflective surface. The lightest tint was used to simulate the tip of the flame, with slightly darker pieces inserted here and there variously down to the base of the flame, where the darkest of the tints define the lines of the bronze of the torch against the glass of the flame. The pieces of glass average about 1 ft. sq., making a complete glass area in the torch of some 600 sq. ft. The glass is so fixed to the ribs that any section may be replaced at any time from the inside. A lighthouse lens is fixed in the torch, and it will contain about 20,000 C.P.

Finally, to put "life" into the simulated flame of the burning torch, about 15 500-c.p. gas-filled electric lamps will be placed upon a series of flashers, to produce the unsteady, but constant, flicker of the torch.

The sources of the flood-lights are 15 batteries of projectors, the total number of projectors is 246, each being of 250 watts. The lamps are 35-volt lamps, and each of the projectors has its individual compensator to step down the 220-volt current to the lamp voltage.

We are indebted to the Society for Electrical Development for the foregoing particulars.

Russia: The 1886 Company: Swiss Protest.—According to the *Norvye Vremya*, the Swiss shareholders in the 1886 Company are alarmed to learn that the concern is indeed to be wound up, and have applied to the Minister of the Interior, A. D. Protopopoff, with a memorandum, expressing their confidence that the Russian Government, through the Council of Ministers, will reject the project of the Committee for Suppressing German Control which has decided for the liquidation, and that it will not allow any change in the rules made re the 1886 Company last year. Besides, the Swiss shareholders affirm, again, that most of the shares are not in German hands, but are in the hands of Swiss citizens. In conclusion, the memorandum commends the impartiality of the Minister of the Interior, who they hope will not permit the injustice of the liquidation of the company. The memorandum has been handed to the President of the Council of Ministers.

A Large Battery Installation at Winnipeg.—A special battery building has recently been constructed by the Winnipeg Electric Railway Co. to house a 3,000-ampere-hour storage battery,

which is to be used for stand-by railway service and for improving the station load factor. The building is 41 ft. wide x 196 ft. long and 16 ft. high, and provides space for a fan room 41 ft. long x 12 ft. wide x 10 1/2 ft. high at one end, and for a switch-board room at the other end. The foundations are of concrete, the roof of double concrete with 3-in. air space and four monitor roof ventilators, supported by reinforced concrete pillars. The floor is made of vitrified brick pavement with asphaltum filler laid on an 8-in. concrete base having a fall of 17 in. from one end to the other. The building is ventilated by an indirect steam heating system, air being forced through steam heated coils into concrete ducts running longitudinally the entire length of the building, allowing air to circulate up into the battery room and out through the monitor ventilators.

The battery is of the Tudor type with a rating of 5,000 ampere-hours. There are 286 cells, each composed of 184 in. x 184 in. in lead-lined wooden tanks, each supported on 10 oil-insulated porcelain supports. The terminal cell connections are made of lead-coated copper bus.

A compensating and recording hydrometer installed in a lead-glass case gives a constant record of specific gravity, and also indicates by means of a bell alarm to the switchboard operator when a certain charging point has been reached.

In conjunction with the battery there is installed a 3,300-ampere, 175-volt, inter-pole type booster set.

The battery is protected by a 6,000-ampere, 650-volt, circuit-breaker mounted on a reinforced marble board. A single-pole, double-throw switch allows the battery to be operated in conjunction with the booster, or in case of emergency to be thrown directly across the railway bus.

In case of emergency, such as a shut-down on the transmission line, the battery is immediately thrown directly across the railway bus and keeps the cars in operation long enough to allow the operators to get the railway machines back on the line again. On one or two occasions when the battery has been directly across the railway bus, discharges as high as 9,000 amperes have been observed by the operators.

The battery is kept floating on the line continually, and is of great assistance on peak loads. The charging of the battery is done mostly at night when the cars are not in operation.—*Electrical World.*

Sheffield's Future.—The *Times* states that the Sheffield City Council, last week, discussed the appointment of an Industrial Development Committee. The Deputy Lord Mayor said the city, by the great enlargement of its electricity undertaking, was making provision for the future, and it was necessary, if they wished Sheffield to retain its present foremost position, that they should do all they could to develop its industries. A Committee was appointed to deal with the subject.

Overhauling a Big Set.—The Commonwealth Edison Co., of Chicago, recently performed what must be considered a feat of speed. The 30,000-Kw. turbo-generator at the Northwest station was shut down at midnight on a Saturday for its annual cleaning and overhauling, which includes overhauling, inspecting, cleaning, renewing worn turbine blades, and replacing practically the entire auxiliary water-handling system of turbine and pumps. The condenser had also to be cleaned, and about one thousand tubes removed and replaced. This was done, and everything replaced, and the machine made ready for service within 70 hours.

The turbine unit measures 60 ft. in length, 15 ft. in height, and 19 ft. in width. The total weight, including the condenser, is 1,182,000 lb., the low and high-pressure turbine weighing 477,000 lb. There are 10 single high-pressure stages and two low-pressure stages. The turbine is rated at 45,000 H.P., and operates at 1,500 R.P.M. Steam is furnished through a 20-in. header at 250 lb. pressure, and superheated to 625°. Of the steam-admission valves, 18 in number, 14 are used up to full load, and admit steam to the upper half of the first stage, while the other four are used for overloads.

The condenser is of the two-pass surface type, and contains 11,000 tubes of 1 in. diameter each, constituting a cooling surface of 50,000 sq. ft. The cooling water in the condenser weighs 65 tons. 52,000 gallons of circulating water are passed through the condenser per minute, requiring for this purpose a 650-H.P. Curtis non-condensing turbine, which operates at 1,500 R.P.M., directly connected to a 48-in. double-suction centrifugal pump working against a head of 15 ft.

Institution and Lecture Notes.—**Fuel Economy.**—At Nottingham University College, last week, Prof. H. E. Armstrong gave a lecture on a national fuel and power policy, in the course of which he severely criticised the policy of the Nottingham Corporation, which was alleged to refuse to supply electric power to factories except on terms that applied to the ordinary small consumer, with the result that several important firms in the town were installing electric power plant of their own. He strongly advocated the establishment of a central Fuel and Power Board, which should promote the scientific use of coal, and dwell on the importance of carbonising coal at a low temperature, so as to obtain a good smokeless fuel for domestic use, gas for power, and all the residuals. A resolution was unanimously adopted urging the immediate development of a national policy to govern the use of our fuel supplies.—*Nottingham Guardian.*

Leeds Association of Engineers.—The annual report for the past year states that the surplus revenue amounted to £101, and the assets were valued at £5,050. Satisfactory progress has been made during the year.

Inquiries.—Makers of the "Realm" lamps, and of "Hohly Tuxham" and "Houmoller Alpha" marine motors, are asked for.

Fatality.—Patrick Davis, a Dublin electrician, was fatally crushed at Amiens Street Railway Station (Great Northern of Ireland), on Saturday last.

Nitro-Energy.—In this period of stress and strain, the importance of the Sunday newspaper has advanced by leaps and bounds. Very few of us are content to wait from Saturday night till Monday morning for the latest news from the Front. Incidentally, therefore, the immense amount of printed matter which is now supplied in the leading Sunday papers has acquired a new importance. All the more is it to be regretted that such articles as the one which appeared in a Sunday contemporary recently, headed "Nitro-Energy," should be dangled before an anxious and unscientific public. The matter that caught our eye was one of the sub-headings, "Electricity at 1/50th the Cost."

Reading the article we find that an American mining engineer has come to England with an invention for using nitrogen as an energy-producer in place of coal, at a fraction of the cost; and he is generously offering it to the British Government. His estimate of the total nitrogen in the earth's atmosphere now available for use in the production of the new power is nearly 4,000 billion tons. Lest there should be any anxiety, however, that this enormous supply should eventually be completely used up, we are informed that, unlike all other fuels, which are destroyed, his method of using "nitro-power" converts the fuel back into its elemental state. Obviously, therefore, we have here a source of unlimited power which will last for ever and ever, without diminution, like the widow's curse.

When we had fully taken this in, we were prepared to read further that this new energy could be used for every purpose for which coal and crude oil are now used, even to smelting.

This great invention is not only to come in as part of the reconstruction in that dim and happy future, after the war, but it is even to be made available for war purposes within the next three months. "Submarines large enough to mount 6-in. guns can be driven twice round the world by this energy without re-fuelling." The difficulties in connection with freight in shipping tons of mere fuel will, therefore, be entirely avoided. The energy melts away into the water, or the ether, or somewhere, without causing any bubbles to rise to the surface to betray the presence of the submarine. No batteries are needed, the space occupied by them being available for torpedoes. The speed claimed for the new submarine is the same as that of a destroyer of the present day.

No smoke stacks are required, and we are told, further, that half a ton of nitro-energy on a battleship or a cargo boat would do the work of 600 tons of coal and leave immense space for war material in the one and for commerce-carrying purposes in the other.

The inventor, we are told, is producing temperatures of 8,000° F., and yet the temperature outside the generators is the same as that of the surrounding atmosphere. The action is all automatic.

The inventor concludes by saying that he could, if he wished, form a company in the City to work the invention, but that is not his purpose. "It is an invention of such stupendous possibilities, that I want to place it in the hands of the nation."

Many times before we have had occasion to remonstrate with our non-technical contemporaries over articles, generally in connection with new inventions, upon which they should have sought expert opinion. In these days it is really deplorable to find that the power of the Press can be applied in our own particular field with such absolute ignorance of the first principles of science. Surely, with so many scientific men practically out of work, it would not be difficult for wealthy newspapers to get the advice of one or two such men before printing matter of this kind—fatuous drivel from start to finish.

A Siemens Centenary.—In honour of the centenary of the birthday of their ancestor, Werner von Siemens, the von Siemens family, says a telegram received by wireless from Berlin, have established a fund of £50,000 for the construction of houses for employes and workmen. The Siemens & Halske Co., Ltd., and the Siemens-Schuckert Works have each added £50,000.—*Times*.

The Tribunals and Diesel Men.—We read in the *East Anglian Times* that at the Felixstowe Tribunal, last week, the Electricity Supply Co. claimed conditional exemption for the following men, viz.:—An electrician and Diesel engine-driver in charge of a power house, married, aged 30, on the ground of certified occupation and national interest; the Tribunal gave the man temporary exemption to March 31st next. A fitter, turner, and Diesel engine-driver, married, aged 24, on the same grounds; the Tribunal decided not to assent to the application. An engineer and electrician, married, aged 37, on the same grounds; the Tribunal gave the man temporary exemption to January 31st next, no further application without leave of Tribunal. An engineer and electrician, married, aged 36, on the same grounds; the Tribunal gave the man conditional exemption.

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place.—Lieut. Col. C. B. Clay, V.D., Commanding.
From *Thursday, December 21st*, to *Thursday, December 28th*, inclusive.—Headquarters closed.
Friday, December 29th.—Technical for Platoon No. 10, at Regency Street. Squad and Platoon Drill, Platoon No. 9. Signalling Class. Recruits' Drill, 6.25 to 8.25.

(By order) MACLEOD YEARSLEY, Adjutant.

Industrial Research in Canada.—The Canadian Government has appointed an honorary advisory council on scientific and industrial research to advise a committee of the Cabinet on all matters relating to the extension and co-ordination of scientific and industrial research.

Self-Luminous Compound for Switches.—One of the large manufacturers of switches, sockets, and supplies is now preparing to bring out a line of electric light switches and sockets painted with a self-luminous compound which will render their position visible in the dark. A "radium" paint will be used, similar to that already employed on luminous-dial watches, compasses, &c. This paint is continuously self-luminous, and it should be noted, is to be distinguished from the luminous paints and pull-chain balls which have been on the market for some years, which require exposure to strong light to make them luminous in the dark for a period of several hours.

The base, zinc sulphide, is the same for the new self-luminous paint as for the older phosphorescent paint which absorbs light and then gives it out again, shining with a greenish or bluish glow in the dark. The new paint, however, contains a small quantity of radium bromide, the alpha particles of which, continuously bombarding the crystals of the sulphide, render it luminous in the dark with a pale greenish glow of about the intensity of a rubbed phosphorus match. By increasing the quantity of radium compound included in the paint, the more brilliant can this phosphorescent glow be made. On aeroplane compasses used by the European armies, the luminous compound employed is of such intrinsic brilliancy that its glow can be seen even in contrast with twilight. Such a high mixture of radium compound, however, rapidly disintegrates the zinc sulphide, so that the life of the paint may be barely 12 months. In the intensity to be used on the new switches, which has been found most practical for average use on watch dials, &c., the figures are readily visible in a darkened room, and such paints have an assured luminous life of 10 to 15 years, if not longer.

It is proposed to tip the switch push buttons with this luminous compound, so that when entering a darkened room the user can quickly find the button, press it, and secure electric light.

In order that ordinary flush switches already installed may be made luminous, the electrical manufacturer referred to has devised the ingenious expedient of luminous-head screws which can be used to replace the present screws, giving visible points of luminosity by which the switch can be located in a darkened room.

The cost of making and applying the self-luminous paint is, at present market prices of materials, about \$1 per sq. in. At this rate it is expected that the extra cost of equipping an ordinary electric light switch will be from 20 cents to 30 cents.—*Electrical World*.

The A.C. Arc used in Scrapping Plant.—When the Llewellyn Iron Co. took the contract of dismantling and scrapping three compound Corliss engines and the three 800-kw. direct connected generators in an old railroad power house in Los Angeles, it was discovered that in order to reduce the machinery into pieces small enough to handle, a great amount of cutting must be done on the job. It was impracticable to use the oxyacetylene flame, for the reason that practically all of the cutting was on cast-iron. To drill and wedge the various pieces apart was a laborious job, and the following method was tried as an experiment.

Two 50-kw. transformers were set up in the engine-room and connected to a single-phase 2,200-volt, 50-cycle main, through fuse blocks and an oil switch, from the Southern California Edison Co.'s system. The primaries of the transformers were connected in series while the secondaries were connected in parallel, so as to supply 52-volt service. Two 4/0 cables in parallel made up each secondary lead, one lead terminating at a movable holder which consisted of a hollow wooden rod about 5 ft. long, to the end of which was fastened a metal clamp for holding a carbon electrode 3 in. in diameter and about 12 in. long. The other lead was made fast to the casting that was to be cut.

In order to prevent abnormal surges on the line, a resistance of about 30 ohms was inserted in series with the primary. With 52 volts on the secondary it was impossible to maintain the arc, especially on heavy cutting, so the primary connections were changed to parallel, giving a transformer capacity of 100 kw, with the secondary voltage raised to 110.

With one man occupied continually with the cutting, the energy consumption for about one week's use was approximately 1,000 kw.-hours measured on the primary. With a light cut, such as the spokes of the fly-wheels, collector rings, foundation bolts, piston rods, and the like, the normal current in the primary was about 35 amps, with swings to 100 amps. On heavy cuts, such as armature spiders, bed plates, and wheel rims, the current consumption was around 60 amps, with swings as high as 150 amps, measured on the primary.

Since the apparatus used was very crude, the time necessary to make the cuts was longer than would be needed with a more refined equipment. To cut a 2-in. foundation bolt required from three to four minutes, depending on the ease with which it was possible to approach the work. A cast-iron ring of section 25 in. × 1½ in. was cut through in one hour's time. The carbon consumption was a practically negligible quantity, except for breakage due to the cumbersome holder. A 3-in. diameter carbon 24 in. long was sufficient for all the cutting that was done in 10 days. It is contemplated to install an equipment of this kind as a permanent arrangement, substituting a reactance in the primary in place of the resistance to limit the primary current to ten times the full load current of the transformers.—G. W. TEFFAU, JR., in the *Electrical World*.

Flood-lighting Policemen.—In St. Louis, U.S.A., the policemen at busy crossings are being put in the possession of a new weapon in flood-lighting projectors, which can be used on motor buildings so that the constables can see without annoying them or the drivers of vehicles.

Fire.—The *London Telegraph* states that a disastrous fire occurred at Tonbridge, last Saturday, resulting in the complete destruction of the telegraphic and electrical stores of the South-Eastern Railway.

Northampton Polytechnic Institute.—On Saturday afternoon the annual prize distribution took place, the prizes and certificates being presented by Mrs. R. Mullinoux Wadsway. The presentation was preceded by an organ recital, and after the ceremony the proceedings concluded with the Rumanian and British National Anthems.

Glasgow Electricians' Wages.—The arbiter in the dispute between the Electrical Contractors' Association of Scotland and the Electrical Trades Union in connection with an application by the latter for an advance of 2d. per hour for their members employed by firms in the Association in the Glasgow district has, after consideration of all the circumstances, awarded to the electricians and armature winders in the employment of the above firms an increase of 1d. per hour, on the same terms as those on which this increase was granted to the men concerned in the Clyde district by the award of the Committee of Production on September 20th last, but with the difference that the increase in the present case shall begin on the first day following the issue of this award. (*Telegraph Herald*.)

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station Officials.—Chesterfield Corporation has advanced the salary of Mr. E. P. AUSTIN, assistant borough electrical engineer, from £220 to £250 per annum.

Mr. W. M. GIVAN, who has held various positions in the electrical department of the Belfast Corporation, has been appointed general electrical superintendent at the central generating station.

Mr. A. W. JOHNSON has been appointed charge shift engineer at the L.C.C. Greenwich generating station at a salary of £250 a year, rising by annual increments to £300.

General.—Mr. E. EASTWOOD, who for the past 11 years has had charge of the electrical repair shops of the London County Council tramways at their central repair depot, Woolwich Road, has resigned his appointment with them, and has accepted the post of manager for the Electrical Repair Co., Martin's Yard, Endwell Road, Brockley, S.E., who are specialising in all types of armature and field coil winding and repairs.

The John Fritz medal was awarded in January, 1916, to Dr. ELIOT THOMSON, for "Achievements in Electrical Inventions, in Electrical Engineering, in Industrial Development, and in Scientific Research," and was to be presented to Dr. Thomson in Boston on December 8th.

Roll of Honour.—The *Staff War Bulletin* of the County of London Electric Supply Co., Ltd., and associated companies, including the South London Electric Supply Corporation, contains a Roll of Honour revised to date, and photographs of men holding commissions. Since the last issue 54 more men have joined the Services, making the total to date 408. Interesting extracts from letters from the Front are given.

The Serbian Military Medal, for services rendered in the field at Salonika, has been awarded to Sapper J. B. SULLIVAN, of the Signalling Section of the R.E., who was formerly in the engineer's department of the telephone office at Canterbury.

Rifleman J. ELKINGTON, Rifle Brigade, who has fallen in action, was prior to the war with the British Thomson-Houston Co., Ltd., at Rugby.

CORPORAL SOLDIER MAJOR ALAN CORLE, who has died of wounds, was a draughtsman with Messrs. Mirlees, Bickerton and Day, Stockport.

Gunner WILLIAM WOLSTENHOLME, R.F.A., who has been invalided home from France, was employed by Messrs. Jones Bros., electricians, Blackpool.

Private HARRY BURNS, Manchester Regiment, reported missing, was employed by Messrs. W. T. Glover & Co., Ltd., Trafford Park.

Lance-Corporal BERNARD ABRAMS, Manchester Regiment, wounded and in hospital, was employed by Messrs. I. Frankenberg & Sons, Ltd., Salford.

Second-Lieutenant ROBERT CARR, R.E., assistant manager of the Ormskirk Gas & Electric Co., has been awarded the Military Cross.

Private R. TENNANT, Machine Gun Corps, aged 26, killed in action, was with Messrs. D. Royan & Co., of Glasgow, as an electrician.

Captain P. T. FOYSTER, R.E., aged 28, who died of wounds on December 11th, was, according to the *Times*, assistant engineer to the British Engine & Boiler Insurance Co., at Manchester.

Corporal MARK BOGG, who has been awarded the Military Medal, was an employee at the Leeds Corporation electricity department. He has been wounded four times.

Private JOHN APPLEY, North Staffs. Regiment, who enlisted whilst on the staff of the Hanley Electricity Works, is reported missing.

Sergeant W. E. RICKARD, R.A.M.C., a former employee of the India Rubber, Gutta-Percha & Telegraph Works Co., Ltd., has won the Military Medal.

Obituary.—Mr. G. H. POWNALL.—Mr. G. H. Pownall, President of the Institute of Bankers, to whose address on banking and trade and industry we recently referred in the *ELECTRICAL REVIEW*, passed away last Saturday at the age of 67 years.

Mr. EDWIN HODGSON.—The death is announced, at the age of 61 years, of Mr. Edwin Hodgson, who had for a long period carried on business as an electrical engineer at Northgate, Cleckheaton.

SEC.-LIEUT. JOHN SEAR GIBSON.—Sec.-Lieut. John Sear Gibson, attached to the Trench Mortar Battery, who has died of wounds received in action, aged 32, was an electrical engineer at Tunbridge Wells, and an A.M.I.E.E.

Will.—The late Sir JAMES SIVEWRIGHT left estate of the value of £98,784. The bequests include £10,000 to the Senatus of the University of Aberdeen, and £5,000 to the Committee of Milne's Institute, Fochabers.

NEW COMPANIES REGISTERED.

Midland Dynamo & Motor Repairs, Ltd. (145,468).—

This company was registered on December 5th, with a capital of £2,000 in £1 shares, to carry on the business of electricians, electrical, mechanical, motor, telephone, heating, ventilating, and general engineers, bell-foundry, fitters, maintainers, and repairers of and dealers in all kinds of electrical apparatus, aeroplanes, airships, motor cycle and car fittings, alabaster, porcelain, china, and earthenware goods, petrol, benzol, and oils, varnish, and chemicals of all kinds, &c. The subscribers (with one share each) are: B. Gill, 49, Winchester Avenue, Leicester, electrical engineer; G. Ward, 420, Narborough Road, boot and shoe manufacturer. Private company. The first directors (to number not less than two or more than four) are: B. Gill and G. Ward, Solicitors, W. Harding, 14, New Street, Leicester. Secretary: F. Haynes, 84, Pocklington Walk, Leicester. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

Midland Electric Co. (Southport), Ltd. (145,444).—This

company was registered on December 2nd, with a capital of £1,000 in £1 shares, to take over the business carried on at Southport (Lancs.) by T. E. K. Greenhalgh, as the Midland Electrical, Gas & Incandescent Co. The subscribers (with one share each) are: T. E. K. Greenhalgh, 99, Hawkeshead Street, Southport, engineer; A. L. Clough, 85, Liverpool Road, Birkdale, accountant. Private company. The first directors (to number not less than two or more than five) are to be appointed by the subscribers. Qualification, £200. Remuneration as fixed by the company. Solicitors: J. P. Mitchell, Southport. Secretary: A. L. Clough. Registered office: 16a, Hill Street, Southport.

Reuter's (1916), Ltd. (145,516).—Registered December

11th by Bircham & Co., 50, Old Broad Street, E.C. Capital, £200,000 in £1 shares. Objects: To take over the telegraphic business heretofore carried on by Reuter's Telegram Co., Ltd., to carry on and extend the same, to obtain and supply wireless, telegraphic, telephonic, and other news and intelligence, to carry on business as advertisement contractors and agents, to construct, purchase, hire, or otherwise acquire and work wireless installations, telegraphs, and telephones, to undertake and facilitate the collection and remittance of money, securities, and other valuables, merchandise, and property in, to, and between any part or parts of the world, and either by wireless, telegraph, telephone, or otherwise to grant and issue letters of credit and circular notes, to receive deposits of money and securities, to open credits, and generally to utilise the means of intercommunication possessed by the company for the purpose of granting pecuniary, financial, and commercial facilities in and between any part or parts of the world, to advance money on and deal with bullion, specie, produce, and merchandise, and the documents of title relating thereto (particularly in connection with the dispatch or carriage thereof from different countries or places), to act as bankers, and carry on every description of English and foreign banking business, to undertake mercantile, financial, insurance, and other agencies, especially in foreign and distant places, and on instructions given or transmitted by wireless, telegraph, telephone, mail, or similar means of communication, &c. The signatories (with one share each) are: Lord Glenconner, 34, Queen Anne's Gate, S.W.; Sir Leander Starr Jameson, Bart., 2, Great Cumberland Place, W. Private company. The first directors (to number not less than three or more than eight) are the Hon. Mark F. Napier (chairman), the Hon. Edmund Parker, George Grinnell-Milne, Gerald W. Williams, Roderick Jones, and John Buchanan-McNemara (excluding any director whose name may determine £2,300 per annum, or such larger sum as the company may determine, divided between them. Solicitors: Bircham & Co. Registered office: 24, Old Jewry, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electro Mechanical Brake Co., Ltd. (98,276).—Capital, £30,000 in £1 shares (2,500 pref.). Return dated November 6th, 1916, 1,500 pref. and 22,500 ord. shares taken up; £1 per share called up on 1,500 pref. and 16,465 ord.; £17,965 paid; £6,035 considered as paid on 6,035 ord. Mortgages and charges: £7,500.

Capo Electric Tramways, Ltd. (54,636).—Capital, £300,000 in £1 shares. Return dated November 29th, 1916, 491,222 shares taken up; £1,222 paid; £300,000 considered as paid. Mortgages and charges: £461,700.

Landaulet Co., Ltd. (72,890) (formerly known as Electric Landaulet Co., Ltd.)—Capital, £50,000 in 410 shares. Return dated June 28th, 1916. 3,928 shares taken up; £39,280 paid. Mortgages and charges, £6,000.

Frederick Braby & Co., Ltd. (2,537c.)—Capital, £400,000 in 37,300 ord. and 2,500 pref. shares of £10 each. Return dated August 3rd, 1916. 27,500 ord. and 2,500 pref. shares taken up; £10 per share called up on 24,250 ord. and 2,500 pref., and £6 per share on 3,250 ord.; £287,020 paid, including £20 on five forfeited shares; £13,000 (£4 per share) considered as paid on 3,250 ord. Mortgages and charges: £53,000.

Electrical Installations, Ltd.—A memorandum of satisfaction to the extent of £300 on November 30th, 1916, of debts. dated December 5th, 1906, securing £2,000, has been filed.

Reid Bros., Engineers, Ltd.—Particulars of £7,000 debts., created November 28th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including un-called capital. No trustees.

Veritys, Ltd.—A memorandum of satisfaction in full on September 12th, 1916, of mortgage dated April 26th, 1914, securing £800, has been filed.

Llanely and District Electric Lighting & Traction Co., Ltd.—Second supplemental trust deed dated November 30th, 1916 (supplemental to trust deeds dated August 3rd, 1911, and November 10th, 1912), securing £47,000 deb. stock ranking *pari passu* with £75,000 like stock issued under principal and first supplemental deeds, charged on lighting and tramway undertakings, leasehold power station, and car sheds, and company's other assets, including un-called capital. Trustees: Century Insurance Co., Ltd., 18, Charlotte Square, Edinburgh.

Traction Development, Ltd.—Mortgage debenture dated November 10th, 1916, to secure £2,000, charged on the company's undertaking and property, present and future, including un-called capital. Holder: F. L. Davis, Leadenhall Street, E.C.

Electrical Contracts & Maintenance Co., Ltd.—Particulars of £1,000 debentures, created December 5th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including un-called capital. No trustees.

W. H. Allen, Son & Co., Ltd.—Mortgage dated November 21st, 1916, to secure £103,880, charged on certain lands and premises in London, Biddell, and Westmore, life assurance policy, and company's undertaking and other assets present and future, including the benefit of a contract subject to prior charge.

Dixon & Corbitt and R. S. Newall & Co., Ltd.—Deed dated November 22nd, 1916 (supplemental to trust deed dated November 1st, 1904, securing £35,000 debts.), extending term and securing an increased rate of interest on the said debts, charged on certain lands, hereditaments, and premises, and company's undertaking and property, present and future, except un-called capital. Trustees: T. Bowden, Newcastle-on-Tyne.

Venner Time Switches, Ltd.—A memorandum of satisfaction to the extent of £500 on October 19th, 1916, of debts, dated July 10th, 1911, securing £5,000, has been filed. (Amount outstanding, £2,450.)

Oriental Telephone & Electric Co., Ltd.—A memorandum of satisfaction to the extent of £2,049 on December 6th, 1916, of deb. stock covered by trust deed dated June 28th, 1905, and supplemental deed of acknowledgement dated June 12th, 1907, securing £200,000, has been filed.

CITY NOTES.

An extraordinary general meeting was held last week to consider the proposal to increase the capital by the creation of 50,000 additional "B" shares of £1 each, which would bring the capital to £200,000. Ald. F. H. THORNTON, J.P., presided, and said that the authorised capital was £150,000. Up to October, 1915, they had issued £110,000, and in November, 1915, the business had increased so much that they were obliged to call for £40,000 more to make the great extensions necessary for the developments of their trade. That amount was practically subscribed, and almost all of it had been spent in purchasing a site of 10 acres near Nunn Mills, and in making extensions which were necessary to meet the very important requirements of the boot trade during the present winter. In the present works they had used part of the money in the erection of a new set of 500 k.w., and they had also laid mains extensively in the outlying parts of the town, the object being the supply of high-tension current at 6,600 volts to manufacturers. By that means they had been able to supply current economically. There was no room for any more plant at the present works, and they were now proceeding with their extensions on the site they had bought near the river. They intended to erect a generating station where all the current would be generated at high voltage, and the present works would become a transforming station. The issue of new capital had the sanction of the Treasury and the support of the Ministry of Munitions. From the point of view of the company, it was not a good time to make an issue, because money was dear. He did not suppose that at any other time it would have been necessary to issue shares, as the directors proposed to do, at par, because before the war their shares stood at 25s. 6d., but with the competition of Exchequer Bonds and War Loans generally, it was hopeless to try to get the money any cheaper. The directors estimated that they would save 6,000 tons of coal a year at their present works, and taking that at 10s. a ton they would have £3,000 a year, which was 6 per cent. on £50,000. In the new works they proposed to erect a 3,000-k.w. plant, far larger than anything they had at present. The resolution was carried unanimously.

Melbourne Electric Supply Co., Ltd.

In their report for the year ended August 31st, 1916, the directors state that to provide for future expansion, it is proposed to increase the capital by £750,000, divided into 50,000 preference shares of £5 each, and 500,000 ordinary shares of £1 each, the latter to be converted, when fully paid, into consolidated ordinary stock ranking equally with the existing stock. The consents of the existing preference and ordinary shareholders in separate meetings being necessary to the creation of the new preference shares, such meetings were held yesterday following the annual meeting. A resolution was also submitted for increasing the borrowing powers by £250,000. During the year, £144,405 has been expended on additional land, buildings, plant, mains, &c., and the capital account now stands as follows:—

	Expenditure during Aug., 1915.	Expenditure the year.	Total written at Aug. 1916.	Balance of expenditure at Aug. 1916.
Melbourne ..	£364,227	£147,561	£14,680	£1,077,778
Geelong ..	175,861	6,844	3,775	178,080
including trams	£1,190,888	£144,405	£18,155	£1,256,988

The area of the suburban districts in Melbourne, covered by the company's statutory powers is approximately 74 square miles, with a population of 360,000, and a supply is now available in 566 miles of streets, being an increase of 40 miles during the year; 4,222 new consumers were connected to the mains during the year, bringing up the total number connected to 27,713, being an increase of 30 per cent. as compared with the preceding year. The power supply has increased by 15 per cent., the electric motors now connected being equivalent to 20,106 h.p.; the total connections, including lamps, motors, heating, and other apparatus, have increased by 22 per cent., the total units sold by 36 per cent., and the gross revenue by 24 per cent.

The profit and loss account shows that the gross profit during the year amounted to £142,315, as compared with £117,677 for the preceding year, an increase of 21 per cent., which compares with an increase of 13 per cent. in the previous year. After payment of debenture interest, and management and general expenses at the London head office, and after making the following allocations, viz., to first debenture stock sinking fund £2,500, to consolidated debenture stock sinking fund £2,900, to income certificate service fund £1,800, to general reserve (raising the latter to £90,000), £20,000, to reserve for income-tax and excess profits duty £15,000, there remains a credit balance of £72,476. The dividends having been paid on the 7 per cent. preference shares, 10 per cent. for the year is paid on the consolidated ordinary stock, and there remains to be carried forward £21,366. To this is added £40,778 brought forward from last year, making a total credit balance of £62,144 to be carried forward, subject to any further demands in respect of excess profits duty. The following tables show the progress of the Melbourne and Geelong undertakings:—

Date.	Number of consumers.	Lighting in k.w.	Motors in k.w.	Total connections in k.w.	Total units sold.	Gross profit.
Melbourne Aug., 1914	19,066	16,316	12,444	28,759	19,963,300	£93,202
Aug., 1915	23,191	19,932	17,609	37,541	17,486,300	£107,515
Aug., 1916	27,713	23,901	20,106	44,007	24,902,084	£134,573
Geelong - including trams						
Aug., 1914	1,881	2,050	2,085	4,136	1,275,280	£11,137
Aug., 1915	2,290	2,306	2,155	4,461	1,270,516	£10,162
Aug., 1916	2,573	2,468	2,314	4,782	1,519,944	£11,641

The business continues to be well maintained, notwithstanding the adverse influence of the war. There is an increasing demand for light and power from all classes of the company's consumers, including numerous firms in Melbourne and Geelong engaged in the manufacture of war munitions and requisites. The directors deem it advisable to make such alterations in the articles of association as will enable them to capitalise any part of the company's undivided profits and distribute same to the consolidated ordinary stockholders by way of dividend or bonus.

The directors in their report for the British Columbia Electric Railway Co., Ltd.

The directors in their report for the year ended June, 1916, state that after making provision for renewals maintenance £102,237, for income-tax £10,000, and for addition to capital amortisation fund £2,656, the net revenue amounts to £134,964, plus £5,667 brought forward and £70,000 transferred from the reserve fund, making £211,631. After deducting interest on debentures and debenture stock for the year, £132,771, and dividends already paid on 5 per cent. cum. pref. preference stock for the year £72,000, £5,860 remains to be carried forward. It will be observed that in order to pay the above dividend the reserve fund has had to be drawn upon. The most determined efforts have again been made by the board and management to curtail expenditure in every direction. Operating and all other expenses have been rigidly controlled. The capital expenditure of the railway and subsidiary companies during the year amounts to \$134,900, compared with \$873,558 in the previous year. The general manager reports that the property of the company has been well maintained, and none of the economies effected have in any way impaired the efficiency, safety or general upkeep of the company's plant. The reduction in the population, the reduced spending capacity of the citizens, the continuance of the unfair competition of jitney cars, together with the greatly increased cost of all supplies, are responsible for the decrease in the company's revenue. About 35,000 soldiers have left British Columbia for overseas service, of whom probably 25,000 have left the territory served by the company, and a

further large number of people more or less directly and indirectly employed have also left. It can safely be estimated that the population of the city in 1914, the population of the city, has decreased by 50 per cent. The railway business also continues to suffer severely from the competition of jitney cars. Since January 1st this competition has been less acute than in the previous year, but it is estimated that these cars are still depriving the company of earnings amounting to approximately \$350,000 a year. The various public services furnished by the company, including the railway service, have been fully and efficiently maintained, but with no improvement in the jitney situation in prospect, the necessity of curtailing the car services has become urgent. The earnings from freight show an encouraging increase during the year, and this class of traffic promises to become an increasingly profitable part of the company's business. The company's financial position remains satisfactory. In spite of the present adverse situation there are indications of an improvement in commercial and industrial conditions in British Columbia, and with these the company's prosperity is closely bound up. The net earnings for the first four months of the current year show an encouraging increase of over £30,000, and the directors are not without hope that the profits of the current year will be sufficient to cover the debenture interest, and also the dividend on the 5 per cent. cum. pref. stock, without further trespassing on the reserve fund. The directors think that the company's financial position justifies the payment of the dividend on this stock for the current year, and a resolution will be submitted to the stockholders approving of this payment being made, and authorising the directors to draw upon the reserve fund, if necessary, for that purpose. The directors are unable to hold out any hope of the payment of a dividend on the pref. ord. or def. ord. stocks for the current year. Mr. R. H. Spierling, having been granted a commission in the Army, has retired from the board, to the great regret of his colleagues. Mr. Spierling has accepted the position of adviser to the board. Sir W. M. Aitken, Bart., M.P., and Mr. John Davidson have accepted seats on the board. A resolution will be submitted to the stockholders to increase the number of directors to nine, and, if approved, Sir William Mackenzie, who, on the invitation of the directors, has expressed his willingness to accept a seat on the board, will be elected. Sir William Mackenzie is president of the Toronto Railway Co., the Toronto Power Co., the Winnipeg Electric Railway Co., and other large public utility enterprises in Canada, and the directors are desirous of securing for the company the advantage of his wide experience.

Annual meeting: December 22nd.

Tata Hydro-Electric Power Scheme.

From the last issue to hand of the *Indian Tattle Journal* (September), we learn that an extraordinary general meeting of the Tata Hydro-Electric Power Supply Co., Ltd., was held in Bombay in August, Sir DORABJI J. TATA presiding, at which was confirmed an agreement entered into by the directors of the company with Sir D. J. Tata, Sir Sassoon David, the Hon. Mr. L. Samaldas, and Mr. N. M. Goculdas, whereby it was agreed, subject to the confirmation of the shareholders of the company, that the interest of the company in the concession granted by the Government of Bombay for the development of the Andhra Valley in the Maval Taluka of the Poona district to the purposes of a hydro-electric scheme, shall be transferred to a new company to be formed by Sir D. J. Tata, Sir Sassoon David, Mr. L. Samaldas, and Mr. N. M. Goculdas. The chairman said that a statement explanatory of the reasons for the proposed transfer of the concession obtained by the company from the Government to develop a hydro-electric power project by the storage of water power in the Andhra Valley to a syndicate had already been supplied to the shareholders.

The circular to shareholders stated: "In October, 1915, an application was made to Government for a concession in respect of the Andhra Valley, and Government has very recently replied intimating the entertainment of such application. On further careful consideration, however, your directors came to the conclusion that it would not be practicable for the company to undertake this scheme, at all events in the near future, and a syndicate was then formed with a view to taking over the scheme from the company and forming a new company to work it. In the month of January last, when your directors came to the conclusion, and the syndicate was formed, the company had expended rupees one lakh or thereabouts upon investigations in connection with the Andhra Valley project, and was confronted with the necessity for payment of heavy fees for surveys, necessary works, and plant, &c., and it was then arranged that the syndicate should take up and continue the company's investigations and should defray all further expenditure in connection therewith; and the company's expenditure has stopped short at one lakh, which will come back to the company if the present agreement is confirmed. The Tata Hydro-Electric Power Supply Co., Ltd., was formed in November, 1910, as an undertaking for the supply in Bombay of 30,000 electrical h.p., and it was then estimated that a capital of Rs. 175 lakhs would be required, but subsequently the electric plant has been extended to 40,000 electrical h.p., and the hydraulic works, which are as yet incomplete, have been extended to a capacity of upwards of 60,000 electrical h.p. For the company's

undertaking, which at its present contemplated state of development is for the supply of 40,000 h.p. in Bombay, a capital of rupees 252 lakhs (including debentures) has been raised, but further capital to the extent of approximately rupees 80 lakhs is required to complete the company's present undertaking, both to cover excess expenditure over the original estimates and to provide some further items not included in the original estimates; for instance, the acquisition of a strip of land beneath the transmission line for its full length from the power house to Khapoli to the receiving station in Bombay. The development of the Andhra Valley project is estimated to require a capital of rupees 200 lakhs, and if it were to be embarked upon by the company, the company would have to raise new capital to the extent of rupees 280 lakhs. One obvious objection to the Andhra Valley project being undertaken with capital raised by the company in extension of its present undertaking is the fact that rupees 85 lakhs in the capital of the company is represented by first mortgage debentures, and no further debentures ranking equally therewith can be issued. If the company undertakes the Andhra Valley project, the whole of the property acquired in connection therewith will merely go to increase the security of the holders of the debentures referred to, and the entire capital required for the development of the Andhra Valley project will have to be provided in shares, as it will not be feasible to place second debentures. This will necessarily render it difficult to finance the Andhra Valley scheme as an extension of the company's undertaking. Your directors, moreover, are advised upon technical grounds that it is important to the company, especially if supply is to be given to railways and tramways, that there should be two independent installations, interconnected as is now proposed, so that one may assist the other in emergencies in the maintenance of continuity of supply. Your directors, as stated above, do not consider that it is practicable for the company to undertake the Andhra Valley project in the near future, or, in fact, for some years, and, apart from any other reason, the indefinite postponement of an alternative supply is, in your directors' opinion, calculated to be prejudicial to the interests of the company. It must, moreover, be borne in mind that the concession granted to the company in respect of the Andhra Valley scheme will not be allowed to lie idle indefinitely, and that failure to take advantage of the concession may probably lead to its being withdrawn, and must of necessity open the door to other prospectors and to possible competition, which will not exist under the terms proposed to be entered into between the company and the intended new company.

The agreement, now confirmed, provides, among other things, the following consideration to be paid and satisfied to the company for the transfer of the concession:—

The new company shall pay to the company annually from the date of the registration of the new company the sum of Rs. 30,000, and as and when the new company shall earn profits divisible or capable of being divided amongst its shareholders by way of dividends the new company shall pay to the company annually either the said sum of Rs. 30,000 or a sum equivalent to 15 per cent. upon the remainder of its profits, whichever shall be the larger, the intention being that the company shall be entitled to receive from the new company the sum of Rs. 30,000 as a minimum and the cumulative dividend of the profits of the new company for the purposes of the before-mentioned periodical payment shall be arrived at after making all proper allowances and deductions, from the annual gross earnings for interest on debentures and deposits, and dividends, and the property of the company against profits, including agents' commission, and deducting a sum sufficient to pay a dividend at the rate of 7 per cent. upon the issued capital for the time being of the company paid up or credited as paid up, and such amount (if any) as may be required to satisfy any arrears of the cumulative dividend on the preference shares of the new company for the time being unpaid, and deducting a further sum for depreciation equivalent to 2 per cent. upon the capital expenditure of the company for the time being upon all buildings, machinery, plant, and other property of the company, in respect of which deduction for depreciation would ordinarily be made in the case of undertakings of a similar nature. The new company shall enter into an agreement with the company defining so far as may be practicable the sphere and scope of the operations of each company where such operations are likely to clash, and for the purpose of promoting co-operation between the two companies and preventing competition, and of preserving and protecting the interests of the two companies.

Your directors consider that these terms are very liberal, and, although they firmly believe in the economic value of the Andhra Valley project, yet it is to be remembered that that scheme is not an established undertaking, and your directors consider that the present company will be well advised to obtain a definite and concrete consideration for its present undeveloped interest in the scheme.

German Electrical Companies.

The *Helios Elektrizitäts Gesellschaft, of Cologne*, which has been in course of liquidation for some years past, has closed the year 1915-16 with an unchanged debit balance of £419,000. The securities in portfolio remain of the value of £69,000.

The *Rheinische Schuckert Ges. für Elektrische Industrie, of Mannheim*, reports net profits of £45,500 for 1915-16, as compared with £45,000 in the previous year. It is intended to distribute 5 per cent. on the share capital of £550,000, being the same rate as in 1914-15.

The accounts of the *Süddeutsche Telefon Apparate, Kabel und Drahtwerke, A.G., of Nuremberg*, for the year 1915-16 show gross profits amounting to £43,000, as compared with £46,000 in the previous year, on an ordinary share capital of £50,000. The net profits are £11,000 and £14,000 in the two years respectively, the method of disposing of which has not been disclosed for either year.

The liquidators of the *Moore Licht A.G.* state that several patents were disposed of during 1915-16, whilst the remaining patents are to be allowed to lapse. The non-realizable debts owing in France, England, and Russia, together with

claims forming the subject of legal proceedings, had been sold by auction. So far the return to the shareholders had amounted to 86½ per cent., and the liquidators hoped that a total of 100 per cent. would be eventually distributed.

The report of the *Bayerische Stickstoffwerke A.G., of Munich*, states that the demand for nitrogen of lime (cyanamide) continued to expand in 1915-16, and that this material had not only proved to be a valuable substitute for the nitrogenous fertilisers hitherto used, but results had also been obtained from it which would ensure to the product a constant market in open competition with other artificial nitrogenous fertilisers. The maximum price in 1915-16 had been fixed at 1s. 5½d. and then at 1s. 5d. per kilogramme of nitrogen in nitrogen of lime, free at consumers' stations, including bags. The maximum price only slightly exceeded the price in peace times, and was essentially cheaper than the price of other nitrogenous fertilisers. It had been possible to bring into full operation the extensions of the plant near Trostberg, and it was proposed now to begin the works for the utilisation of the power available at Tacherting-Margarethenberg, on the Alz. The net profits are reported at £73,000, as compared with £57,000, and a dividend at the rate of 14 per cent. has been declared, this contrasting with 12 per cent. in 1914-15.

Companies Struck Off the Register.—The following companies have been struck off the register, and are accordingly dissolved.

Auto-Electrics, Ltd.
Auto-Flash Sign Co., Ltd.
Cable Construction Syndicate, Ltd.
F.B. Two-Stroke Engine Co., Ltd.
Flash Controller Co., Ltd.
Grindell-Matthews Radiophone Syndicate, Ltd.
Holmes Motor Speed Controller, Ltd.
Improved Wheel & Axle Adjustment Co., Ltd.
International Power & Light Trust, Ltd.
Lester Engineering Co., Ltd.
Llanidloes Electric Lighting Co., Ltd.
Pioneer Pump Patents (1913), Ltd.
Radium Treatments, Ltd.
Sandors Motive Power Syndicate, Ltd.
Scientific Researches Co., Ltd.
Turbo Engine & Pump Co., Ltd.
Wireless Telephones, Ltd.

Buenos Aires Lacroze Tramways Co., Ltd.—The gross receipts for the past year were \$5,883,262, a decrease of \$217,389. The working expenses were \$3,895,787, an increase of \$135,005. The causes of these results are: the large number of people leaving the country owing to the war, and the stoppage of works in general causing unemployment, and so decreasing traffic, notwithstanding the liberality of the services which the company had continued to give. The working balance is £1,987,475, and after deducting debenture interest, amortisation of municipal concessions, paving accounts, &c., the balance is \$644,519, plus \$83,638 brought forward. \$32,225 is put to reserve, \$32,225 goes to directors, \$3,222 (¼ per cent.) goes to the syndicate, and \$625,000 to the shareholders, leaving \$35,483 to be carried forward.

Buenos Aires City & Suburban Tramways, Ltd.—The directors report that the construction of the line between Olivos and San Isidro has been completed, but the level crossing over the Central Argentine Railway Co. at Olivos has not yet been built, and the line beyond that point has not been opened. Relations with the municipal and provincial authorities continue to be satisfactory.—*Financier*.

Blackpool, St. Annes, & Lytham Tramways Co., Ltd.—The traffic receipts for the past year were £46,893. The amount paid to the Corporation of Blackpool was £10,123. Traffic expenses amounted to £7,848, general expenses £3,742, general repairs and maintenance £7,535, power expenses £5,046, and rent of leased lines £2,294, the balance to profit and loss account being £11,714. The directors recommend the trustees for the debenture holders to distribute the full year's interest of 5 per cent. upon the debenture stock, this being on account of arrears due to date.

Automatic Telephone Manufacturing Co., Ltd.—The preference share and transfer books are closed from 18th to 25th inst., for the purpose of preparing the dividend warrants on the 6 per cent. preference shares for the half-year.

Adelaide Electric Supply Co., Ltd.—A general meeting of this company was held on December 18th to approve the payment of the usual dividend. The annual meeting will not be held until the receipt of the duplicate accounts from Adelaide.

Ferranti, Ltd.—The annual meeting was held on Tuesday, at Basilidon House, E.C. The proceedings were not open to the Press.

Cordoba Light, Power & Traction Co.—The accounts for the year ended September 30th, after payment of debenture interest, show a loss of £230, which reduces the credit balance of £26,581 brought forward to £26,351. This amount is to be carried forward.

Cuban Telephone Co.—Dividend, 1½ per share on the preferred and common shares.

Eastern Telegraph Co., Ltd.—Third quarterly dividend, 1½ per cent. on the ordinary stock, free of tax.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—Interim dividend for September quarter, 3s. per share, free of tax.

Tucuman Tramways, Light & Power Co.—For the year ended June, 1916, the net profit was £7,305, reducing the debit balance to £35,210.

STOCKS AND SHARES.

TUESDAY EVENING.

With the close approach of the Christmas holidays, it was scarcely to be anticipated that the Stock Exchange would be in a commercial frame of mind. As a matter of fact, the unexpected has happened this week; and in consequence of the effective reply made by the French at Verdun to the German peace proposals, coupled with the conviction that the proposals themselves were actuated by growing weakness on the part of the Central Powers, prices have been good in the markets and business rather more active.

The outstanding feature is the strength of Home Railway stocks. In their market, prices have risen from one to three points during the past few days, the reason being that the Government have admitted the taking over of the railways to have proved a remunerative bargain for themselves. This was said partly to justify the acquisition of shipping and coal interests; and the statement was sufficient to revive the jaded spirits of holders of Home Railway stocks and to make them feel that, after all, their investments might hold something pleasant for them, notwithstanding all the rebuffs and checks to which they have been subjected by Government restrictions and Labour troubles.

The British Columbia Electric Railway Co. has issued its eagerly-awaited report, and, judging from the severe slide that has taken place in the company's stocks during the last three weeks, it would seem very much that somebody had advance knowledge of what the figures were going to show and was trying to get out before the report did. The company is going to pay the 5 per cent. dividend on its preference stock, but in order to do this a sum equivalent to that which is required for this service is to be withdrawn from the reserve, and careful analysis of the report will show that the company has earned comparatively little more than its debenture interest.

Such a result justifies the falls which have been taking place during the past month; but that the weakness should have been apparent so long before the actual accounts were published is at least a strange coincidence. The company is evidently suffering badly from competition; and while it is hoped that the present tide of its fortunes will prove to be the lowest ebb, it is obvious that the management have still anxious times ahead of them.

Brazilian Traction common shares have recovered to 46½, moving in sympathy, to a great extent, with the shares in the American-Canadian companies concerned with munition-making. These have been undergoing sharp fluctuations during the past few days. The peace hopes which make for strength in Consols and domestic securities naturally have an opposite effect upon those of American munitioneers. Canadian Generals gave way, but recovered a trifle. Other lighting and power issues are scarcely mentioned.

The dangers which beset London in consequence of its lighting restrictions were thrown into deeper gloom on Saturday night by a thick fog which involved metropolis and suburbs. Buses and trams had to stop running, means of communication were reduced in numbers of cases to shanks' pony, and innumerable were the tales of minor accidents to people who lost their way in the darkness.

It might well be thought that on such an occasion the authorities responsible for the lighting orders would have had the audacity to brave the Zepps and turn up the light, if only for an hour or two, in order that Londoners might see their way to get home—especially when it is considered that, had danger threatened, all lights could have been extinguished or dimmed in so short a space of time. But perhaps the powers that be were not out in the fog and paid no heed to the obvious risk to life and limb.

Meanwhile, shares in the lighting companies continue to droop, further declines taking place in the shares of the city and the county companies; and the market as a whole is as dull as the weather. Westminster is 5s. down at 53, and St. James' lost a similar fraction at 6. The various peace hopes circulating round the Stock Exchange have not yet afforded the electricity supply department any support. The Adelaide Electric Co. is paying the usual dividend and bonus, making 12 per cent. in all, on its ordinary shares, although the chairman explained at the meeting the other day that the audited accounts from Adelaide for the past financial year had been lost, owing to the sinking of the *Arabia*.

The Melbourne Electric Supply Co. reports a profit for the year ended August 31st last of £142,000, being an increase of £25,000, as compared with the preceding year. The directors recommend a final dividend of 5 per cent., free of tax, making 10 per cent. for the year. The meeting is to be held this week, and the directors are seeking powers to alter the articles of association, with a view to enabling them to capi-

any part of the undivided profits and to distribute the same to ordinary stockholders by way of dividend or bonus. The price of the stock is about 156.

Some of the most satisfactory reports that have been issued for some time past is that of the India-Rubber & Gutta-Percha Co., Ltd. The profits have kept up from £80,000 in 1914-15 to £100,000 in 1915-16, and the directors are retaining the ordinary dividend of 10 per cent., £50,000 being used to buttress the reserve fund, while the carry-forward of £100,000 is as good as it was a year ago. The price of the shares has risen 12s. 6d. to 132.

Another factor at 164, but other manufacturing shares incline to be slightly easier. British Westinghouse preference, Babcock & Wilcox, and Castner-Kellner are all a trifle down. The Dick, Kerr Co. has made an offer to the United Electric Car Co. for the purchase of the shares in the latter company. The price of Dick, Kerr ordinary is 13s. 3d., and the 6 per cent. preference stand at 17s.

The telegraph market is disposed to be a little heavy, although the Eastern group stands out as exceptional to the prevailing tendency. Business has sprung up again in Marconi, the parent shares rising to 2½ buyers, while American Marconis at 17s. 9d. are 3s. 6d. higher than they were a fortnight ago. United River Plate Telephones gave way to 6 11/16.

The rubber share market is quiet, unperturbed by the gyrations in the price of the raw material. After being nearly 3s. 6d., rubber went back to 2s. 9d., from which it recovered to 2s. 11d. per lb. Good reports and dividends from the leading companies are the principal factors which have helped to keep the market firm. Ammunition and explosive shares are mostly lower on the week, for obvious reasons.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend	Price	Rise or fall	Yield
	1914, 1915.	Dec. 19, 1916.	this week.	p.c.
Brompton Ordinary ..	10	101	61	7 11 0
Charing Cross Ordinary ..	5	6	32	7 8 2
do. do. do. 4½ Pref.	6	48	37½	8 11 0
Chelsea ..	6	4	3	6 18 4
City of London ..	9	8	118	7 0 8
do. do. 6 per cent. Pref.	6	8	10	6 0 0
County of London ..	7	7	101	6 18 3
do. do. 6 per cent. Pref.	6	6	92	6 1 6
Kensington Ordinary ..	9	7	62	6 4 6
London Electric ..	4	8	12	6 10 5
do. do. 6 per cent. Pref.	6	6	42	6 15 4
Metropolitan ..	34	9	21	6 13 4
do. 4½ per cent. Pref.	44	44	32	7 4 0
St. James' and Pall Mall ..	10	8	6	6 13 4
South London ..	5	6	22	7 5 6
South Metropolitan Pref.	7	7	12	6 7 3
Westminster Ordinary ..	9	7	52	5 1 9

TELEGRAPHS AND TELEPHONS.

	Dividend	Price	Rise or fall	Yield
	1914, 1915.	Dec. 19, 1916.	this week.	p.c.
Anglo-Am. Tel. Pref. ..	6	6	954	6 5 8
do. do. Def. ..	80/6	83/6	24	7 10 0
Chile Telephone ..	8	8	74	6 12 8
Cuba Sub. Ord. ..	6	6	82	6 8 6
Eastern Extension ..	7	8	14	6 14 4
Eastern Tel. Ord. ..	7	8	1404	6 11 0
Globe Tel. and T. Ord. ..	6	7	124½	6 12 0
do. do. Pref. ..	6	6	104	6 12 6
Great Northern Tel. ..	22	22	37	6 19 0
Indo-European ..	13	13	491	6 11 4
Marconi ..	10	10	22	6 15 4
New York Tel. 4½ ..	44	44	1	6 13 4
Oriental Telephone Ord. ..	10	10	25	6 4 6
United R. Plate Tel. ..	8	8	613	6 19 8
West India and Pan. ..	1	6d.	1	6 15 4
Western Telegraph ..	7	8	124½	6 15 4

RAILS.

	Dividend	Price	Rise or fall	Yield
	1914, 1915.	Dec. 19, 1916.	this week.	p.c.
Central London, Ord. Assented	4	4	654	6 2 2
Metropolitan ..	12	1	224	8 19 2
do. District ..	Nil	Nil	164	Nil
Underground Electric Ordinary	Nil	Nil	24	Nil
do. do. Income ..	6	6	94	6 9 10

FOREIGN TRAMS, &c.

	Dividend	Price	Rise or fall	Yield
	1914, 1915.	Dec. 19, 1916.	this week.	p.c.
Adelaide Sup. 6 per cent. Pref.	6	6	449	6 1 6
Anglo-Arg. Trams, First Pref.	5	5	364	9 3 4
do. do. 2nd Pref. ..	5	5	24	Nil
Bombay Electric Pref. ..	4	4	404	7 12 8
Brazil Tractions ..	6	6	104	6 17 8
British Columbia Elec. Ry. Pice.	6	6	624	8 0 0
do. do. Preferred ..	Nil	Nil	437	Nil
do. do. Deferred ..	Nil	Nil	429	Nil
do. do. Deb. ..	42	42	62	6 17 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	324	Nil
do. do. 6 per cent. Bonds	Nil	Nil	274	Nil
Mexican Light Common ..	Nil	Nil	124	Nil
do. do. Pref. ..	Nil	Nil	174	Nil
do. do. 1st Bonds ..	Nil	Nil	324	Nil

MANUFACTURING COMPANIES.

	Dividend	Price	Rise or fall	Yield
	1914, 1915.	Dec. 19, 1916.	this week.	p.c.
Babcock & Wilcox ..	14	15	212	5 6 9
British Aluminium Ord. ..	5	7	30	6 6 8
British Insulated Ord. ..	15	17	112	7 5 10
British Westinghouse Ord.	7	7	112	6 6 4
Callenders ..	15	20	13	7 13 10
do. 5 Pref. ..	5	5	42	6 17 8
Castner-Kellner ..	20	21	82½	6 12 4
Edison & Swan, 2½ paid	Nil	Nil	12	Nil
do. do. fully paid ..	Nil	Nil	12	Nil
do. do. 4 per cent. Deb. ..	3	6	624	8 0 0
Electric Construction ..	6	7½	10	7 0 2
Gen. Elec. Pref. ..	6	6	10	6 0 0
do. do. Ord. ..	10	10	132	7 5 6
Henley ..	20	25	14	6 12 8
do. 4½ Pref. ..	44	44	4	7 6 8
India-Rubber ..	10	10	182	7 6 8
Telegraph Con. ..	20	20	38	8 5 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, December 20th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ..	per lb. 1/7	1d. dec.
a Ammoniac Sal ..	per ton 275	..
a Ammonia, Murate (large crystal) ..	254	..
a Bisulphide of Carbon ..	233	..
a Borax ..	231	..
a Copper Sulphate ..	231	..
a Potash, Chlorate ..	per lb. 2/6	..
a Perchlorate ..	9/	..
a Shellac ..	per cwt. 142/	..
a Sulphate of Magnesia ..	216	..
a Sulphur, Sublimed Flowers ..	219	1d. inc.
a Lump ..	216	..
a Soda, Chlorate ..	per lb. 1/	..
a Crystals ..	per ton 120/	..
a Sodium Bichromate, casks ..	per lb. ..	..
METALS, &c.		
c Brass (rolled metal 2 to 12 basis) ..	per lb. ..	..
c Tubes (solid drawn) ..	..	..
c Wire, basis ..	..	..
c Copper Tubes (solid drawn) ..	1/10 to 1/104	4d. dec.
a Bars (best selected) ..	per ton 215	24 dec.
a Sheet ..	215	24 dec.
a Rod ..	218	24 dec.
d (Electrolytic) Bars ..	210	24 dec.
d Sheets ..	218	24 dec.
d Rods ..	213	24 dec.
d H.C. Wire ..	per lb. 1/7	1d. dec.
f Ebonite Rod ..	3/	..
f Sheet ..	2/6	..
n German Silver Wire ..	2/5	..
a Gutta-percha, fine ..	6/10	..
a India-rubber, Para fine ..	8/34	1d. dec.
i Iron Pig (Cleveland warrants) ..	per ton Nom.	..
i Wire, galv. No. 5, P.O. qual. ..	226	..
l Lead, English Pig ..	224 5	..
g Mercury ..	per bot. 218 15	..
e Mica (in original cases) small ..	per lb. 6d. to 8d.	..
e " " medium ..	9/6 to 6/	..
e " " large ..	7/6 to 14/ & up.	..
d Silicon Bronze Wire ..	per lb. 1/1	3d. dec.
r Steel, Magnet, in bars ..	per ton ..	..
g Tin, Block (English) ..	..	..
n Wire, Nos. 1 to 15 ..	per lb. 2/11	..

Quotations supplied by—

a G. Boor & Co.	g James & Shakespear.
c Thos. Bolton & Sons, Ltd.	g Edward Tilt & Co
d Frederick Smith & Co.	i Bolling & Lowe.
g Wiggins & Sons.	i Richard Johnson & Nephew, Ltd.
l India Rubber, Gutta-Percha and	g P. Ormiston & Sons
Telegraph Works Co., Ltd.	r W. F. Dennis & Co.

Test for Moisture in Transformer Oil.—While a thorough test for the suitability of oil for transformers and oil switches can be made only with high-tension testing apparatus, very good indications of the presence of moisture have been obtained by Mr. J. K. Mackie, superintendent of the Connecticut Power Co., as follows:—A sample of the oil to be tested is drawn from the bottom of the transformer, oil switch, or storage tank. (Samples from the upper parts of the tank are not considered suitable for the test, as water is heavier than oil and usually collects at the bottom.) In the sample thus taken is placed powdered anhydrous copper sulphate. If moisture is present the copper sulphate will be dissolved, producing a blue colour that will diffuse through the oil if moisture is in suspension. Since enough copper sulphate is added to ensure a saturated solution, the intensity of the blue tint will be a measure of the amount of moisture present. As small percentages of moisture have a very deleterious effect on the dielectric strength of oil, however, the lightest shade of blue is sufficient indication that the oil should be dried by filtering. It may be pointed out that other substances giving a deeper tint than copper sulphate may be used, the only requirement being that they dissolve quickly in water but not in oil.—*Electrical World.*

Australian Electrolytic Zinc.—According to the *Sydney Daily Telegraph*, further particulars were forthcoming in connection with the establishment of the Electrolytic Zinc Co., of Australia, Proprietary, Ltd. Speaking at the half-yearly meeting of the Amalgamated Zinc (De Bary's) Ltd., in Melbourne, Mr. W. L. Baillieu, after indicating the lines of the new company, said that all the zinc concentrates were now disposed of through the Zinc Producers' Association Proprietary, Ltd., which body, through the good offices of Mr. Hughes, had effected the sale of 100,000 tons of concentrates for immediate delivery to the Imperial Government, and was now settling the details of a post-war contract for 1,000,000 tons at satisfactory prices. A substantial tonnage had also been sold to the Allies. The company would participate in these sales. The whole of its estimated output for 1916 had been disposed of, in addition to a fair percentage of the 1917 output. The company had been much assisted by the Prime Minister's arrangement that the production for ten years should be taken by the Imperial authorities at satisfactory prices.

THREE-PHASE EXTENSIONS AT WALLASEY.

As our readers may be aware, in the latter part of last year the Wallasey Corporation put to work a new three-phase generating station, designed on modern lines for cheap power production, and situated on a site where adequate fuel and water facilities existed.

The decision to build a new station was adopted in 1912 in preference to the alternative of making considerable extensions to the original one in Sea View Road, which, like so many of our original generating plants, was constructed at a time when the necessities of the future could not be adequately gauged.

The municipal supply of electricity—a single-phase one—was started in January, 1897, and has been financially successful from the commencement.

Direct-current extensions to the plant were made in 1900, in order to supply the tramway undertaking, and at a more recent date a 1,000-kw. three-phase turbo-generator was installed to cope with increasing demands.

The scheme for the new station, which was prepared by Mr. J. A. Crowther, the borough electrical engineer, involved the use of a site near the Birkenhead Docks with suitable railway facilities, and provided for two 1,500-kw. turbo-alternators, with condensers, boilers, &c., and the conversion of the existing station into a sub-station, and laying of E.H.T. cables to connect the two; rotary converters were to be provided for traction supply, and static transformers for lighting, while a margin would remain for three-phase power supply.

This scheme was approved by Mr. (now Sir John) Snell, and subsequently Mr. Crowther was instructed to carry it into effect.

In the meantime, however, the demand for energy greatly increased, and it was decided to install 3,000-kw. sets instead of the 1,500-kw. sets originally contemplated; the station was in running order last autumn, but for reasons connected with the war only one set has been available for use.

The initial equipment provided for is three Babcock boilers, each of 5,500 sq. ft. heating surface, and rated at 22,000 lb. evaporation per hour, with a maximum of 30,000 lb., to steam at 200 lb. per sq. in. pressure with 200° of superheat, also a similar but smaller boiler of 16,000 lb. per hour evaporative capacity.

The boilers are fitted with integral superheaters and chain-grate stokers, and three economisers are provided behind them, each of 3,000 sq. ft. heating surface, and each discharging into a Pratt ejector type chimney equipped with a fan with variable speed motor drive. Two turbine-driven boiler feed pumps are installed, which exhaust into a feed-heater, raising the feed temperature to over 100° F., before it enters the economisers. The generating units will consist of two 3,000-kw. Westinghouse sets, delivering three-phase energy at 6,600 volts, and equipped with surface condensing plant and wet air filters; also a 1,000-kw. B.T.H. turbo-generator set. The circulating water is drawn from the adjoining dock, through screens, into a large tank near the engine room, and is discharged through 24-in. diameter cast-iron pipes leading back to the dock. All the pumps in connection with the condensing plant are of the rotary type, motor driven, and, indeed, there is no reciprocating plant in the station.

The E.H.T. switchgear was supplied by Messrs. Crompton, and includes three generator, four feeder, and two transformer panels, which supply the station auxiliaries and the small works adjacent to the station.

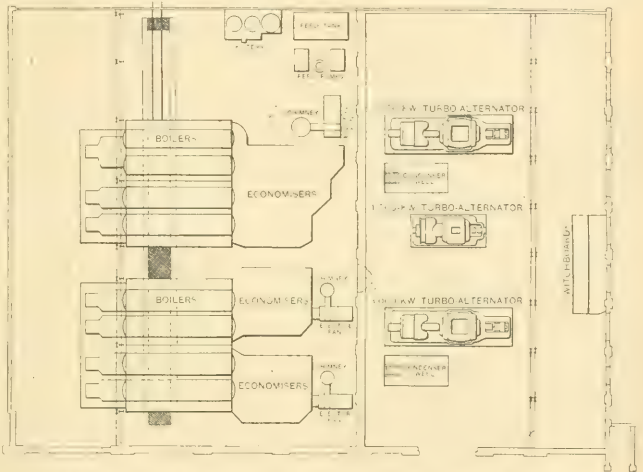
The E.H.T. feeders, as previously mentioned, connect to the old station, which is equipped with the necessary converting and transforming plant; they also run to large sub-stations

on the Dock Road, for the supply of power to flour mills, &c., one of which is now a consumer of 4½ million units per annum, while others will be considerable consumers when the station is fully equipped.

It is satisfactory to know that the results obtained so far have quite justified the policy of the Council in building a new station, instead of extending the old one, where fuel cartage, and ash removal were considerable problems; the railway accommodation on the new site deals with all the traffic. A recent month's return shows that the new plant operates on 2½ lb. of slack per kw.-hour generated, showing a considerable economy on the old station, and similarly the amount of town water purchased is much reduced.

The buildings are of steel frame construction, filled in with brickwork, and lined with glazed brick inside; these buildings cost 32s. per kw. installed, while the cost of the turbo-generators and condensers amounted to £2 12s. per kw. installed, and that of the entire station, with the land (excluding cables), has been £6 17s. 9d. per kw. installed—an exceedingly low figure, even lower than that quoted recently in the case of the new Walsall plant, which is apparently of rather larger capacity (£7 12s. per kw., see ELECTRICAL REVIEW, November 24th).

The comparison is only a rough one, in the absence of details, but it is evident that the carrying out of the work



PLAN OF NEW POWER STATION, WALLASEY, SHOWING PLANT ARRANGEMENT.

reflects great credit on the borough electrical engineer, Mr. Crowther. To some extent the Wallasey design lends point to the arguments advanced in our remarks on power station design in our issue of November 24th, as the relatively low cost has been obtained with an arrangement of boiler plant—boilers, economisers, draught plant, &c.—on the floor level, whereas at Walsall a superposed arrangement was adopted leading to considerable space economy.

We may mention that the Wallasey authorities possess a considerable area of land available for extending the plant, and that there is every indication of additional energy being required in the near future.

In conclusion, we are indebted to Mr. Crowther for his assistance in the preparation of these notes.

American Farm-Motor Installation.—The Lilac Hedge Farm, near Grand Forks, installed electrical equipment for the first time in 1911 for both lighting and power purposes. Electric drive has been used ever since for milking and other purposes (an average of 60 cows are milked twice a day). About 1,000 tons of ensilage are cut each year; all the threshing, feed grinding, wood sawing, water pumping, &c., is done by electric motors, two of which are stationary, one for driving the milking machine and one for pumping water. The rest of the farm work is done by a 35-h.p. portable motor, so arranged that it can be plugged in at various places on the farm. The installation has been a very satisfactory revenue producer for the central station, and has more than satisfied the owner of the farm.—*Electrical World.*

SOME ASPECTS OF INDUSTRIAL RESEARCH.

By R. W. MARCHANT.

The description given by Mr. A. P. M. Fleming in his paper at Manchester, on Dec. 12th, of the development of industrial research in the United States, must cause everyone interested in the welfare of industry in this country to realise the urgency of the question if we are to maintain unimpaired and strengthened our industrial position.

A comment in the *Electrical World* for November 18th, 1916, on the scheme for industrial research proposed by Dr. Murray Butler, of Columbia University, may be of value as showing the point of view of the American electrical industry. It remarks that "we stand face to face with a Europe which will be organised with superb efficiency after the war." It seems doubtful whether the British part of the organisation is really as "superb" as the Americans appear to think it is, but there is no doubt that, as far as industrial research is concerned, American industry is far ahead of anything that has been attempted in this country.

Perhaps the most interesting development described by Mr. Fleming was that of industrial research laboratories in connection with large firms and manufacturing associations. It seems self-evident that institutes to carry on the kind of work done by these laboratories must be established in this country, either in connection with or independently of Universities.

It would appear that the best solution of the problem of industrial research will be the establishment of research laboratories, or institutes in which all problems in connection with any particular industry can be worked out. The difficulty of equipping any Institute capable of carrying out more than a small fraction of the research work required for the manifold industries of this country is insuperable, and still more difficult must be the task of finding a Fellow, or a number of Fellows or researchers, who have the necessary knowledge and experience to work out the practical problems that have to be solved. There are, besides such institutes, two other places in which research can be carried out—i.e., the Universities and Higher Technical Schools and the research laboratories of the individual works. All these laboratories would seem to have a place in the scheme of industrial research which it is hoped may ultimately be established.

If one may attempt to define the scope of the various Institutions mentioned, the Universities and Higher Technical Schools will probably confine their work to the more general scientific problems which lie at the basis of the industry, the Research Institutes will deal with the development of scientific results into commercial processes, and the works themselves will deal with the technical research required to bring the operations involved in any process of manufacture to a high degree of efficiency. It is obvious that there are many cases in which the functions outlined above will overlap, but it is in the highest degree desirable that there should be some attempt to co-ordinate the different branches of industrial research.

It seems evident from the reply of Lord Crewe to the deputation on Scientific Research, last week, that the conditions laid down for the expenditure of money under the Privy Council scheme are such that comparatively little will be contributed by firms to help it forward. Whether a different view of the subject will be taken by the new Government remains to be seen; but unless the manufacturer is going to derive some direct benefit from the expenditure of his money, it seems very unlikely that he will be willing to spend it on research work. The most hopeful method would appear to be for the manufacturers to take the subject in hand for themselves, and establish institutions under their own control to assist their work. If this were done, Government grants might well be obtained to assist individual researches. The British Engineers' Association has already been formed, and there could be no better body to consider the establishment of research institutes for the engineering industry.

THE PARALLEL OPERATION OF ELECTRIC POWER STATIONS.

At a meeting of the NEWCASTLE-UPON-TYNE LOCAL SECTION of the INSTITUTION of ELECTRICAL ENGINEERS, on December 11th, Mr. J. S. PECK read his paper on this subject. Mr. H. W. CLOTHIER presided, and stated that the Secretary had already sent their message of goodwill to the members who were serving at the Front.

Mr. PECK said that bringing to their notice the question of the parallel operation of power stations was something like "bringing coals to Newcastle," but when the paper was recently discussed it seemed to him that many doubted whether there was any such "coal" in Newcastle. He hoped the discussion would go to prove that such operation of stations was possible and reasonable.

The CHAIRMAN, in opening the discussion, said that when they read the discussion of the paper in London, it did seem that development in the matter of linking-up power stations was very much greater in the Newcastle district than elsewhere. They really got the impression in London that there was no such thing as linking-up, whereas when they looked round this district they found 16 power stations linked up in parallel. Of course, there were difficulties. Mr. PECK had said that one of the chief criticisms was directed to the power factor, and he supposed there were power companies or undertakings which would fight shy of linking-up, but he thought the difficulty was not so much one of an engineering character as a financial one. The question had to be settled who had to get the profit and who had to do the dirty work. As to the frequencies, he was rather surprised to hear Mr. PECK say that a low frequency of 25 cycles was easier for the switch to break than a higher frequency, because of the longer period near the zero line at the lower frequency. By linking-up more power was brought on to the switchgear, and the short-circuit current became heavier. He understood that in America the practice was to relieve the switchgear by putting into operation definite time-limit relays. Here we endeavoured to get our faults out as soon as possible after they were discovered, but were we right in doing that?

Mr. VERNIER said that after reading the discussion of the paper in London he wondered how Tyneside had got on at all, for linking-up had been adopted so extensively.

Mr. BEARD said he thought the best service they could do Mr. PECK and the industry generally was to emphasise the fact that the system of parallel operation had already been adopted. People outside that district did not seem to appreciate the extent to which the system had been developed. At present there were 15 or 16 power stations, and he thought the district could claim to be the most complete parallel-operating system in the country. In 1904 Carville and Forth Banks, fairly close together, were linked up; in 1905 Wallsend and a station eight miles away were linked up, and he heard of no special trouble that they met with. In 1910 the Tees and the Tyne were linked up, although 42 miles was the shortest route. On the one side they had 6,000 volts stepped up to 20,000 volts, then stepped down to 11,000, and then to 3,000. In several cases there was a change in frequency. In this connection, he mentioned the costliness of apparatus, and said that manufacturers in this country had not done enough on this subject, and often they had had to go abroad for it. The maintaining of regulators was a serious matter according to his experience, and all sorts of trouble arose as to insulation.

Mr. JACKSON said he thought a good deal of the trouble with regard to the question they were considering lay in the matter of the governors. He advocated the use of the synchronous type of frequency changers.

Mr. LONGMAN also emphasised the importance of the question of governors. Messrs. TURNBULL, CARR, GREGORY, and PORTER also took part in the discussion, and Mr. PECK, in reply, expressed satisfaction at its character.

At a meeting of the YORKSHIRE LOCAL SECTION of the INSTITUTION of ELECTRICAL ENGINEERS, on December 8th, Mr. W. LANG occupying the chair, Mr. JOHN S. PECK summarised his paper on "Parallel Operation," adding information as to tests which had been made on the previous Tuesday by Mr. Robertson, of Salford, on the paralleling of his plant with that of the Lancashire Electric Power Co. at Radcliffe. The Radcliffe pressure was 10,000 volts, and the Salford pressure 6,600 volts. They tried conveying 2,000 kw. from the Radcliffe station to Salford, holding the voltage at both ends of the line normal, and under these conditions they got the power factor on the interconnecting line up to .63. Both systems were controlled by automatic voltage regulators, so that the voltage was maintained absolutely constant. The voltage at Radcliffe was raised from 10,300 to 10,500, 2 per cent., and the voltage at Salford remained the same. The power factor then came up from .63 to .87. Then the voltage at Salford was dropped from 6,600 to 6,500, keeping the voltage 2 per cent. higher at Radcliffe, and that gave a power factor of .95. That meant that when they were sending power from Radcliffe to Salford with a voltage exactly equal—exactly normal—with 2,000 kw. flowing into Salford, they

got a power factor of .63. As the voltage at Radcliffe was raised and the other was lowered, the power factor came up gradually to .95, until, when there was a difference approximately of $\frac{3}{4}$ per cent., they got the best conditions. Radcliffe did not care to raise the voltage any higher, and Salford did not care to go any lower. That connection was with about five miles of overhead line, 10,000 volts, and approximately one mile of underground cable. The next thing they did was to put another feeder in parallel, the second feeder being entirely underground, and by rather a roundabout way. Starting with normal voltage again, 6,600 at Salford and 10,300 at Radcliffe, they got 2,000 kw. with .74 power factor instead of .63. Keeping the Salford voltage at 6,600, and raising that at Radcliffe just 2 per cent., the power factor came up to unity. Next they raised the load from 2,000 to 3,000 kw., still in the same direction, Radcliffe to Salford. Under normal conditions that would give a worse power factor. The voltages were maintained as before. First they had Radcliffe 2 per cent. higher and Salford normal, and the power factor dropped from unity to .83. Holding Radcliffe still 2 per cent. up, they dropped Salford about 1 per cent. down to 6,570, and the power factor came back to unity again. Thus it became quite apparent that by a very small change in voltage at the two ends of the line it was possible to shift the wattless current from one station to the other and get unity power factor in the line. Readings were taken on quite a large number of instruments, and all the readings seemed to check up quite well. The next test was reversing the flow of energy, taking power to Radcliffe from Salford, and in this they got very much the same conditions; when they raised the voltage at Salford and dropped the voltage at Radcliffe, and maintained a difference of about 3 to $\frac{3}{4}$ per cent. they got 2,000 kw. transmitted at unity power factor, and this showed that the load could be transmitted in either direction without trouble.

In the course of the discussion, Mr. R. H. CAMPION said Mr. Peck had almost started again the old battle of the systems. He had noticed in connection with synchronous sets that the stations which had synchronous sets and motor-generators always had the best regulated power factor. The stations he had in mind were supplying cotton manufactories, and they got much better power factors than were got in Yorkshire. He had been interested to see that Mr. Peck now practically recommended the rotary converter for changing to the d.c. supply, and he had noticed that rotary converters worked very much better with 25 periods than with 50. There did not seem to be half the experimental work required with 25 periods that there was with 50.

Mr. CHRISTIANSON said the paper seemed to raise the whole question of standardisation of frequency, voltages, and phases. In his view, paralleling would not be a success. Until the question of voltage regulation was dealt with. Under the majority of the present voltages in this country the opportunity for parallel running seemed very limited, and it appeared that before anything could be done on any large scale we should have to adopt very much higher voltages, probably of the order of 50,000. There were considerable difficulties in linking-up with the present voltages which would be reduced with the higher voltages.

Mr. T. ROLES said the chief engineer whose office was a mile away from the works had little opportunity of observing the paralleling; the sport and fireworks were left to his assistants. He remembered the old days when it used to be a question not only of paralleling the alternators, but also paralleling the engines. He had never heard of any trouble in paralleling in connection with the Bradford works. As to the matter of periodicity, he did not think there was likely to be much trouble in Yorkshire. He did not know of a single undertaking in that district which had not 50 periods, and that would get over a large amount of trouble in the early days of interlinking. The question of what was to be the periodicity of the super-station which was now talked about was a matter that should be very thoroughly looked into before any super-station was put down for any special district. As to the voltage of transmission, he did not think much could be done with the present voltage of 6,000. If there was going to be any linking-up with the larger stations to effect any useful purpose, such as a saving of plant, a question of serious consideration would be what was the highest voltage which could be used with cables which could be procured. So far as he could find out from the makers, 33,000 was about the highest voltage they would guarantee. They would make cables for 40,000 volts, but if they did they would want the consumer to share the risks with them.

Mr. W. M. SELVEY said he had occasion lately to go into the question of transmission, and he realised the importance when one was linking-up two stations of ascertaining, to begin with, for what purpose they were being linked up. The object of linking-up nowadays was an attempt to increase the economic factor by supplying a smaller station at such times as that smaller station itself could not generate, and the cable between them should, therefore, be called a transmitter. If it was a long cable, they had to consider that transmitter as if the small station was a consumer. They had to consider the amount of power they had to send down, and unless they made use of the transmitter in the same sense that they would if they were supplying a customer there was very little economic justification for it. If they were going in for linking-up, it was not a question of linking-up two stations, but one of linking-up a number of stations, and as soon as

they got to linking-up more than two there were quite a number of new problems. The fact seemed to be that the only solution of the question of linking-up power stations was that one main station should do the bulk of the work and take the responsibility, and the smaller stations should run at 100 per cent. load factor and take practically no responsibility at all. On the whole, linking-up was the right thing, and there was no doubt the problems would be solved.

Mr. WILSON HARTNELL said there must be some standard voltage. He thought also that Mr. Peck should presently look into the question of cost.

Mr. NORMAN STELL said one of the great factors to be taken into account was the life of the cable.

Mr. J. E. STORR said he thought that until they could get forward with the higher pressure cable work there would not be much headway. He thought the cable manufacturers would have to consider more not what they would make or guarantee, but what the consumer was going to call for. With high voltages and some method of correcting power factor they would be better able to deal with the interconnecting problem.

The CHAIRMAN said that the point might be overlooked that the cost of interconnecting and the trouble which were always incidental to it might make it not worth bothering with. The money might, perhaps, be far better used if it was admitted that, in certain small stations, much better results might be obtained if they were simply used as distributing centres rather than to aim at the 100 per cent. load factor which Mr. Selvey referred to.

Mr. PECK, replying to the discussion, said that he had been one of the most peaceful meetings he had had, for, contrary to some of his previous experiences, they all seemed to think that this paralleling business was easy. There seemed to be two classes on the question, one headed by the Editor of the *Electrical Times*, who seemed to believe that there was some wonderful mystery which made it impossible to operate in parallel, and the other class perhaps best represented by Mr. Feilden,* who had a communication in the *ELECTRICAL REVIEW* in which he said he did not see what all this talk was about, because he had been operating in this way for years past. As to the higher voltage for linking-up, he thought it was purely a question of balancing the cost of the extra copper against the increased cost of high-voltage cable and the transformer which would be required. Where the power stations were located long distances apart it would be necessary to go to higher voltages, but in other cases he did not see why the connecting cable of 6,000 volts should not afford a great amount of relief where stations were overloaded. He had purposely avoided dealing with the question of costs because that had been done in the report issued by the committee of which Mr. Robertson, of Salford, was secretary, and Mr. Woodhouse was a member. This committee had worked out the case for linking-up in Lancashire, and made out a very excellent case. He scarcely considered himself capable of dealing with the question of the best kind of cable. The central-station engineers had much more experience of that than he had.

THE EXPORT TRADE TO THE FAR EAST.

THIS was the title of a paper read to the members of the BIRMINGHAM AND DISTRICT ELECTRIC CLUB recently by Mr. W. G. L. RIDDLE (President). He said that everyone connected with the Far Eastern business knew that previous to the war their greatest competitors were the Germans, although, even at that time, they were, in turn, feeling the competition of the Japanese in the low-priced articles of household commodities and apparel. In his opinion, there was no doubt that Japan would become a great power in trade with China because of her close proximity, which meant low freights and transit charges. Then, again, Japan could send her travellers to penetrate China, where the standard of living was somewhat of the same nature as that of Japan. Before he left China in April last year, Japan was making large quantities of electrical porcelain goods, flexibles, and the smaller sizes of cables. In other words, Japan lay at China's door, and the needs and peculiarities of the Chinese were better known to Japan than to any other nation. Some years before the present war broke out the General Electric Co., of Schenectady, built a factory in Japan to manufacture electric lamps and fittings, and some five years ago, when the Shanghai Municipal Council issued their specification for a year's supply of metal-filament lamps, the contract was secured by the Japanese works at a price that no British firm could touch. When he was in Shanghai, one could go into any electric sundries store and purchase a lamp for 1s. that one would have to pay 2s. 8d. for in Birmingham, and from what he was told by one of the Council's engineers the lamps made in Japan were superior to many of the British makes. This competition was very hard to fight against. They might also expect increased competition from America in engineering enterprises in China.

* See also the *ELECTRICAL REVIEW* of October 13th, November 10th, &c., for the Editors' opinions.—Eds.

...and a ... the ... business. ... the Chinese Mining ... The Germans, however, ignored this preposterous stipulation, and got the Chinese to pose as the capitalists, having an understanding ... the exporting of the mine output, and that they should import the machinery for the mine. This opened the way for the importation of all classes of cargo, the Germans being established by this means in many important centres in China. The Germans had also sunk much money in China in antimony mines, and were beginning to get it back tenfold. The Germans employed experts in every line of business, and were not content to do business as commission agents in Shanghai, Tientsin, and Hankow. They sent their men right into the interior of China, and got hold of the actual producer of raw material and introduced to him imported goods of German manufacture. How could English houses hope to get the business out in China, or in their Colonies for that matter, when the English banks and commercial houses here at home were full of German clerks, humble looking, underpaid individuals, but who were in the pay of the big German banks and firms, say in Hamburg, and who knew what business was being done by their English employers? These clerks, as they went home to lunch or supper, dropped a code telegram to their employers in Hamburg or Berlin, with the result that the quotations given by the competing English and German firms in China were different by a point or so—the German firms getting the business. It was the same in the import trade from China to England; English banks and English firms full of Germans. One of the largest German firms in Shanghai, with a registered head office in London, and swagger offices in Hong-Kong and Shanghai, posed before Britishers in China as "all the same" English firm trading under our flag, traded on our social advantages, and undercut us with German goods at every turn. Was not it marvellous that we never saw how we were being led to death? Why did the staffs in the German firms in Shanghai always have to work later than the English and French firms? Because they had to put in an hour or two extra in drawing up secret reports to send to their principals, giving particulars of what they had heard from their English and French friends at the clubs. The Germans considered anything was worth looking into, and passed business on to one another. Not so the English firms.

British manufacturers should get their goods on the Chinese market as cheaply as possible, making what the Chinaman wanted, not too good, but something that would last a reasonable time. As it was quite an expensive business for an English firm to send a representative to China, he would suggest that, say, five or six British firms who made somewhat similar machinery should combine and send a smart Britisher out to China as their representative to work under a British firm of merchants in China, who would act as the combine's agents, having offices in some principal centre, such as Shanghai, Tientsin, or Hankow. The representative should not be a pure salesman, but a man who had been through the shops and knew his business thoroughly. Manufacturers in this country, failing to form a combine, and being unable to send out their own representative, should co-operate with firms already established in China who knew the country and the trade routes. Travellers for home manufacturers were not so effective as a locally established representative. The Chinese liked to deal with a Britisher who had an established Chinese Hong name, and they looked with suspicion upon a strange foreigner.

He was often asked the question: Will the Germans get the business after the war? Personally, he did not see that there was anything to prevent them, especially if they could undersell us and give the Chinese long credits again. They probably had not been able to do much business during the war, but they were "carrying over," so to speak, with the Chinese. They had kept their staffs going at reduced pay. The Chinese would be only too glad to take advantage of the foreign commercial situation. The Germans had been keeping their trade going by using American firms, and but for the shortage of tonnage on the Pacific and the congestion of freights on the American railways, this would have been very serious for us. Unlimited capital expenditure was the only way to capture profits anywhere in the world, and, after the war, we should have to face competitors using money they had made out of us during the war, using German methods of business. If English capitalists would put money into development work in China, and with our financial whip-hand at Pekin this was more possible for us than any other nation, something would be done to keep their trade going, because the development work would give them good face with the Chinese and combat the idea that we were short of money. He had always found the Chinaman a good man to do business with. His word was practically as good as his bond, although that trait of his would die out, and was probably not so good as it was 20 years ago. A Chinaman delighted in a bargain, and it was no use, whether one was buying or selling with him, one must be prepared for a bargain. The Chinaman knew three classes of cargo; he preferred the English if he could afford it. Say it was priced at 75 cents at an English Hong, 60 cents at a German, and 40 cents at a Japanese. The Chinaman would buy the German article, because at any rate, it was foreign goods, and though it

might not last as long as the British goods, it was what he wanted; and, besides, the extra 15 cents might be just beyond his means, though he would not descend to the trashy Japanese article. To the uneducated Chinese the German could always pose as an Englishman, the foreign names conveying nothing to the Chinaman. The German used their language in business in Shanghai, as in other places in China. To his mind it was extremely probable that German competition would be keener after the war was over, and as it would require more export business than ever to bring more money into the country, it was up to Britishers to fight Germany on their own ground, using better methods than they did. They must meet German competition and secure for British Labour and Capital a fair share of what must in time be an important and expanding business, especially as China developed her mining and industrial resources.

British houses who were at present established in China and could handle engineering and machinery on an extensive scale could almost be counted on the fingers of one hand, but they were principally firms of good financial standing with branches in many parts. China was a huge country, and in many of the provinces the British had not touched it at all. So Germany had had no competition to fight except among themselves, and consequently had been able to secure full margins of profit. Germany after the war would have to devote her attention in a greater degree to such neutral countries as China, where there was no sentiment against her, and they could only hope that she would be so crippled financially that her banks and finance houses would not be able to accord the long credits and the exceptional facilities to her merchants that were formerly in vogue.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Recruiting Skilled Engineers.

I was much interested in your remarks in the leading columns of the REVIEW of Friday last, *re* Diesel engine stations, which, unfortunately, I have had no time to glance through until to-day. I am not sure whether by chance one of the stations you refer to is Newcastle-under-Lyme, but, if not, perhaps the enclosed information may be of interest:—

Plant.—6 engines (2 Diesel and 4 gas).
Staff.—Chief engineer, aged 33, married, passed for C3 service; senior assistant, aged 33, married, passed for B2 service; second assistant, boy of 17 years of age; junior assistant, none; jointer and main assistant, none; power station fitter, none; engine driver, age 10, married, passed for C1 service; engine driver, over age; general labourer, none.

With the above staff we are attempting to keep things going. My senior assistant having, fortunately, served his time as a fitter, is running shift, and also doing the fitter's work, and in his spare *see* time assisting me with the outside work.

At the last meeting of the local tribunal it was suggested by the Military Representative that the engine driver could easily and quickly be replaced by a woman, and that a woman could also, with a little training, take the place of my one and only qualified assistant.

Comment is, I think unnecessary. I may say that I only succeeded in getting two months' exemption for each of these men, which means, of course, that we must, as you state, inevitably shut down if further exemption is at any time refused to either of the men in question.

A. J. C. De Renzi,

Borough Electrical Engineer.

Newcastle-under-Lyme.

December 13th, 1916.

Breakdowns of German Plant.

With reference to your comment on "Breakdowns of German Plant" in your issue of the 1st inst., whilst agreeing with the same I think the end desired will never be attained until our own manufacturers wake up to the fact that they owe something more to their customers than merely delivering the goods. Complaints of faulty workmanship or working should receive prompt attention, and any alterations found necessary should be carried out in a speedy manner and not at the expense of the customer; especially should that be done where manufacturers have turned their attention to new types of plant of which they have had no practical experience. Your mention of Mr. Edgcombe's experience is unfortunate; I have here two foreign (not German) engines, which certainly required some alterations made at first; these were promptly carried out at no expense to ourselves. On the other hand, the first English-built engine of this type, which we installed in October, 1913 (one of the first they made), has given no end of trouble, the general reply to our complaints being lack of attention or suggestions of inexperience; finally, the engine has been dismantled since May last, and although we (to save expensive law

costs) agreed to pay half the cost of the repairs, we are still without the use of this engine.

Wake up our own manufacturers to their responsibilities: when that is accomplished they need not fear German competition.

H. L. Alderton.

Electricity Works, Guildford.

December 13th, 1916.

Everyone appreciates your endeavours to forward the interests of the British engineering trade by bringing "together a number of instances" of faults in German design. One feels an immense amount of enjoyment at the instances quoted, but the joy is tempered by the reflection that the full uses of a specification are not yet appreciated, or we should not see the buying of plant which is admittedly against correct modern practice and experience. It is not to be wondered at that "engineers who have been bitten are not proud of their scars, and are apt to conceal them jealously," if their scars are analogous to some of the reported instances.

In the account of the breakdown of a 5,000-kw. A.E.G. turbo-alternator it is stated "the blading was found to be of an alloy containing an excessive proportion of nickel—over 31 per cent.—a material well known to be unfit for use, especially with superheated steam." I submit that by keen carrying-out of a properly drawn specification such an error would not occur.

In the address on "The Power Supply of the Rand," by Mr. Bernard Price, and with reference to the complicated winding on a large alternator, one assumes in such a case that designs would be submitted with tenders, and "studied" by the intending purchasers; or is it merely a case of buying a "pig in a poke," and then complaining of the badness of the "German pig"?

In the instance of steam pipes, one wonders what—yes—what ordinary mill mechanic would have installed such pipes; it is apparent that the art of combining practice with theory in a common-sense way is still not understood.

In the case of the four A.E.G. transformers which were found to be so "badly designed that the purchasers decided to have them reconstructed and re-wound before even putting them in service," surely, by the adoption of a proper procedure and scrutiny, such a drastic series of operations could have been avoided.

Finally, I submit that British engineers, in accepting the above examples of German engineering, do not add to our national engineering reputation, and, after reading your account, one is left with the impression that expensive plant is still bought by some people, like anyone would buy a pound of tea or sugar.

John Stansfeld.

Leeds.

[With regard to the Melbourne turbine and the transformers which had to be re-wound before use, it should be noted that these were all delivered just before the outbreak of war, and consequently it was not possible to call the German makers to account for any departure from specifications.

The excuse offered by the A.E.G. for the excessively complicated winding of their rotors and the impossibility of rewinding them outside the makers' workshops, was "that the workmanship and design were such that breakdowns, and consequently the necessity for rewinding, were impossible!"

So far as the record of disaster on the Rand is referred to in the last paragraph of the above letter, we believe the British engineers had no choice in the matter: the Germans held the debentures of the company, and stipulated that the plant should be purchased in Germany. For this scandalous condition the reluctance of British capitalists to finance the undertaking was responsible.—Eds. *ELEC. REV.*]

A War Bonus for the Managerial Staff.

£1 WORTH 12s. 6d.

LIVING 60 PER CENT. DEARER THAN BEFORE THE WAR.

Board of Trade figures issued last night show that retail prices of food on December 1st were about 3 per cent. higher than a month earlier.

It is estimated that the average increase in the cost of living of the working classes between July, 1914, and the present time, taking food, rent, clothing, fuel, and light into consideration, is about 60 per cent. Disregarding increased taxation, that means that the sovereign is worth 12s. 6d.

From the *Daily Mail*, December 16th, 1916.

Is there no room for improvement in dealing with the man who does not perform the manual labour of the works but is the brains or the business-getter of the organisation?

—Extract from page 647, *THE ELECTRICAL REVIEW*, December 15th, 1916.

Most of the electrical engineering firms are now controlled establishments.

Provision has been made in the Ministry of Munitions Acts for an increase of at least 20 per cent. above the average profit for the standard period. This provides for an increase in dividends for the shareholders, whereby they meet the increase in the cost of living.

Provision has also been made in the Munitions Acts whereby the Minister can authorise a war bonus for the managerial staff. All that is necessary is that an application be sent by the controlled establishment management to the Minister of Munitions for the permission to pay such a war bonus.

Some applications have been made and granted, so the principle has been approved.

No doubt it is just an oversight that other applications have not been made; but it is just such oversights as give point to the observation quoted above from *THE ELECTRICAL REVIEW*.

Those occupying positions of responsibility feel that on matters of this kind the initiative should come from the management, and that there should be a recognition of the fact that the increase in the cost of living has equally affected the brain worker as well as the manual worker.

No doubt the publicity obtained by the insertion of this letter in your widely-read paper will cause some boards of directors to wonder why the point did not occur to them before, and they will hasten to rectify the omission.

A Brain Worker.

The Use of Low-Grade Fuels.

There seems to be an impression that, because it is technically possible to employ high-ash fuels in a water-jacketed gas producer fitted with an eccentric revolving grate to discharge the ash continuously, such an indirect firing method should be adopted for steam boilers.

In the case of the colliery cited in the Report of the U.S. Bureau of Mines, there is nothing to show whether the gas is used in internal-combustion engines or not; but the fact is very clear, that while it was technically possible to handle the low-grade fuel for which the revolving-grate producers were installed, the reduction of unit capacity was prohibitive.

The low-grade fuel was selected batts. 52.12 per cent. ash, 18.37 per cent. volatile matter, 6.99 per cent. moisture, only 5.065 B.T.H.U. per lb.; but the fuel actually used was crushed and then washed, producing a fuel with only 24.60 per cent. ash, 28.75 per cent. volatile matter, 5.86 per cent. moisture, 9.869 B.T.H.U. per lb.

This actual fuel could obviously be burnt direct to great advantage on mechanical stokers, having not only continuous ash-discharge, but also continuous coal-feed, thus eliminating the manual labour of charging to producers.

Prof. Fearnside's proposal to utilise the second-class coal of the upper Barnsley seam provides for its being screened and washed, so that it will contain as many heat units per ton as the best coal now brought into Sheffield.

As every refuse-destroyer plant evidences, there is no technical difficulty in raising steam from the direct combustion of low-grade fuel; but, on commercial grounds, the duty per unit of space is so small, and the labour cost so high, that even at collieries it pays much better to screen and wash out excess dirt, rather than to handle a large proportion of uncombustible matter with the fuel.

A favourite size unit water-tube boiler raises 50,000 lb. superheated steam, involving the efficient direct combustion of three tons of good slack coal hourly; this is easy duty for a 12-retort continuous-cleaning grateless underfeed stoker 20 ft. wide, which can be applied to a boiler of 23 ft. outside width, with depth for stoker plus boiler from 17 ft. upwards.

For an equal duty with indirect firing of the same boiler by producer-gas plant of 75 per cent. efficiency, the fuel and ash would be one-third more, and the space and cost would be prohibitive.

The revolving-grate gas-producers with washers, shown in the Report of the U.S. Bureau of Mines, are 2 metres, say, 6 ft. 8 in. in internal diameter, and occupy a space of 7 metres, viz. 23 ft. wide. Assuming that each producer can gasify one ton of coal hourly, this means that four such producer units would be required for the 23-ft. water-tube boiler, raising 50,000 lb. of steam hourly.

Instead of mechanically handling 3 tons of coal hourly by a single 12-retort stoker for direct combustion, and discharging the ash continuously, the indirect firing method would involve the manual charging of 4 tons of coal hourly to four separate gas-producers, with mechanical discharge of ash alone.

The thermal efficiency of direct-firing with modern mechanical stokers leaves no scope for improvement; and stokers assembled from any number of retort-units permit unlimited unit-capacity of boilers.

While the 12-retort stoker for 3 tons of coal, or 50,000 lb. of steam, is a good example of modern central-station practice, one plant alone has five double-ended boilers, each with two 15-retort continuous-cleaning stokers, two and a-half times that capacity.

It is perfectly possible to burn high-ash coal on such stokers; but, whether for stokers or for gas-producers, dirty coal means reduced unit capacity, and therefore it pays far better to screen and wash out excess dirt at the colliery, and to employ good quality fuel.

Erith's Engineering Co., Ltd.

London, E.C., December 18th, 1916.

Heat Standard for New York Gas.—The Public Service Commission for the Second District of New York has made an order fixing heat units instead of candle-power as the standard of value for artificial gas. Hereafter gas must average 585 B.T.H.U. per cu. ft. instead of 16, 18, or 20 C.P., as heretofore. With the universal substitution of electricity for lighting, the Commission finds that gas is more and more being developed as an agency for cooking, heating, power, and other industrial and domestic purposes where heat value is of supreme importance and illuminating power of no consequence whatever.—*Electrical World*.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

UNITED KINGDOM AND CERTAIN FOREIGN COUNTRIES.—A Supplement (Part I) to the Board of Trade Tariff of November 2nd contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported from Denmark, France (including Algeria, Greece, Italy, Japan, and the Netherlands). This Supplement also contains the complete list of articles which are prohibited to be exported from the United Kingdom. A further Supplement (Part II), issued on November 30th, contains similar lists for Norway, Portugal, Rumania, Russia, Spain, Sweden, and Switzerland, and this Part contains also a copy of the United Kingdom Contraband List complete to date. The information given in these two Supplements supersedes that given in the Supplement published on August 17th last. Copies of the Supplement may be obtained, price 3d. each (post free) of the Messrs. WATKIN & SONS, Bedford Lane, E.C.

PROTECTORATE OF SOUTH-WEST AFRICA.—By a Proclamation dated July 25th, the Union of South Africa Act No. 27 of 1910 is made applicable to the South-West Africa Protectorate, the effect being to put the Customs and Excise Tariffs of the Union and the Protectorate on a uniform basis. [The alterations effected in the Union Tariff by the Act above referred to, so far as they affect electrical goods, were indicated in the ELECTRICAL REVIEW of September 15th.]

TANGA (EAST AFRICA).—From an official notice published in the Zanzibar Gazette it appears that an import duty of 10 per cent. *ad valorem* has been fixed for all goods entering the Port of Tanga.

GERMAN EAST AFRICA.—According to a telegram received at the Colonial Office from the Government of East Africa Protectorate, a specified portion of the territory known as German East Africa was opened to traders on December 1st, subject to local regulations.

FRANCE.—A Presidential Decree, dated October 25th, provides that, from December 1st, import and export declarations relating to goods dutiable by weight, by number, or by measure, or to goods which are free of duty, must specify, for statistical purposes, and in addition to the particulars required for the application of the Customs Tariff, the value of the goods at the place and time of presentation to the French Customs Authorities.

RUSSIA.—It is announced in the official *Torgovo Promyshlennaya Gazeta* of Petrograd that the importation of all goods on private account into the Russian Empire, *via* Vladivostok, except those connected with Government requirements, is at present prohibited. While this prohibition is of a temporary character, it is impossible to say how long it will continue, as the period must depend upon the amount of Government material to be sailed and on the capacity of railway conveyances. Applications for permission, in each separate case, to import goods for the requirements of the Government are to be addressed to the Department of Trade at the Ministry of Commerce, Petrograd.

BRAZIL.—Telegraphic information has been received at the Foreign Office from H.M. Minister at Rio de Janeiro, to the effect that the Brazilian Budget Bill for 1917, which has already been passed by the Chamber of Deputies, but has still to be approved by the Senate, proposes that the proportion of all import duties which must be paid in gold shall be raised from 40 per cent. (the rate fixed by the Budget Law for 1916) to 55 per cent. This proposal would in effect increase the amount of duty leviable on goods imported into Brazil by 12½ per cent., at the present rate of exchange. Should this provision be incorporated in the Budget Bill as passed by the Senate, the new rate will come into force on January 1st, 1917, and will apply to all goods not actually presented for clearance in the Custom houses on or before December 31st, 1916, irrespective of the date of arrival of such goods in Brazil.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

17,371. "Systems of electrical distribution." H. A. GILL (U.S. Light and Heat Corporation), December 5th.

17,372. "Dynamo-electric machines." H. A. GILL (U.S. Light and Heat Corporation), December 5th.

17,373. "Systems of electrical distribution." H. A. GILL (U.S. Light and Heat Corporation), December 5th.

17,374. "Dynamo-electric machines." H. A. GILL (U.S. Light and Heat Corporation), December 5th.

17,375. "Method for multiplying frequency of electric currents." MARCONI WIRELESS TELEPHONE CO. & L. SHORROCK, December 5th.

17,376. "Electrical discharge devices." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.), December 8th.

17,377. "Storing gear for vehicles." E. C. R. MARKS (Mercury Manufacturing Co.), December 8th.

17,378. "Electric annunciator systems for calling attendance." E. E. ROGERS, December 8th.

17,379. "Electrical projecting apparatus." F. O. READ & L. GIDDINGS, December 8th.

17,380. "Dynamo-electric machines." J. S. G. REES & W. WHEATHEAD, December 8th.

17,381. "Machine for conversion or simultaneous production of alternating currents of different frequencies." BERGMANN ELEKTRICITÄTS WERKE Akt. Ges., December 8th. (Germany, December 8th, 1915.)

17,382. "Current generators for telephonic, &c., calls." J. B. NABERES, December 8th.

17,383. "Electric ovens, hot cupboards, &c." J. S. LANGFORD, December 8th. (New Zealand, January 14th.)

- 17,384. "Systems of electrical distribution." H. A. GILL (U.S. Light and Heat Corporation), December 5th.
- 17,385. "Dynamo-electric machines." H. A. GILL (U.S. Light and Heat Corporation), December 5th.
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PUBLISHED SPECIFICATIONS.

1915.

- 12,150. CONNECTOR FOR THE ADJUNCT PORTIONS OF TWO OR MORE FLEXIBLE WIRES, CABLES, OR THE LIKE. A. H. FARGO, August 23rd.
- 12,151. CONNECTOR OR COUPLING FOR THE ADJUNCT PORTIONS OF TWO OR MORE WIRES, CABLES, OR OTHER MEMBERS. A. H. FARGO, August 23rd.
- 13,504. ELECTRICAL DISTRIBUTION SYSTEMS. E. T. WILLIAMS, September 22nd.
- 14,749. WIRELESS SIGNALING SYSTEMS. BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.), October 19th.
- 16,336. ELECTRO-DEPOSITION AND EXTENSION OF ZINC. J. C. LINTON and J. N. PRING, November 19th.
- 16,443. METHOD OF AND APPARATUS FOR PRODUCING AND DISTRIBUTING ELECTRICAL CURRENT WAVES. BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.), November 22nd.
- 16,464. DYNAMO-ELECTRIC MACHINES. J. C. LINTON (Akt. Ges. Brown, Boveri & Cie.), November 22nd.
- 16,476. ALTERNATING-CURRENT MOTORS. A. H. NOULAND, November 22nd.
- 16,486. ELECTRIC SWITCHES. E. T. BROOK & G. H. BISHOP, November 30th.
- 16,994. ELECTRIC HEAT RADIATORS. A. F. BETTS, December 2nd.
- 18,114. METHOD OF ELECTRIC WELDING. D. H. WILSON, December 24th. (July 9th, 1915.)

1916.

- The numbers in brackets are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.
172. FLEXIBLE SHEATH PULLEY BOXES AND SIMILAR FLEXIBLE FRCTIONS. R. WELBOURN and British Insulated & Helsby Cables, Ltd., Jamaica 13th. [102,163.]
179. MOUNTINGS FOR ELECTRIC SWITCHES AND CONNECTION APPARATUS. H. E. MITCHELL, January 15th. [102,167.]
- 1,278. ELECTROLYTIC BATTERY. MacKay Copper Process Co., April 9th, 1915. [100,264.]
- 2,114. ELECTRIC SWITCHES. R. H. WILLIAMS, February 12th, 1916. [102,184.]
- 2,478. ELECTRIC CONDUCTOR FITTINGS FOR RELAYING THE CONNECTION OF SUCH CONDUCTORS WITH ELECTRIC CIRCUITS FROM PULLING STRAIN. S. FIELDS, February 19th, 1916. [102,188.]
- 2,896. ELECTRICAL SOUNDERS, HOOTERS, OR THE LIKE FOR TELEPHONE OR OTHER PURPOSES. E. A. LAIDLAW, February 26th, 1916. [101,753.]
- 3,605. DRY CELLS AND BATTERIES THEREOF. C. F. BURGESS LABORATORIES, February 28th, 1916. [100,286.]
- 6,329. TELEGRAPHIC TRANSMISSION DEVICES. R. D'ANTONIO, May 3rd, 1916. [102,214.]
- 6,824. X-RAY APPARATUS. C. L. CHAPMAN, August 7th, 1915. [101,143.]
- 8,359. ELECTRIC ARC LAMPS. BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. (Westinghouse Electric & Manufacturing Co., U.S.A.) June 13th, 1916. [102,221.]
- 8,470. DEVICE FOR ATTACHMENT TO THE SPARKING PLUGS OF PETROL AND THE LIKE ENGINES, FOR AUTOMATICALLY CHANGING THE SPARKING POINTS OF SUCH PLUGS. A. E. LAMKIN, June 15th, 1916. [102,222.]

THE ELECTRICAL REVIEW.

VOL. LXXIX.

DECEMBER 29, 1916.

No. 2,040.

ELECTRICAL REVIEW.

GOVERNMENT ASSISTANCE FOR OUR FOREIGN TRADE.

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It will be remembered that the late Prime Minister appointed a Sub-Committee of the Cabinet to consider the question of reconstruction after the war. The changes in the Cabinet, we suppose, necessarily involve a change of *personnel* in that Sub-Committee, and though the membership of the House of Commons has not materially altered, it is safe to assume that the conclusions arrived at by those who advise Parliament concerning reconstruction policy, will not now be the same as they would have been if the Lloyd-George spirit had been suppressed. It is universally understood that the present Cabinet has been formed for the purpose of bringing the war to a victorious end with the utmost expedition, but while its members are bound to be very busily occupied with their individual tasks, they will not be able to leave Reconstruction measures out of account; indeed, the announcement of a great Empire Conference to be held in February is a proof of their desire to deal promptly with such subjects. There are more business and industrial men in the Government than we have ever had before, and they will not be in the mood for wasting time in academic discussions. Furthermore, they have in a number of cases already expressed views on trade policy which will cling to them, and, to put it mildly, those views are not less advanced than were those of either Mr. Asquith or Mr. Runciman. The Sub-Committees that have been, and in some cases still are, sitting, will send up their considered reports as to what measures should, or should not, be taken in order to safeguard our industries after the war, and the conclusions of the Paris Economic Conference will, together with these, ultimately settle what certain aspects of our Empire and inter-Allied trade relations will be, while such matters are almost certain to find a place in whatever "terms" are eventually made with the enemy. To our mind, however, none of these matters need interfere with, or be affected by, measures that require to be taken for securing long-needed and long-called-for measures of reorganisation of the machinery available in certain Departments of the Government for the promotion of British trade in foreign countries. Therefore, we do not consider it premature to urge upon the attention of the Government the recommendations, to which we only briefly alluded last week, of the Federation of British Industries.

The Federation lays it down, and everybody in trade or industry must surely agree with it, that after-the-war conditions will render it a vital necessity for British productions to secure a greatly increased sale in foreign markets in order to assist us in carrying the financial burdens which may be ours for years to come. In all probability that necessity will exist for Allied and Enemy countries alike, though not to the same extent in all cases. It is reasonable, therefore, to anticipate increased severity of competition in some markets, though we shall be able to rely upon larger trading relations with our own Colonies and dependencies and with some of our Allies. Reorganisation leading to greater governmental sympathy with, or encouragement of, foreign trade has been called for for many years. The demand has expressed the common sentiment of business men, but the revelations and consequences of the war have brought it nearer to practical realisation. All drastic change is not necessarily good, but

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and some of the difficulties which seems to us to call for a solution. The more criticism of Government Departments is accumulated for a general change, or the suggestion that some new Ministerial appointment or other will solve our problems, are only of use up to a certain point. They have sometimes drawn the question: "What, then, do you suggest that we should do that we are not doing already?" That is the official attitude as we have sometimes met it, and if propositions have been proffered, there have been some departmental or political obstacles standing in the way of reform. Now, however, with an altered national attitude toward, and anxiety for, trade, and with a disposition of the nation to look to Whitehall and Downing Street for industrial encouragement, the atmosphere is a suitable one in which to consider detailed proposals; and this being so, the scheme elaborated by the Federation of British Industries, and the recommendations of the Special Committee of the Executive Council of the Association of Chambers of Commerce, have made a most timely appearance. The Federation suggests certain broad principles which are considered essential to any successful reorganisation of Governmental Commercial Service. Separation and overlapping have been weaknesses which have stared most of us in the face, and have explained some past inefficiencies. Therefore it seems right to suggest that there should be concentration of control in a single department. The situation requires "a large scale organisation" under "active, vigorous, and homogeneous central control," and the Federation favours no measures for tinkering with detailed reforms of existing organisations, but a "fundamental reconstruction of the present administration." But however large an organisation, and however homogeneous, it will not give the desired efficient service unless it be in the closest possible touch with the industrial and commercial community. We have emphasised this point again and again in our pages, urging that those who go abroad to officially represent our national trade interests should be afforded the amplest possible facilities for steeping themselves in our industries and commerce by practical contact with them in suitable districts before they go. In a number of cases in recent years this practice has been followed, but the official whose days are all spent in Civil Service office life will be one of the first to admit that he is at a loss when he is met by the eager, live representative of some industry or other. In short, there is all the difference in the world between passing on in official document form some piece or other of information received from a correspondent, and affording valuable material as the result of a practical first-hand acquaintance with the actual parts of an industry itself. The more closely a new Department comes into touch with real manufacturing activity the more likely it is to be able to understand our national abilities, and to practically meet the needs of the manufacturer in respect of information or other assistance. The point is so obvious, yet it is none the less important, because the obvious seems to have been too long inadequately appreciated.

The Federation holds that foreign commercial policy can only be successfully conducted as an integral and important part of general foreign policy, and that the Department charged with commercial duties should be the Department in general charge of Foreign Affairs. There are such questions as railway, loan, dock, and similar projects, and schemes for the development of foreign natural resources, likely to assume a large place in our affairs in the future, and these and all cognate matters should come under one Department of the Foreign Office. No divided control, no dual element, will do.

The Federation considers that the Foreign Office should be responsible for the protection and promotion of all British industrial, commercial, and financial interests and activities in foreign countries, and for the collection and distribution of all information on matters connected with industry, commerce, or finance in those countries. Prompt and vigorous support of all efforts to secure contracts, concessions, or orders in such countries would be called for, and in these days of sacrifice the Federation recognises that this support may sometimes "entail the selection of one of several British competitors." The Foreign Office may here be inclined to advise our firms

to co-operate in these matters, instead of competing—have we not lost too many good contracts in foreign fields in the past because we have competed against each other the while the amalgamated foreigner has appropriated the spoils? It is also urged that only *bona fide* British firms should be accorded such support. "It should be refused to all firms, whether technically British or not, which are in any degree under foreign influence." This is excellent in spirit, but the Foreign Office Department will have to be very much alive, and will have to be furnished with very different records from those, if any, which existed in Government offices concerning either wholly or partly-owned companies before the war. In war time much valuable information of this character has been got together, more requires compiling, and the black lists of war time will need constant revision, or there may be difficulties in ensuring that only the purely British trader is supported. But difficulties or no difficulties, our factories will call for orders and our workers for employment; that fact must dictate our policy and the course of our departmental activities. The Federation suggests that there be left to the Commercial Department of the Board of Trade, to a Ministry of Commerce, or some other Department, the necessary organisation and control of industrial and commercial activity at Home, and the collection of commercial intelligence respecting the Dominions and the Crown Colonies, but that the work of such Department, and of the proposed new Foreign Office Department, should be co-ordinated, and that there should be free and full consultation between them. Presumably it is regarded as impracticable to concentrate foreign and colonial commercial matters in one Department. Short of that, there certainly will require to be efficient co-ordination and co-operation.

Of course, all these and other re-arrangements will involve large increases in national expenditure, but we have always advocated the generous policy in such matters, believing that the return will amply justify it. We need hardly follow the document through all its propositions respecting the extra staff and accommodation required, the need for the staff to frequently visit industrial centres, and to accord intelligent interviews to all British subjects desiring to discuss foreign trade questions; the appointment of representative Committees of Trades; the raising of rank of Commercial Attachés; the appointment of Commercial Counsellors (we dislike the term) attached to every Embassy and Legation; and the condition of appointment, promotion and training of all the officials. The spirit running through most of these and other parts of the document is to demand that men of suitable training and experience should be employed wherever it is necessary to render British traders assistance in the foreign markets, and that their status should be worthy of the importance of their calling, which is to ensure ample and prosperous activity for British factories and for British workpeople.

We cannot pass without special reference the concluding proposal, namely, that relating to the provision of a staff of experts. It is shown that as the knowledge and experience of the officers of the regular services must be general in character, it will become necessary to provide means for securing detailed and expert reports on particular trades, industries and markets. We have repeatedly urged the importance of this, and have noted in our conversation with Government officials how greatly they are at a disadvantage, because they are unable to discuss our own, or any one particular industry, with a really intimate knowledge. Save in quite exceptional cases the replies to our requests for information on the electrical trade situation have been so vague as to be of little practical value. Yet the officials themselves can hardly be blamed, for we recognise that "their regular services," as things now stand, must inevitably "be general in character." The Federation recommends that a large number of commercial and technical experts should be selected and employed on temporary missions, as and when required, to investigate and report upon industrial or commercial conditions or opportunities in particular markets and particular countries. These are so much like our own words that we need not say how heartily we endorse them.

We join with the Federation in strongly urging upon the Government the vital importance of taking immediate

steps to reorganise the present services, so as to be as ready as possible for future events: there are things left undone that ought to be done, and there is overlapping which ought to be avoided.

Whether or not the Federation scheme, either in part or in entirety, is adopted by the Government, it certainly forms an excellent basis for both discussion and action, and the organisation deserves the thanks of British industry generally for the full and serious attention that it has devoted to the matter.

The Wire-Drawing Industries.

THE question of German competition in the wire-drawing industries has received, and is still receiving, the careful attention its importance merits from the responsible heads of the leading British firms. Doubtless the question of American competition after the war, which is becoming one of increasing importance is also receiving the proper attention it deserves. The statistics just received from the Board of Trade of American exports of fully-manufactured copper wire, strip, &c., exhibit, as they were expected to do, a heavy increase on pre-war figures. The fact that the war has thus benefited American wire manufacturers in some measure at the expense of British firms, is a circumstance inevitably arising from the exigencies of the situation, but the German wire manufacturing firms must have suffered, as regards their hitherto prosperous export trade, in a still more marked degree. The positions acquired by the American firms is now more than ever one of great strength, and the competition between British and American firms after the war is likely to be conducted on very keen lines. On the other hand, the position of British firms is, we believe, one of great strength, and the war has opened out for the immediate future fresh channels of trade for the home firms hitherto almost entirely monopolised by foreign manufacturers. With increased inter-organisation, and a still closer co-operation of principles of mutual trade propaganda interests among the leading British wire manufacturers, the position for the future may be regarded with confidence.

Accounts and Discounts.

IN our issue of March 3rd last, a central station engineer of a reforming disposition drew attention to the extraordinary methods adopted by some manufacturers in rendering their accounts, successive discounts such as 20, 10, 5, and 5 per cent. being deducted from the list prices, while in some cases, after several discounts had been deducted, 5 per cent. would be added to the amount on account of an advance in prices. It would seem that no business man would permit such a system to obtain in his counting-house without very good reasons indeed, and the practice is so common, that there must be some such excuse for its continuance; even firms of the highest standing make use of the system freely, and we have before us a recent example of this kind, in which, moreover, almost every item has both positive and negative discounts appended. One might think that "25 per cent. plus 5 per cent." meant 30 per cent., but it does not; neither does it mean 20 per cent. In the worst cases there are four arithmetical operations—three deductions and one addition—to be carried out without even the aid of decimal coinage. Now, despite the argument that there surely must be good reasons for these manipulations, we know that they are not indispensable, for on March 31st we were able to state that Messrs. Henley had issued a price list showing net prices without any calculations at all. Again we commend this excellent example to the notice of all manufacturers, in the hope that by following it they will eliminate no small amount of wasted labour, and thus help to win the war.

ELECTRICAL SIGNS OF THE TIMES.

[COMMUNICATED.]

IN these dark days and darker nights, those of us who are interested in electrically-illuminated signs can only possess our souls in patience and wait for better times. A glance, however, through the American technical Press will do something to raise our spirits; for there we can read, with something approaching envy, of the progress of the electrical sign movement in a country where lighting restrictions, or, for the matter of that, any other restrictions, appear to be unknown.

It is permissible to wonder whether the present universal upheaval will bring about a renaissance of public spirit in England, and whether our cities, towns, and villages will develop that spirit of municipal emulation which, judging from what one reads, is common in America. Will any English town or city be as bold as so many American cities have been, where they use electrical signs to prove that they are more progressive than their neighbours? and also, so that no traveller shall be in any doubt in identifying one town from another, even if he pass through it by night. There are dozens of towns in the United States which vie with each other in displaying mighty electric signs blazing forth the names of the towns, with appropriate mottoes, and with all the ingenious flashing devices which the trade can supply.

These town mottoes, or "slogans" as they are called, are apparently selected by means of local competitions, and when one reads the winning slogan one wonders, at times, what the "also-rans" were like. For instance, we read that the city of Wausau, Wis., has recently dedicated an electrically illuminated sign 40 ft. x 38 ft., lighted by 976 lamps, reading "Work for Wausau." All the inhabitants of the city turned out to the dedication: there were processions, bands and speeches, and doubtless a great trade in ginger beer and ginger bread upon the side walks, for one feels somehow that so progressive a city must be in a prohibition belt. The flashing device is thus lucidly described:—"First the eagle and ribbons come on, followed by the torches, which are followed at an interval of 15 sec. by the wording, then all out, all on at once, all out, and repeat as before." It reads rather like instructions to knit soldiers' socks, but is doubtless very effective.

The city of Pottsville, Pa., is apparently not so important a place as Wausau, Wis., as its sign is only 20 ft. x 20 ft. The slogan is the inspiring one—"Pottsville, the Best Site on the Anthracite." One feels that the inventor of this motto has a genius for rhyme and rhythm, which is destined for a larger field than Pottsville.

Elyria, O., was, perhaps, more fortunate in its slogan, and certainly more ambitious in its sign, for it is 50 ft. x 36 ft. The lamps are in five colours, and it is wired for "scintillating effect." The slogan in this case is "Elyria, the 100 per cent. city," which cryptic words rather leave one wondering, not only what they mean, but what the other suggestions in the competition were like.

Goldsmith's "Deserted Village," had it but had the modern advantages of Wausau, Wis., Pottsville, Pa., or Elyria, O., might have been deserted no longer, and so have increased its sphere of usefulness.

This municipal slogan sign business is not the only case in which the American electric sign manufacturer has an advantage over the English one. Even the churches out there do not object to draw public attention to themselves through the medium of the electric sign. Trinity Church, Cincinnati, O., has an "enormous electric sign in the shape of a cross, 18 ft. x 8 ft., hung 12 ft. above the sidewalk." There are 250 lamps upon it, and in 16 in. illuminated white letters on a blue background are spelt the words, "Trinity Church." "The completion of the sign was made the occasion of impressive dedication ceremonies, attended by special music, and presided over by high church dignitaries, including several bishops. The sign is lighted every night."

There are many people in England who maintain that the Church has fallen behind in its work, and that it requires rejuvenation. Doubtless the electrical sign manufacturers will be willing to take their share in the great awakening

which it is as possible that, as usual, we shall be too busy with our internal means of publicity the illuminated signs, with a quantity of small lamps and ingenious and complicated lighting devices, is not alone in the field. In America it is, in fact, just a little passé. The present rage is for "flood-lighting": powerful lamps, more or less concentrated, are by reflectors made to project a great flood of light on to the selected building, which thus stands out shining from its neighbours. The tower of the Woolworth building in New York is illuminated by the light from 600 1,000-c.p. lamps, each mounted in a projector and fixed upon adjacent buildings.

Hundreds of municipal buildings up and down America are lighted in this way. Shall we, when the reaction from our present lighting restrictions sets in, squander the electricity we have saved by flood-lighting St. Paul's Cathedral or the Bank of England? The effect would be somewhat startling to our insular ideas. There are people who suggest that many of our public institutions would be the better for more light upon them, but probably they are not thinking of the same thing.

One can conceive that English public taste might have some restraining effect upon the kind of building to which flood-lighting would be applied. For instance, we in England would probably consider that a public mortuary might be left in as much obscurity as possible. Even in these times, few of us are anxious to find our way there, and those within probably desire nothing better than to be left in peace. In the United States they look at these things differently. In a recent number of the *Electrical World* there is an account of the flood-lighting of a mortuary in Denver, Co. It appears that this mortuary is the property of one George Olinger, a Denver undertaker. We are assured that it has long been one of Denver's show places by day, and that Mr. Olinger desired that it might be made equally attractive by night. It seems a quaint notion, but in fairness to the proprietor it should be pointed out that "at the outset he stipulated that the effect must not be garish or circusy"; one likes the man for that. Apparently several schemes were tried; the first one failed, "for while the lamps illuminated the building effectively, the glare was objected to by persons coming from the building at night."

One has an idea that the usual inhabitants of a mortuary, suddenly finding themselves able to get out at night, might easily object to the glare from the 56,600 c.p. of electric lamps with which the front of the building was lighted. There seems something ghoulish about the idea to an Englishman, but Mr. Olinger assured the correspondent who describes the installation that it was "the best thing in the way of advertising he had ever undertaken."

From the above examples it will be seen that there are in England vast unexplored fields of usefulness for the electric sign, if only our local authorities will waive some of their out-of-date regulations, and if we will take some lessons from our American cousins.

HIRE AND HIRE-PURCHASE SYSTEMS.

[COMMUNICATED.]

ALL electricity supply engineers and managers are anxious, so far as may be possible, to extend their sources of revenue, and most of them have given attention already to the important question of placing various current-consuming apparatus on their mains under some form of hiring or hire-purchase arrangement.

Certain authorities have supplied motors under such schemes for many years, whilst other apparatus that has thus furnished an additional and a remunerative income includes ventilating fans, heating and cooking apparatus, and—in pre-air-raid days—lamps.

But if much attention has been given to this form of revenue, it must be conceded that there is an immense field yet unexploited, and, in fact, it is not an exaggeration to say that only a beginning has been made in the development of what is possible and probable in this direction.

While it may be argued that the present is not the most propitious time for such expenditure, should such expendi-

ture be necessary for the inauguration of a scheme, yet now is the time to go into the matter in complete detail, so that with the return once more of normal conditions, everything may be in proper train for the successful initiation or extension of one or other of these systems; this is particularly the case when it is remembered that very likely the restoration of peace may be accompanied by a scarcity or a tightness of money, than which favourable condition for a successful hiring scheme there is none better.

The writer ventures to suggest, therefore, a few of the important considerations and aspects of the subject to which attention may be usefully drawn.

In the first place, the object of a hiring business being to make money, it will be readily seen that it is essential to introduce some safeguard against loss, due to financial instability of the prospective consumer. It is not always possible to ensure against total loss, nor is it possible here to lay down any rules to govern such a contingency. It must be left to each engineer or manager to devise his own regulations in this matter, and these regulations should obviously be drawn up to suit the various classes of consumer, apparatus, &c., involved. The days are gone by when the word "hire" carried with it something of a stigma or an insinuation that the hirer was not overburdened with capital, and it is fairly common to find that establishments of long and sound standing may prefer to put in quite large factory installation under this arrangement; it is, of course, entirely a matter of terms and comparisons. The electrical supply authority catering for this class of business is, moreover, at some advantage over the canvasser selling bicycles or sewing machines, in that whilst these may be usefully employed elsewhere by any dishonest "fitter," electrical gear has its sphere of employment limited by voltage considerations, &c. There is the further point that the slow payer may be brought to reason by having his supply cut off. However, as already stated, little can be said upon this aspect beyond emphasising the importance of safeguards.

Then there is the legal question to consider. While certain legal points must be kept in sight, it is extremely easy to exaggerate the importance of others; the law is always more or less harassing to the layman, and in drawing up a standard form of hiring or hire-purchasing agreement to meet all contingencies, legal aid should be called in, but it is well to see that the lawyer is well chosen, by which I mean that he should be one specialising in commercial work, and both willing and able to pay every regard to simplicity and brevity. These two characteristics are of the greatest value in negotiating business under the agreement with prospective consumers. In most cases an agreement that—

(a) Insures against loss by fire, theft, &c.

(b) Is applicable to a private individual or to a limited liability company.

(c) Prevents distraint upon hired machinery or apparatus for rent or other debt, and at bankruptcy or liquidation.

(d) Prohibits removal of hired machinery or apparatus from certain stated premises except by the written consent of the supply authority, and

(e) Makes suitable provision for periodical payments, may be taken as covering the more necessary requirements, but the particular nature of the business done by individual supply authorities will suggest their own agreement requirements. Thus in a number of smaller concerns, certain of the foregoing suggestions may be deemed unnecessary, such as clause (a), whilst in the case of a hire-purchase agreement, as distinct from a hiring one, there must be inserted a clause allowing the customer the option of purchase outright at a pre-arranged price and at any period of the agreement. Again, agreements operating under Scottish law must be drafted accordingly. So far as the foregoing suggested clauses are concerned, some notes may not be out of place:—

(a) If this clause is used, an arrangement may be made whereby the premiums are paid to the insurance company by the supply authority and refunded by the hirer.

(b) and (c) Purely a matter of legal draft.

(d) In regard to this it is as well to point out that the legal mind variously regards what the layman would term a "fixture" according to the use of screws or nails. It is desirable to affix to all apparatus supplied a nameplate

indicating that it is the property of the supply authority : this namplate to be removed only when a *purchase* is completed.

One of the most necessary steps in the inauguration of a successful scheme is the provision of a showroom electrically lighted, heated, and ventilated.

The suitable locality of the showroom is a problem calling for special consideration of the circumstances attached to the scheme as a whole. Thus, if the business sought be in the nature of fittings, fans, cooking apparatus, fires or other heating apparatus, the showroom could not be placed in a more likely position than in one of the best shopping streets where the feminine shopping community congregate. Obviously, such a position may be totally unsuitable for a power supply authority looking solely to a motor load; in such a case the showroom must appeal to a totally different class of customer—the business man, the engineer and the foreman—and be located accordingly; a suitable position for a showroom of this description may be in the industrial part of the town or in close proximity to a railway station largely frequented by the men it is proposed to attract.

The manager of the showroom must be a man of good address and personality, a capable salesman and a sound commercial engineer, fully conversant with the apparatus he is pushing, and abundantly blessed with tact.

The equipment in the showroom must be kept constantly up to date, and special prominence given to *novelties* for both domestic and industrial application: each piece of apparatus should be neatly and briefly labelled with:—

- (a) Catalogue number or other reference.
- (b) Price for hire.
- (c) Price for hire-purchase.
- (d) Price for sale outright.
- (e) Cost price.

Circumstances may not necessitate all this; the cost price must, of course, be coded, and the others may be, if deemed advisable. It is a good scheme to allow the showroom attendants a commission on apparatus sold, upon the lines indicated in recent commercial articles in the *ELECTRICAL REVIEW*.

Next we may discuss the fixing of the rates for hire or hire-purchase; every attention and care must be devoted to this, bearing in mind that while the rates must in themselves be financially and commercially sound, the real *raison d'être* for the whole scheme is the sale of *electricity*. Again, while the hiring rates must not be so high, that the prospective customer feels he is being "squeezed," yet the "purchase outright" price must be made attractive enough to encourage this class of sale, more especially in the less expensive apparatus, where it is infinitely better to keep the routine and clerical work within the closest limits; for example, it will readily be seen that, if it can be avoided, a flat-iron should not be sold under a hiring system unless, of course, it is but part of a larger and more remunerative sale. This last remark, - however, would have to be suitably modified in those districts which afford scope for an organised "campaign" and where, consequently, the "all-in" cost can be correspondingly reduced. Other factors to be considered in fixing rates are costs of repairs, and wiring for new heating circuits, &c., when necessary. In regard to these, actual experience only can enable a manager to give the close estimate necessary, and with special reference to the cost of repairs, this item is necessarily uncertain, depending, as it does, so much upon the class of apparatus, the reliability, or otherwise, of design and workmanship, and the conditions of service. Experience alone is the best guide for the accurate determination of the respective values of the hiring and selling groups, and therefore of the fixing of the respective rates and prices for the two classes of business; altogether it is a matter for nice adjustment.

Having effected a sale, either for cash or by hire, it is well that the manager should realise that the transaction has not ended: quite apart from the question of payment, it can safely be said that it has but begun. The efficient manager always has it in mind that the new consumer must be a "satisfied consumer"; to this end he arranges for periodical inspection and observation of the apparatus, and its behaviour, and for providing the customer with any useful "tips" there may be for satisfactory operation. It is pro-

bably well to emphasise that in a hiring business, more so than in any other, it is essential to supply only apparatus by well-established manufacturers of repute, and likely to give a minimum of trouble: this consideration quite independently of the repairs bill.

We now come to a very important point in all hiring systems—viz., the necessity of keeping as accurately as possible the life history of each individual piece of apparatus. This may best be done by means of a suitably-indexed card system. I have already said that it is desirable for all clerical and routine work and expenses in connection with a hiring scheme to be reduced to the absolute minimum, and, at first glance, it may be thought that the suggestion herein contained is too cumbersome and expensive, especially for the smaller lines of apparatus. My contention, however, is the reverse, and that the system, once initiated, is remarkably efficient, inexpensive, and altogether a commercial asset of considerable value; one which many times over repays for the initial expenditure.

The system referred to can be quickly grasped by a glance at this reproduction of a card drawn up for the occasion :—

Description.....	Maker's ref.
.....	Corporation ref.

Bought from..... On..... Cost.....

Date hired.	Name.	Address.	Rate.
-------------	-------	----------	-------

Inspected onRemarks.....

Naturally, this is intended only as a rough guide and may readily be altered to suit individual requirements: thus, a space may be provided for information as to date and cost of any repairs that may have been necessary. A suitable cross index under consumers' names and apparatus under the supply authorities' serial numbers should be made.

In conclusion, it only remains to be said that these notes are not intended to cover all the points calling for consideration; they constitute only a brief survey of some of the more prominent features of the successful hiring business, and of the possibilities thereof. Mention has been made in these notes more than once of heating and cooking apparatus, and there is little doubt that, marvellous as has been the growth of this class of business during the last few years, the next decade should show still greater strides now that the difficulties inseparable from the development and application of new designs have been overcome. And in regard to power, he would be a bold man who would venture to estimate the numbers of effete and inefficient gas engines which have been lately discarded in favour of electric motors. It is commonplace to say that the huge output of munitions of war has only been made possible by electric power; and, if it had not done so before, the electric motor has certainly now come into its own. In these two classes of apparatus, to specify no others, the hiring system will undoubtedly reach huge developments in coming years.

Agricultural Machinery Research.—According to the *Times*, the Board of Agriculture and the Development Commissioners have been considering the establishment of a Research Institute to investigate problems relating to agricultural machinery; it is suggested that this should be established at Cambridge in association with the existing Schools of Engineering and Agriculture. The principal officers would be a director experienced in mechanism, and an assistant-director experienced in agriculture. Land for experimental work would be available on the University farms.

SOME SOURCES OF ERROR IN THERMOMETRY.

By E. B. PAUSEY.

It is a curious trait of human nature that fallacies—especially those which contain a half-truth—are apt to maintain their hold on the imagination of the majority of mankind with great tenacity. Witness the almost pathetic belief of the average man in the inherent inability of the photographic camera to record anything more or less than a true and complete image of any object or view upon which it is exposed: this belief persists even at the present day, in

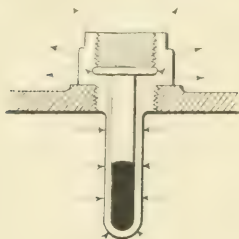


FIG. 1.

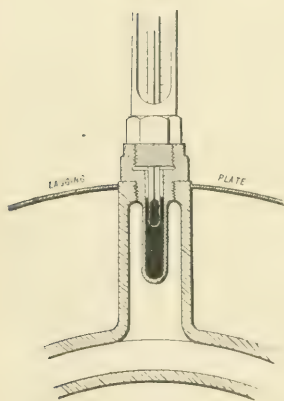


FIG. 2.

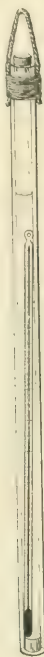


FIG. 3.

spite of all the evidence against it daily presented by the cinema, where impossible occurrences usually form a main feature of the programme. In like manner a very large number of engineers appear to hold an equally unshakeable belief in the veracity of their thermometers, although, as I propose to show in this article, it is quite within the bounds of possibility for a thermometer, well made and correctly calibrated though it may be, to tell the most arrant lies—lies which, in some cases, may cost the owners of a plant considerable sums of money, and in others keep them in a fool's paradise with regard to the efficiency and safety of their plant.

Everyone who is responsible for the operation of plant for the generation of electrical energy—or, indeed, of any form of power plant—should be quite aware of the fact that if economical and satisfactory working is to be expected regular and reliable temperature records are a necessity. The common mercury-in-glass thermometer is by far the most popular instrument for this purpose, and it must be granted that it is fully entitled to its popularity, as it is, in itself, capable of very high accuracy. Unfortunately, however, its reputation for accuracy is itself an indirect cause of serious errors, which are commonly overlooked, for it is this reputation that leads engineers to that unquestioning belief in the infallibility of thermometer readings to which I have already referred. So far from there being any ground for this belief, the temperature indicated by the height of the mercury in the stem is simply and solely that of the

mercury in the bulb, and unless the latter approximates very closely to that of the body whose temperature is to be measured, the records taken cannot be either useful or satisfactory. Yet, in spite of this rather obvious fact, thermometers are frequently so incorrectly applied, that their indications diverge from the truth to a surprising extent; these divergencies are usually quite unsuspected by those in charge of the plant, who accept the temperature readings without doubt, utilise them in calculating efficiency percentages to, perhaps, two decimal places, and are often incredulous when the existence of large errors is pointed out. Considering the importance of the subject, the amount of thought hitherto given to the correct application and use of thermometers in practice is very meagre, and but little information is available either from text books or the technical Press; in these circumstances, I venture to hope that these brief notes may direct attention to this matter, and be of some assistance to engineers in charge of power plant. The few examples described in the present article, out of many which might be quoted, are quite sufficient, I believe, to demonstrate the need which exists for the devotion of greater care to this matter.

It is curious, and nevertheless a fact, that in the majority of cases, thermometric errors favour the manufacturer of plant as against the purchaser. I do not, of course, doubt that this circumstance is purely accidental, nor do I desire to suggest that manufacturers install thermometers with any other view than the correct registration of temperature; but I do say that it strongly emphasises the need for the user to assure himself that the thermometers and pockets fitted to his plant are such as will serve their purpose in a satisfactory and accurate manner.

A type of thermometer pocket as commonly used is shown in section in fig. 1. In order that the transfer of heat from the steam or other fluid surrounding the pocket to the bulb shall be as perfect as possible, the pocket is intended to contain oil or, preferably, mercury. There are two sources of inaccuracy in such a fitting, the most important of which is the effect of its situation—dealt with below; the second, which is usually negligible, but which still merits consideration, is loss of heat by conduction and radiation. This loss is illustrated by the arrow-headed lines, which represent heat received by the pocket from the steam, or other fluid, conducted up the walls of the pocket, and radiated away from its exterior portion. By making the pocket reasonably deep, by reducing the thickness of its walls as much as is consistent with safety, by using a thermometer such that the bulb is nearly at the bottom of the pocket, and by using just sufficient mercury to immerse the bulb completely, and no more, this source of error may be reduced to an almost vanishing quantity. The aim of these precautions is to render the conduction of heat from

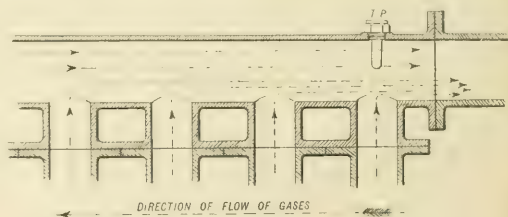


FIG. 4.

the lower part of the pocket to the exterior as difficult as possible.

When the pocket is fixed in position, it will really receive heat, not from the whole of the fluid in the pipe or other vessel, but from a comparatively small sample thereof, and it is, therefore, essential that this shall be a representative sample. This is a most important matter, and want of attention to it is the cause of very large errors indeed. The pocket should be fitted in such a position as to be fully exposed to the direct flow of the fluid. Often it is placed in some out-of-the-way corner, where the flow is sluggish and the radiation losses possibly high, and in such a case it

cannot give a true reading. Fig. 2 is an example of this kind of faulty application, probably about as bad an example as could be found. The thermometer is supposed to indicate the temperature of the steam at the stop valve of a steam turbine, and it is, therefore, a most important item in the calculation of the efficiency of the machine. The pocket is screwed into the upper part of a hollow cylindrical projection cast on the stop valve body. This arrangement has the apparent object of raising the thermometer to a position clear of the lagging plates on the valve body; but while it certainly serves this purpose, one cannot altogether help wondering whether there may not be any ulterior object in such a design. So far from the pocket being fully exposed to the direct flow of the steam a lot of trouble seems to have been taken to place it where there can hardly be any flow at all; moreover, the radiation losses from the cylindrical projection are bound to be excessive, and, to make matters worse, the bulb of the thermometer only reaches about halfway to the bottom of the pocket. The net result is that the thermometer reading is from 80° F. to 100° F. below the actual steam temperature, as indicated by a more correctly applied thermometer close by. Such an enormous inaccuracy makes this one example alone sufficient proof of the importance of more careful attention to these fittings. If the arrangement had been specially designed for no other purpose than incorrect registration of the superheat temperature it could hardly have been better adapted to that end.

When the temperature of a liquid flowing in a pipe is required to be measured, it is necessary that the pocket shall not only be exposed to the direct flow, but also that it be not fitted in a place where the liquid is liable to separate into strata of different temperatures; if no attention is given to this matter, and the fitting is situated in such a place, the natural result will be that the reading of the thermometer will by no means represent the mean temperature of the liquid, but simply that of the stratum in which the pocket happens to be immersed. Fig. 4, which exemplifies a case of this source of error, shows a thermometer pocket as generally fitted to the outlet of an ordinary economiser, for the purpose of indicating the temperature of the feed water supplied to the boilers. From the reading of this thermometer, the probable effect of the economiser in increasing the overall economy of the plant is reckoned. I shall now show that its readings are unreliable, and that any estimates of the efficiency of the economiser based upon them are erroneous and exaggerated—at the same time admitting that the actual usefulness of the economiser is unquestionably so great that it needs no exaggeration, either thermometrical or otherwise.

The thermometer pocket, T P, is shown in its customary position, namely, screwed into the upper main header immediately over the branch leading from the last top box. Now, the temperature of the water issuing from the top boxes is not by any means equal throughout the economiser, but varies in a rather interesting manner, which can be roughly investigated by feeling the branch pipes with the hand. Economisers are generally arranged for the water to enter at the end where the flue gases make their exit, and to leave it at the opposite end where the gases enter, thus, in fact, applying the "contra-flow" principle. If the rough test of the temperatures be started at the water inlet end it will usually be found that the branch at that end is moderately warm, and that at first the temperatures increase as the outlet end is approached; so far, this is what might be expected from the decrease in the temperature of the flue gases as they pass through the economiser. The maximum will not, however, as one might suppose, be found at the water outlet end, but is generally somewhere near the middle, the temperature of the branches thereafter falling off more and more rapidly as the water outlet end is approached, until that of the last branch—the one immediately below the thermometer pocket in the illustration—may be, but little above that of the inlet water, in spite of the fact that the tubes at this end of the economiser receive heat from the flue gases when the latter are at their hottest. This is due to the flow of water in the economiser tubes not being equal throughout the economiser; it is very much less at the water inlet end than at the outlet end, owing to a large proportion of the water

being carried by its own momentum past the branches at the inlet end to those at the outlet end. The natural result of this is a lower temperature rise in the tubes at the outlet end, as the consequence of the larger volume of water passing through them. Now, the water in the top main header, owing to its slow rate of flow in the branch pipes, does not become mixed to any great extent; an idea of its behaviour is given by the arrow-headed dotted lines in fig. 4, which show how the colder water from the tubes at the outlet end flows along the bottom of the header, missing the thermometer pocket altogether. The latter is, therefore, immersed only in the hotter water in the upper part of the header, and thus it gives an utterly fictitious high reading, the error in one case which has come under my observation ranging from 30° F. to 60° F. When it is remembered that, according to the rough rule of 1 per cent. increase of overall economy for each 10° F. increase of feed-water temperature, this error represents a non-existent gain of 3 per cent. to 6 per cent., its importance needs no further emphasising. To obtain correct readings, the thermometer should be installed in such a position that it indicates the temperature of the water after it has passed through a mixing chamber or a valve of the globe type.

One field where there is a wide scope for scientific consideration is the means for taking the temperature of alternators. The usual method of doing this is merely to hold an ordinary mercury thermometer with its bulb against the core or coils. This method is crude and unscientific; it is unlikely to give the maximum temperature of the windings; it is subject to the personal factor of the observer, a very variable and uncertain quantity; and it is liable to be applied in a more or less irregular and haphazard manner. As an alternator has no commutator to visualise—as one may put it—heavy loads by sparking and flashing, the extent to which it may be loaded is limited by its temperature, and if this is taken in the usual unsatisfactory manner, there is bound to be a good deal of doubt as to whether a machine has a sufficient margin of safety at heavy loads. Particularly during times of emergency, such as sudden heavy increases in load or breakdowns, are serious risks likely to be taken in the way of overloading. On the other hand, machines are sometimes started up and put on load merely to deal with short peaks, which could be quite safely dealt with by overloading the machines already on load for a short time, provided proper and convenient means of indicating their temperatures were in use. Such a means would be an electrical resistance thermometer, with its resistance element fitted closely up to one of the coils of the stator winding, in such a place that it would be subjected to the maximum temperature of the machine. The indicator itself should be fitted as a switchboard instrument on the machine panel, so that the temperature of the alternator could be easily and regularly taken and recorded on the station log sheet in the same way as readings of other instruments. If some arrangement of this kind were, in general use, there is no doubt that all power stations would be run with greater reliability, and some, at least, with greater economy.

Readings of thermometers which are fitted in places difficult of access—such as superheaters, economiser inlets, &c., are commonly very unreliable, owing to very serious errors introduced by the personal factor of the observer. Even the most conscientious attendants naturally feel some repugnance to scrambling over dusty, hot boilers and flues, up dark, dirty trenches or over grimy condensers every half hour or hour, especially in the small hours of the night shift, to take temperatures which usually show few important variations. Human nature is only human nature after all, and its weaknesses must be allowed for. An electrical or any other form of thermometer, capable of indicating upon an instrument which can be fixed in any convenient position the temperatures of apparatus in not easily accessible places, would ensure that these temperatures would be taken and recorded as accurately as those in the engine room itself. As a check on the readings of the distance instrument an ordinary mercury thermometer ought to be used occasionally, when a comparison between the readings of the two instruments would discover any errors, which could then be corrected.

A careful and reliable record of the temperature of the interior of a coal stack might save heavy loss from fire by

getting nearly anything of overheating. Fires, once started, are very difficult to keep under control, especially in the case of large stacks. It is poor comfort for the loss of a steady stack of coal from this cause to be able to claim compensation under an insurance policy, since money, even paper money, is not an efficient substitute for boiler fuel, and, in these times of scarcity, it cannot always be quickly exchanged for it. Coal-stack temperatures are commonly taken—when taken at all—by lowering a thermometer down a pipe driven into the stack. It is not difficult to devise an improvement on this arrangement that is both cheap and satisfactory. In fig. 3 is shown an ordinary mercury thermometer, which should be graduated to above boiling point—say, 225° F.—immersed in water in an ordinary water gauge-glass, the ends of which are closed by tightly-fitting corks. The lower cork should be stuck in with shellac varnish, so that, in case of over-pressure, it will remain in its place, and the upper one be driven out; otherwise, there would be a risk of losing the thermometer. A small string becket is attached to the upper part of the glass by a whipping of fine twine or strong thread, the whipping being well varnished to prevent it slipping. The arrangement may be lowered down a pipe by means of a string tied to the becket. The pipes should be closed at the bottom, so that sufficient water or oil may be put in them to cover the tube containing the thermometer, and pointed so as to be easily driven down into any desired part of the stack. The advantages of this system of taking coal-stack temperatures over the usual method already mentioned are that, as the water in the tube retains its heat when the instrument is drawn up to be read, there is no uncertainty due to the mercury falling rapidly, as is the case with an ordinary thermometer, and that if the pipe just contains sufficient liquid to cover the glass tube, the thermometer will indicate the temperature of the immediate neighbourhood of the bottom of the pipe very accurately. If no liquid is put in the pipe, errors will arise, partly from the bad conductivity of air and partly from the effect of convection currents in the pipe; this last source of error will be considerably increased if a large excess of liquid be used.

In addition to the foregoing sources of error, which are external to the thermometer, there are others which lie in the instrument itself. One, which is extremely annoying and often difficult to deal with, frequently occurs in thermometers used in high-temperature measurements, say above 250° F. This is the "splitting up" of the mercury column, a more or less rapidly-increasing portion of it taking up a position in the extreme top of the bore of the tube, a position from which it can only be dislodged with difficulty. The cause of this is probably that the mercury evaporates owing to the high temperature, fills the vacant part of the bore with mercury vapour, this vapour condenses in the cooler upper part of the bore, and so forms the "split off" portion. Some thermometers are made with a small cavity at the upper end of the bore; when this is the case, all that is necessary is to heat the bulb carefully over a spirit lamp or gas flame until the break in the mercury rises into the cavity; the break will then rejoin, and on cooling, the instrument will be all right again. Great care must be taken, however, not to overheat the bulb, since if the glass is softened at all, it will be collapsed by the pressure of the atmosphere—or burst, if the thermometer be nitrogen filled. All thermometers for high temperatures—say over 250° F.—should have such a cavity in the bore; if they have not, it is often difficult, and sometimes impossible, to bring down the split-off portion of mercury. Swinging or tapping the thermometer may have the desired effect, but, even when brought down, it is not at all easy to get the break to join. This is probably due to a small amount of mercury vapour between the two portions of liquid mercury acting as a cushion, aided, no doubt, by surface tension.

Another case of splitting of the mercury column occurs when an ordinary thermometer, in which the space above the mercury is vacuum, is used for the measurement of very high temperatures. Obviously, in a thermometer of this kind, the only pressure on the mercury in the bulb is that due to the head of mercury in the stem, which, in thermometers of the usual size, about 12 in. long, is

not above 4 lb. per sq. in. absolute when the thermometer is held vertically. The boiling point of mercury under a pressure of one atmosphere is 675° F., but at this reduced pressure it is lowered to between 550° F. and 600° F., so that if the temperature to be measured is higher than this figure, the mercury in the bulb will boil, and the vapour given off by it will drive the mercury column right to the top of the stem; therefore the temperature at which the mercury in the bulb boils forms the highest limit of the scale. In thermometers which are required to read to more than 600° F., the boiling point of the mercury in the bulb is raised by filling the space above the mercury column with an inert gas—such as nitrogen—at a pressure of about 25 atmospheres. The upper limit of the scale is then raised to about 1,000° F. It should be noted that, while nitrogen-filled thermometers furnish a satisfactory solution of this difficulty, they are just as liable as those of the ordinary vacuum type to the trouble of the upper portion of the mercury column splitting off, as described in the preceding paragraph, since evaporation from the surface of the mercury and condensation in the end of the stem goes on independently of the presence or absence of inert gas in the space. Moreover, if this should occur, the presence of high-pressure gas between the two portions of mercury renders their reunion very difficult, if not impossible.

On occasions when specially accurate temperature indications are required, as, for instance, official tests of new plant, extra precautions ought to be taken with the thermometers, particularly with those which are to be used for temperatures which have considerable effect on efficiency calculations, such as those of superheated steam, feed and circulating water, exhaust steam and condensate. The ordinary brass-cased thermometers, such as are commonly fitted for permanent use, should not be used, but should be replaced by special stem thermometers having a limited range, and as open a scale as possible. For taking the steam temperature, which may be expected to lie within the limits of, say, 500° F. to 550° F., a thermometer having a range of about 450° F. to 600° F. should be used; it could easily be read correctly to one quarter of a degree; the other important thermometers should similarly be specially adapted to their work. A small source of error will be eliminated if thermometers which are to register high temperatures are kept at approximately their working temperature for some hours previous to the test, as glass, on being raised from a low to a high temperature, does not immediately expand to the corresponding volume, but continues its expansion slightly during a considerable time. All the thermometers should be checked both before and after the test by comparison with a carefully calibrated master instrument. In the calibration of thermometers the whole of the stem and bulb is at an equal temperature throughout, and the scales are made on this basis. In the case of thermometers for registering high temperatures this condition is not often approached in practice, and, as mercury has a much higher coefficient of expansion than glass, it becomes necessary in accurate work to correct for this error. This is done by means of the following simple formula:—

$$T_c = T_r + kn(T_r - t),$$

where T_r is the apparent temperature as read,

T_c is the corrected temperature,

t is the mean temperature of the stem,

n is the number of degree divisions of the scale occupied by mercury and exposed to the temperature t ,

k is a constant whose value is 0.000083 for the Fahrenheit scale, and 0.00015 for the Centigrade scale.

The temperature t of the stem cannot easily be obtained accurately, but a rough approximation will suffice.

In concluding these notes, I trust that they will have the effect of drawing the attention of the engineering public to the importance of giving due care and attention to these instruments. They are not written from the point of view of an expert, but are the result of practical observations in everyday working, and are intended to be read in that light.

THE CONTROL OF ROTARY CONVERTERS.

In a brochure recently issued by the British Thomson-Houston Co., Ltd., some novel and interesting particulars are given regarding the methods available for obtaining from a rotary converter a variable D.C. voltage whilst the A.C. voltage remains constant, and *vice versa*. Normally the ratio of the A.C. to the D.C. voltage is practically constant for any given load, and in order to vary the ratio it is necessary to introduce reactance on the A.C. side, or to employ a booster machine, an induction regulator, or split-pole control. The reactance method is the simplest and cheapest, and is suitable for use where the voltage variation required does not

the load and voltage. In this case the D.C. voltage is varied by inserting an induction regulator between the transformer and the slip-rings, which increases or reduces the A.C. voltage applied to the rings. The regulator performs exactly the same functions as the booster, but without affecting the commutating conditions of the rotary, so that machines can be built of the largest output for a given size, without complications, and can be made to give a voltage range of 30 per cent. or more. In the latest practice the regulator, which was formerly a separate item, is mounted on the

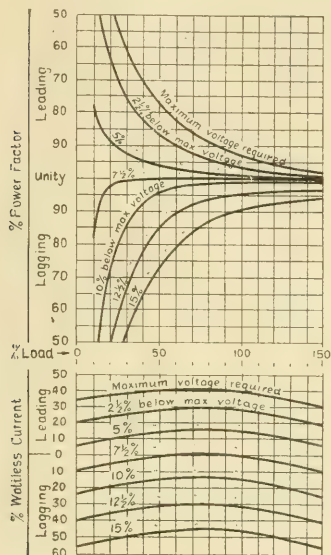


FIG. 1.—CURVES SHOWING POWER FACTOR AND WATTLSS CURRENT OF A REACTANCE-CONTROLLED ROTARY CONVERTER.

exceed 15 per cent., which is usually the case in practice. The effect of the reactance depends upon the excitation of the machine; if the field current is reduced below the value which gives unity power factor at the slip-rings, a lagging current is drawn from the A.C. mains, and the reactance lowers the slip-ring voltage, and therefore also the D.C. voltage, while if the field current is increased, a leading current is drawn and the D.C. voltage is raised. Evidently the power factor varies with the D.C. voltage, but even with 15 per cent. variation of voltage the power factor at full load is not less than 90 per cent., as shown in fig. 1, which also shows how the power factor varies with any given voltage, how it varies when the voltage is varied, and the wattless current expressed as a percentage of the full-load current which will be drawn from the line under various conditions of load and voltage. It will be seen that at constant voltage the wattless current varies only within moderate limits from no load to 50 per cent. overload, and that the power factor of a system may be greatly improved by adjusting the conditions so that a large leading current is drawn from the line. In the figure, the uppermost curves relate to the maximum voltage required and the lowest to a value 15 per cent. lower, but precisely the same curves hold good if the conditions are arranged so that the machine runs at normal voltage with unity power factor, the top and bottom curves then representing the performance with voltages respectively $7\frac{1}{2}$ per cent. above and below the normal.

The use of a booster was one of the earliest methods of varying the voltage ratio, and enables the power factor to be controlled independently of the load and voltage; but with modern rotaries equipped with commutating poles and giving greatly increased outputs, booster control seriously affects the commutation, and is found inferior to other methods.

Control by induction regulator is free from this drawback, while it retains the advantage that the power factor is independent of

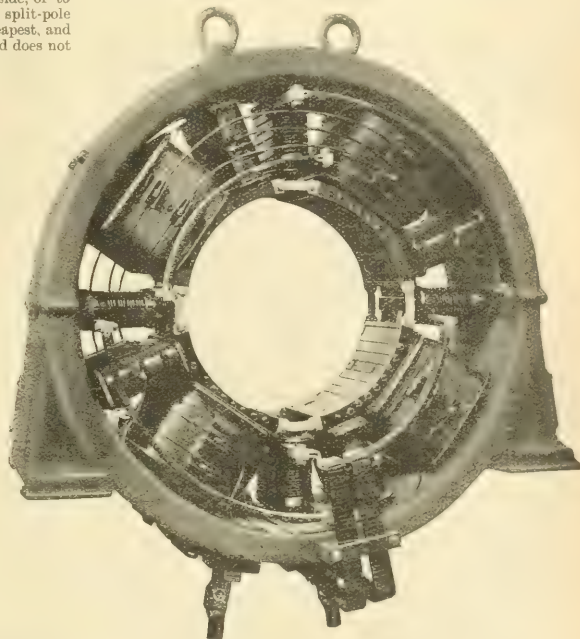


FIG. 2.—MAGNET-FRAME AND WINDINGS OF B.T.H. 250-KW. SPLIT-POLE CONVERTER, WITH COMMUTATING POLES.

bedplate of the converter, which is then of about the same size and cost as a booster-controlled machine, and is self-contained. The design of the regulator has been improved, and the combination, which is illustrated in fig. 3, is useful for correcting a low

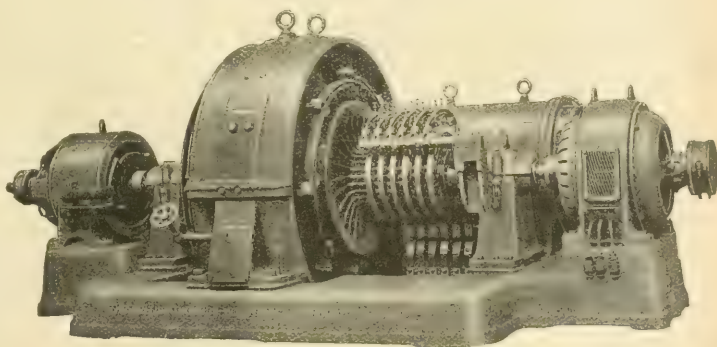


FIG. 3. B.T.H. 500-KW. SELF-SYNCHRONISING ROTARY CONVERTER WITH INDUCTION REGULATOR, A.C. STARTING MOTOR AND SEPARATE EXCITER.

power factor, operating on 90 per cent. leading power factor at full load, at any voltage.

The remaining method of control—the split-pole device—was patented by the B.T.H. Co. and developed for 25-cycle work, giving a D.C. voltage range of 25 per cent. with constant A.C. voltage. In this system each of the field poles of the rotary is divided into a main pole and a regulating pole, the latter being arranged for excitation either in the same direction as the main poles or in the opposite direction. As the D.C. voltage is proportional to the algebraic sum of the fluxes of both poles, while the A.C. voltage is proportional to the vector sum of the A.C. E.M.F.s produced by the two fluxes, and the algebraic sum can be widely varied without greatly affecting the vector sum, the voltage ratio can be varied over a long range; unity power factor can be obtained under any conditions of load and voltage, and as the control is effected in the armature of the

concerned about this as the simplest type of control, in which the power factor is independent of the voltage variation. Fig. 2 shows the fundamental system of a split-pole rotary of 250 KW. with commutating poles.

LEGAL.

WOOLLEY & WATSON, MARSH & CO. (BRONDSBURY), LTD.

At the Lambeth County Court, before Judge PARRY, sitting with Mr. Medical Referee, on December 19th an application was heard for the review and termination of an award under the Workmen's Compensation Act made to Thomas Woolley electrician, the employers being electrical engineers, of Brondsbury, N.W. The case has already been reported and commented upon in the ELECTRICAL REVIEW.

On May 4th, Woolley was working for the firm at Pike's Circuit Cinema Charing Cross, and he alleged that when going to fetch some material, a labourer employed by another firm was wheeling a barrow full of cement up a plank, which tipped over, a bag of cement falling on his left leg and displacing a cartilage. He had not been able to work since, and the Judge, on October 5th, held that the accident arose out of and in the course of his employment, awarding him £1 a week from the date of the accident as compensation, which had been paid him up to the week preceding the present hearing.

Mr. KINGSBURY, for the firm, said that in asking for the review and termination of the award they maintained that the man had entirely recovered from the effects of the accident on November 3rd, a month after the award. At the last hearing, mention was made of an X-ray photograph of the injured knee taken at Charing Cross Hospital when he attended there, but it was not produced. After considerable trouble they had been able to procure the photograph. The difficulty had been whether the condition of the man's leg was due to the accident or to some old-standing disease, and the photograph showed that the condition of the leg was due to arthritis of the knee joint, and not to the accident.

ALFRED R. TOTTELL, medical student in his fifth year, stated that he was in charge of the casualty department at Charing Cross Hospital on the day Woolley met with his accident and was brought there. He found both knee joints inflexed, the left slightly more than the right. There was no swelling, and he could find no evidence of a fracture or limitation of the joint. Woolley stood talking to him for about ten minutes. Witness made an entry that the man had strained the knee joint, and treated him for that. He gave him a week in which to recover. He saw him again that week, but could find no development. He did not find any evidence of any loose cartilage, though he suggested to Woolley that that was what he was suffering from, a suggestion he readily accepted as the cause for the pain from which he was suffering, or said he was. Witness came to the conclusion that he was exaggerating his condition. On June 9th he saw him once more, when he sent him to the consulting surgeon, Mr. Daniel, as witness would have nothing more to do with him. He came to the conclusion that at that time Woolley had entirely got over the effects of the accident. He never prescribed for a loose cartilage, because he did not believe it was there. On November 3rd he saw Woolley in conjunction with Mr. Cooge, consulting surgeon at the hospital. The man was able to walk easily, there being no impairment of the movement of the leg. There were then no signs of a detached cartilage. There was a certain amount of arthritis present in both knee joints, as was shown by the creaking of the joints, this being apparently of long standing. In cross-examination, witness said he never saw any swelling of the knee joints.

DR. PASTELL, resident casualty officer at Charing Cross Hospital, said he examined Woolley in the hospital on November 3rd. He was not suffering from any loose cartilage, but from arthritis in both knees. The X-ray photograph showed the disease in a more extended form, and no evidence of a loose cartilage. There was creaking in the joints. Witness thought then the man was quite able to work. He had been advised to wear a knee bandage, but said he had only had it on once or twice. In cross-examination, witness said it was impossible to say how long the man had suffered from arthritis, but it was present before the accident.

MR. BLOXHAM, for Woolley: Do you say that he is capable of doing the same work now as he did before the accident? — Yes.

JUDGE PARRY: Such as climbing ladders and kneeling down? — I think so.

DR. M. DUTCH, physician at the Lewisham Military Hospital, said he examined Woolley on August 27th, and found no evidence of fluid in the joint, or of a movable body, but he found arthritis present, both knees suffering from it. He thought the man was quite fit to do the same work as he did before the accident. The disease, in his opinion, was of long standing.

DR. IVOR DAVIES, specialist, said he also examined Woolley, and found distinct evidences of arthritis. It was very marked, and was of years' standing. There was no evidence of an accident to the knee joint. In cross-examination, Witness said he was quite capable of climbing ladders and kneeling.

On behalf of Woolley, DR. ROBERTSON, his panel doctor, said he had attended him for some years, and he had never complained of not being able to do his work through arthritis in the knees. He came to him during the time he was attending hospital, and found him suffering from a very swollen and inflamed knee joint. He was of opinion that the man had displaced a cartilage, and

recently recommended him to wear a bandage. He did not yet think he was fit for work, and certainly did not think he could climb ladders. In cross-examination, witness said he thought it would be some weeks before he could go back to work.

After the Medical Referee had examined Woolley, JUDGE PARRY asked if he had made any effort to do any kind of work?

APPLICANT: No, I have done nothing whatever.

JUDGE PARRY said the Medical Referee had spoken very strongly to Woolley about getting back to work. Addressing the man, he said he could work very well on the level if he tried, and now was his time to do something, for men were needed. He must get to work as soon as possible.

WOOLLEY said he did not feel able to go up ladders with safety.

JUDGE PARRY said he could find plenty of work where he would not have to do that. He could not go on getting his £1 a week for ever. It was quite time he made a big effort to get back to work. The Medical Referee was of opinion that the condition of the left knee was due to the accident, and that the arthritis arose out of it. He suggested to suspend the present order to pay the man £1 a week, and grant him 15s. a week until February 1st, in which time he could try and find work, and the result could be reported to him. Addressing Woolley once again, he urged him to get to work, saying, "You may have a little pain at first, but you must stick that and do your best."

SECRET PROCESS IN RUBBER MANUFACTURE.

IN the Chancery Division Mr. Justice Peterson had opened before him on Tuesday, December 19th, the action of the Alpertown Rubber Co. v. Manning and others, by which the plaintiff company sought an injunction to restrain the defendant Manning from communicating to the Belgium Tyre Co., Ltd., or other persons, certain information acquired by him while in the service of the plaintiff company for the benefit of the plaintiff company, and also to restrain the Tyre Co. from taking advantage of the information so communicated.

Mr. Hughes, K.C., and Mr. Hodge appeared for the plaintiff; Mr. Herbert, K.C., and Mr. Manning for the first defendant; and Mr. Tomlin, K.C., and Mr. Devonshire, holding the brief for Mr. Deighton Pollock (who was ill), for the Belgium Tyre Co.

MR. HUGHES, in opening the case, said: The plaintiff company, who were originally incorporated under another name, were connected with the washing of rubber, but in 1912 they changed their name to the Alpertown Rubber Co., and commenced to manufacture various rubber compounds. Many extremely hard substances now used were really rubber productions and were important because of their insulating property in connection with electrical work. They were used for magneto distributors. The plaintiff company had a very large number of different formulae for the mixing of the rubber. The defendant Manning came to their works early in 1912. There was no written agreement of service. One important mixing arose in the following way:—The plaintiffs did a considerable amount of work for the Bosch Magneto Co., and that company used a material called Stabilit, which at that stage was produced in Germany. After the war began it became impossible to get Stabilit from Germany; the Bosch Co. in England was very anxious to get a satisfactory substitute for it, and approached the plaintiffs, amongst others, with a view to getting them to manufacture a satisfactory substance. An analysis was sent for the plaintiffs' assistance by the War Office. The works foreman of the plaintiffs was a man named Fisher, and he, after many experiments, arrived at a satisfactory substitute for Stabilit. This result was attained in the month of June, 1915, when the product was submitted to the Bosch Co. and passed by them as satisfactory, and it was also passed by the War Office, who were equally anxious about the matter, as these magnetos were very largely used for their engines. There were many other formulae for mixing which the plaintiffs had, and in some cases they worked out the mixtures themselves; in others, the customers would supply the formula for the mixing they required. The formula would then be kept on two cards, one of which would be given to Fisher and the other to a man named Drummond, in the drug or compounding works, where the actual mixing was done. The works records, when not actually required, were kept in the company's safe, care being taken to prevent people getting at the knowledge they contained. On June 29th the company gave Manning a month's notice, suggesting that he should take a holiday until the expiration of the month, so that from June 29th he was not on the premises. After he left, Manning invited Fisher to join him in the formation of a company to work a substance now known as "Alperlite," pointing out that he had obtained the formula from the plaintiffs' loose-leaf book. It was found that the formula was not in the book he had left behind, and Fisher and Drummond were the only persons who could know the formula. The two cards had been removed from the book, and the plaintiff company would have no means of ascertaining this mixture. The defendant stated that he had had an offer of £200 for the formula, but Mr. Fisher, after saying that he would think the matter over, wrote declining to have anything to do with it. It would appear that Mr. Manning had removed one of the loose-leaf books from one of the company's offices, and he claimed that it was his own property. Counsel did not see how that could be, as it was paid for with the company's money. He had, however, offered to return the book, but that was not sufficient. Shortly after the termination of his engagement with the plaintiff company, Manning got into communication with the Belgium Tyre Co., who were also manufacturers of a certain class of rubber goods, and it would appear that as early as July, before his engagement with the plaintiffs had terminated, he was giving them an

order. The defence was a denial that Manning was making use of any knowledge that he had acquired while in the service of the plaintiffs, and the Belgium Tyre Co. alleged that they had acquired nothing from Manning over which the plaintiffs had any rights. They admitted that Stabilit was manufactured in Germany, but not entirely in that country, and they denied that any formula used in the plaintiffs' business belonged exclusively to the plaintiffs.

Witnesses were called for the plaintiffs to prove that Manning knew the formula of the plaintiffs' Alperlite, and that the Belgium Tyre Co. were now supplying a substance identical with it. The success of the compound depended upon the formula and not upon the skill of the workman who compounded it, and any departure from the formula would tend to alter the specific gravity, the insulating properties, and the flexibility.

At the conclusion of the plaintiffs' case the hearing was adjourned until next sittings.

RATING OF ELECTRIC TRAMWAY LINES. LONDON COUNTY COUNCIL'S APPEAL SUCCESSFUL.

AT the County of London Quarter Sessions, at Clerkenwell, Mr. A. P. Lawrie, K.C. (Deputy-Chairman), delivered judgment in this appeal against the quinquennial assessment by the Assessment Committee of the Holborn Union of tramway lines in the Boroughs of Finsbury and Holborn.

MR. LAWRIE, in giving judgment, observed that throughout the hearing the fact had more and more impressed itself upon them that this case need never have come into Court, and that was equivalent to saying that, particularly at this time, it never ought to have come into Court. It was a most deplorable thing to see two public bodies spending large sums of money in fighting over matters which should have been easily capable of adjudication without litigation. The Court could but feel that if each party had approached the other with the earnest desire to settle, a solution would have been reached very similar to the result they had arrived at, and much of the ratepayers' money would have been saved. But while a settlement would have been easy if that course had been adopted, a decision in the case was by no means so simple. When the parties found that the question was to be fought they both appeared to have shut their eyes to the points telling against them, and have opened them very wide to every point that even appeared to tell in their favour, with the obvious result that differences necessarily increased, the valuations of the rival sides were hopelessly at variance, and both included many obviously untenable claims, either of additions or deductions. When the case came into Court they gladly recognised that every assistance possible was given to them by all concerned, and they could not speak too highly of the great care and ability with which the case had been presented. The Court had asked themselves what a reasonable man would have anticipated at the time in question, and in the main they had based their finding on the accounts of 1914-15, but there were many variations in those accounts available to anybody in 1915, both figures of increased receipts and expenditure already incurred. There were also tendencies which seemed clearly defined which they had had to consider, and they had had to decide which of those would affect a prospective tenant. They had had to discourage certain ascertained figures which would not have been anticipated. Any decision in such circumstances must be largely a matter of speculation. The result they had arrived at was that the total rateable value in Finsbury should be £6,527, which was in the neighbourhood of two-thirds of the amount of rateable value (£9,770) appealed against. The judgment of the Court, therefore, was that the appeal be allowed, with costs, and that those figures be inserted in the valuation lists. His Lordship merely desired to add that that decision might be of some assistance to the parties in the effort he was sure they would make, without any further litigation, in the outstanding cases in the Borough of Holborn.

In reply to MR. RYDE, the DEPUTY-CHAIRMAN said that, if desired, he could work out the figures for the remaining parishes in Holborn.

MR. CLAVELL SALTER: I think, perhaps, it would be more convenient to see if we can settle in the light of your Lordship's observations.

MR. RYDE: Your Lordship says the result arrived at is two-thirds of the rateable value appealed against. I am content to take the assessment in the other parishes as two-thirds of the amount appealed against.

MR. CLAVELL SALTER: I suppose you are.

The DEPUTY-CHAIRMAN: I suppose Mr. Clavell Salter would not go as far as that. If you (Mr. Ryde and Mr. Salter) can come to some arrangement I think it will be best, but if you cannot I am prepared to work out the figures for the other parishes on the same lines as I have worked out these. The figures are before me, and it will not be an inconvenience to me, so, failing a settlement between yourselves, I am prepared to do it.

COUNSEL on both sides acquiesced in that proposal.

MR. RYDE also suggested that they should try and agree the gross values, which, he said, would affect nobody.

MR. CLAVELL SALTER: I agree that we ought to try and do that.

The DEPUTY-CHAIRMAN observed that he was rather under the impression that the gross values had been arranged.

MR. CLAVELL SALTER said his Lordship would remember that at the outset of the case he submitted that the appellants had no *locus standi* there on the ground that they had not taken the necessary steps as provided by the statute. He would like the matter to be left open so that it might again be mentioned.

The DEPUTY-CHAIRMAN: Certainly.

MR. RYDE: I understand that the appeal is allowed with costs as regards Finsbury. I take it, as your Lordship has not worked out the figures for the other parishes, that the question of costs is not yet decided?

The DEPUTY-CHAIRMAN said that was so.

MR. CLAVELL SALTER: May I take it that the Court would be prepared to consider whether each party should pay their own costs?

The DEPUTY-CHAIRMAN: It is a very substantial reduction, a very large reduction, and it was necessary for the appellants to come here before they could get the reduction.

The matter was then formally adjourned until a day in the New Year, when, it was understood, the result of the conference between learned counsel on both sides would be made known.

LEAHY AND OTHERS v. KERRY ELECTRIC SUPPLY CO.

BEFORE the Master of the Rolls, in the Irish High Court, Dublin, a settlement was intimated in an action by Mr. C. F. N. Leahy, and nine others, members of his family, for an injunction to restrain the Kerry Electric Supply Co. from selling milling machinery demised to them at the Fleck Mills, Killarney. The terms were that the defendants should expend £500 on the erection of a power engine in the mills 12 months from the termination of the war, and that they should be at liberty to sell the machinery in the mill on condition of lodging the proceeds in the National Bank, Killarney, in the names, jointly, of plaintiffs and defendants. In the event of defendants failing to erect a power engine, the money lodged is to be the property of the plaintiffs, but compliance with the condition leaves the money with the defendants. His Lordship directed the defendants to pay the plaintiffs' costs.

COLONIAL TELEGRAPHS AND TELEPHONES.

By R. W. WEIGHTMAN, M.I.E.E.

(Abstract of paper read before the Institution of Electrical Engineers.)

NO review on this subject would be complete without a reference to the great services the late Sir William Preece rendered to the Colonial Administrations during his lifetime; upon the advice he gave the foundations of many of the Colonial systems were laid, and in many cases the superstructures also were built. From Sir William's association with the Colonial services, and with the gradual standardisation of materials and plant generally in the Home Department, and the publication by the Department of books of technical instructions, the Dominions and Colonies have got more or less into the way of accepting Post Office practice as beyond question.

The Administrations of the Dominions send their chief technical officers around the world to see what is being done, and to cull from the various systems of the world those features which appear to them as being most advantageous for adoption in their own countries. Thus we find in the Dominions practice which is a mixture of British and American, and perhaps even a little Continental. But as the bed-rock of it all, British Post Office practice is outstanding.

In the earlier days, many of the engineers, and many officers of other ranks as well, appointed in the Dominions and Colonies, were men who had received their training in the various home services. This still applies to appointments in the Crown Colonies, but it is only rarely the case now in the Dominions. We find the youths of the Dominions qualifying in their respective engineering departments for even the highest positions in them.

There are, however, several Colonies in the tropics in which the heat, and the highly electrical condition of the atmosphere in some cases, are so trying that Europeans must have the relief of a change to a temperate climate at frequent intervals. For the filling of engineering appointments in these Colonies, the Colonial Office will always look for men at home. Higher salaries are offered than men in similar positions in England are paid, but the difference is often swallowed up in the higher cost of living, in the expense of trips to England necessary for health reasons, and, if the engineer be a married man, in the cost of what practically amounts to maintaining two homes; and so in the end the Colonial engineer is rarely as well off financially as he would have been had he remained here. This is surely a matter which should receive the consideration of the Colonial authorities. Low salaries for men in positions of responsibility are *take account*.

In another direction the Governments of the Crown Colonies are very short-sighted. They do not encourage their engineers sufficiently to keep themselves up to date. A technical officer, on whose initiative the engineering methods of a Department depend, should be specially commissioned by his Government to visit England at least every three or four years, to enable him to keep in touch with the latest developments.

With well-trained staffs of European character, the engineers of Canada, Australia, and New Zealand are relieved of

much of the worry which falls to the lot of the engineers in those countries where the bulk of the labour is black. In Australia there is an Arbitration Court for the investigation and settlement of labour disputes, and any difficulties of this nature that arise between the administrations and the working staffs of the telegraph and telephone organisations are referred to it. In New Zealand there is a Board of Appeal on somewhat similar lines.

In Canada there is a law under which employees can apply for a Board of Conciliation to discuss the differences between themselves and their employers; and in regard to this, one high official in Canada remarks: "It is a debatable question whether it is of any advantage to either employers or employees."

In South Africa practically all skilled work is done, and all supervising positions are held, by Europeans. The rough work is done by the natives, and many natives are also employed as unskilled linemen. All departments of industry are hampered by the disinclination of the natives to work. Where they are employed as linemen there is not that continuity of service which is desirable, and their utter lack of sense of responsibility is the cause of much anxiety to the engineer. Engineers in all the black Colonies have the same experience in this respect, and in some cases their difficulties are increased by the refusal of their Governments to provide adequate supervision.

The rates of pay to Europeans in the Dominions and Colonies vary generally with the cost of living, and any reference to them would be liable to be misleading, unless the living expenses and the local conditions in each case were also stated.

Of all the Dominions and Colonies, Canada is the only one that has made any headway in the manufacture of apparatus and material for telegraph and telephone purposes. Practically all wire, cable, subscribers' instruments, and manual exchange equipment used throughout the telephone services of the country are made in the Dominion. Automatic exchange apparatus, where this is in use, is obtained from the United States, but even this is now being assembled and built up in Canada. Copper wire, iron wire, and pole fittings are also made to a large extent. Telegraph apparatus is generally got from the States, and also the glass insulators so largely used. Porcelain insulators, where these are used, have been obtained to some extent from the Continent.

In Australia, cast-iron pipes, stoneware conduits, copper tapes and binders, and certain of the pole fittings are manufactured in the country. Prior to 1913, practically all the insulators used came from Germany, but insulators of both porcelain and stoneware are now being made within the Commonwealth. A fair amount of magneto telephone apparatus and switchboard material is obtained from Sweden, while some of the larger exchange switchboard plant and the Strowger automatic apparatus now being introduced come from America. Wire, cable, telegraph apparatus generally, and material of a kindred nature are obtained almost exclusively from Great Britain. It is the rule to invite tenders for all supplies and to give preference to goods of British manufacture.

The other Dominions and Colonies import practically all their plant. This is largely obtained from England, but quantities of telephone apparatus, especially, have in the past been supplied from both the Continent and the United States.

The great distances these countries are situated from their sources of supply, and the delays in delivery that have taken place, have been serious drawbacks to the smooth working of most of the Colonial engineering departments. The engineer in Australia has to prepare his estimates of expenditure well in advance, but he cannot send off his indents for materials until the funds are actually sanctioned by his Government and voted by his Legislature. His estimates cover new works which cannot be proceeded with until the materials arrive, and as it takes anything from three to twelve months to get supplies from British manufacturers, it follows that in many cases the votes have lapsed to the Treasury before the materials reach him, the money is no longer available, and the work must go on until the "ins-and-outs" of the whole matter have been explained to the Government. In the meantime the workmen, who have been retained in anticipation of the material coming to hand within a reasonable time, have had little or nothing to do, but their salaries have had to be paid just the same. Strong complaint is frequently made by Colonial engineers in this connection, and the author would like to impress upon manufacturers of telegraph and telephone plant the great need there is for the more prompt execution of orders from the Colonies. Before the war started his assumption that to keep an engineer busy he would not put up with the dilatoriness of British manufacturers, and that he would send his orders to the Continent, and in some instances orders were actually sent there.

In the Dominions and in some Colonies these difficulties are aggravated by the establishing of "reserve stores" in which ample supplies are kept to meet all ordinary demands. This is a plan which every colony with any considerable system should adopt. It involves the sinking of a certain amount of capital in the stock, but the convenience and the saving of money in workmen's wages are worth more than the amount of interest incurred. Under this system all materials are purchased from the stores, and as they are issued the stores account is credited with their value from the funds

provided for the works for which they are required. Delays in carrying out works are thus reduced to a minimum.

ADMINISTRATION.

The methods of administration throughout the Colonies are naturally varied to meet the local conditions, but in all the Dominions (with the exception of Canada) and also in all the larger Crown Colonies the telegraphs and telephones are combined with the postal service of the country, and the Postmaster-General is the officer responsible to the Government for the proper management of the organisation as a whole. In some instances the office of Postmaster-General is a political one, and in such a case the permanent head of the department is the secretary, as in England.

In some of the smaller Colonies telephone exchanges have been established by private companies; but apart from these the telegraph and telephone systems are generally on so small a scale that they do not justify the appointment of a fully-qualified telegraph or telephone engineer to control them, and so this duty falls to the colonial public works engineer, whose responsibilities will include everything of an engineering nature from harbour works to electric bells. Under the public works engineer there will perhaps be a telegraph or telephone inspector, who is often a man of good experience and who will, at any rate, relieve him of responsibility for the practical part of the work.

In the larger Crown Colonies we usually find an organisation on the lines of the home Post Office. It is both convenient and economical to combine the staffs of the postal and telegraph and telephone services of a country under the one administration. Unfortunately, under this system there is a tendency for the commercial staff to assume functions which are liable to bring them into conflict with the engineering section, with a serious loss of efficiency to the latter. The officer who is responsible for the traffic and operating sections of the organisation is inclined to see things only from the point of view of the traffic side, and the views of the engineer are, therefore, liable to be subordinated to his. The efforts of the most capable engineering body in the world may be thwarted and the engineers themselves discouraged if there is undue interference and a lack of sympathy and support from the Postmaster-General and his staff.

The telegraph and telephone services of Canada are quite separate from each other, as in the United States. Sections of the telegraph system scattered throughout the country, and including a considerable mileage of submarine cable, are under the Government, and these are connected up through the lines of the public companies. By far the larger portion of the system is in the hands of the great North-Western Telegraph Co. and the telegraph departments of the two great railway companies, the Canadian Pacific and the Grand Trunk. There is no active competition between the different administrations. Each has its defined sphere of operations, and adequate communication between the different systems is provided.

The telephone services of Canada in the Provinces of Manitoba, Alberta, and Saskatchewan are controlled and mainly owned and operated by the local Governments, but there are also private telephone companies and municipally-owned exchanges in operation. In the other parts of the country the telephones are in the hands of private companies, some of them operating over large areas of country. There is no real competition between the large administrations. Each has its particular area of operations, and the exchange and long-distance services are carried on without opposition. The rural companies are, however, frequently started in competition with the ruling company, and intercommunication difficulties arise.

In the three provinces named each system is obliged by law to give connection to all the others, and the long-distance lines of the three provinces are also interconnected.

The construction of rural lines by independent local companies for the purpose of giving telephone service to farmers is much encouraged by the various Provincial Governments, and in this respect Canada is a shining example to the other Dominions and Colonies.

In the great Australian Commonwealth, the telegraphs and telephones are a close monopoly under the Post Office. The Postmaster-General is the Parliamentary head of the Department, and the permanent head is the secretary. In each of the States the local head is designated the Deputy Postmaster-General, and all sections of the department, including the engineering branch, are under his control. The chief electrical engineer at headquarters is responsible to the secretary, but his position is largely consultative, and there is not that direct line of control over the engineering organisations of the various States which is usual. He communicates direct with the head engineers in the States upon all technical matters, but notwithstanding this, there has not been that close co-ordination of engineering practice which is possible under a centralised form of administration.

Lines for public use in country districts which may not be immediately remunerative to the department may be erected under a system of guarantee, under which the department bears 50 per cent. of the estimated annual loss; the balance of the loss is borne by those interested in the construction of the lines.

The fullest encouragement is given to persons living in the country to erect their own lines, either individually, or con-

jointly with their neighbours, for connection with post offices or exchanges, and the department furnishes applicants with all the information they may require.

In New Zealand the Postmaster-General is a political officer, and the secretary is the permanent head of the administration. In the districts, the chief officer is styled "The Telegraph Engineer," and he is responsible to the chief engineer at headquarters, who is again responsible to the secretary. The department has a complete monopoly of the telegraphs and telephones of the country, and it does not encourage the formation of private companies for the establishment of rural or other lines. Under the Telegraph Act no person or persons may construct telegraph or telephone lines for hire or profit, but there is no hindrance to persons erecting lines for their own use. Many such lines have been put up by farmers in the back blocks of the country where the Government do not feel warranted in spending money on lines which offer little prospect of paying their way. Such lines usually terminate in a Government office or exchange, where they are given connection with the Government system. They are usually built as cheaply as possible, and the service is generally inferior, and faults are of frequent occurrence. The Government exercise no supervision or authority over these private installations.

In South Africa, the telegraphs and telephones are also under the Postmaster-General, who is the permanent head of the Administration, the political chief being designated "Minister for Posts and Telegraphs." Of all the Dominions outside Canada whose telephones are administered by a Government department, South Africa is the first to adopt the "functional" system. With the advent of the Union, the separate administrations were merged in the one central administration and a system closely allied to the "territorial," which had been in force in the Cape Colony, was applied to the whole of the Union. The country was divided into seven districts for administrative purposes. With the great development of the telephone system, this method of administration was found to be unsuitable. The "functional" system was introduced about three years ago, and the Postmaster-General, when in England last year, informed the author that it was working with the greatest satisfaction.

In practically all the Colonies and Dominions the railways belong to the State, and in some of the smaller Colonies a feature of the administration is the amalgamation of the railway telegraph engineering and electrical signalling systems with the engineering department of the Post Office.

All electrical signalling systems are of a cognate character, and come, naturally, within the scope and training of telegraph engineers and linemen, and any Colonial Administration which may contemplate such an amalgamation need have no fear for the results provided a capable and well-organised staff is available.

Under some administrations telegraph and telephone engineers are required to carry out the departmental electric lighting work, and it is a highly debatable question whether this principle is a good one. The author's opinion is that in the specialisation which is necessary to-day in telegraphy and telephony, it is too much to expect an engineer to be expert also in the lighting and power applications of electricity in the larger sense.

(To be continued.)

TRADE STATISTICS OF NEW ZEALAND.

The following figures, showing the imports of electrical and allied goods into New Zealand in 1915, are taken from the official statistics which have just reached this country. The figures for the previous year are given for purposes of comparison, and increases or decreases noted. In each year the country named is the country of origin of the goods.

	1914. £	1915 £	Inc. or dec. £
Leather belting.—			
From United Kingdom	4,000	4,000	—
.. United States	1,000	2,000	+ 1,000
.. Other countries	1,000	2,000	+ 1,000
Total	6,000	8,000	+ 2,000
Belting, other than leather			
From United Kingdom	27,000	22,000	- 5,000
.. Australia	1,000	1,000	—
.. United States	3,000	2,000	- 1,000
.. Other countries	1,000	—	- 1,000
Total	32,000	25,000	- 7,000
Engine packing			
From United Kingdom	11,500	11,500	—
.. Australia	1,000	1,500	+ 500
.. United States	4,000	5,000	+ 1,000
.. Other countries	2,000	1,000	- 1,000
Total	18,500	19,500	+ 1,000

	1914. £	1915 £	Inc. or dec. £
Scientific instruments.—			
From United Kingdom	5,000	4,000	- 1,000
.. Germany	1,000	—	- 1,000
.. United States	1,000	1,000	—
.. Other countries	1,600	1,000	- 600
Total	8,600	6,000	- 2,600
Telegraph and telephone wires, ins.			
From United Kingdom	5,000	9,000	+ 4,000
Generators, motors, and transformers.—			
From United Kingdom	55,000	44,000	- 11,000
.. France	1,000	—	- 1,000
.. Germany	5,000	2,000	- 3,000
.. United States	23,000	26,000	+ 3,000
.. Other countries	2,000	2,000	—
Total	86,000	74,000	- 12,000
Electric batteries and cells.			
From United Kingdom	4,000	5,000	+ 1,000
.. United States	2,000	1,000	- 1,000
.. Other countries	1,000	1,000	—
Total	7,000	7,000	—
Carbons and insulating material			
From United Kingdom	6,000	4,000	- 2,000
.. Australia	4,000	—	- 4,000
.. Germany	2,000	—	- 2,000
.. Other countries	1,000	2,000	+ 1,000
Total	13,000	6,000	- 7,000
Other electrical material.—			
From United Kingdom	65,000	67,000	+ 2,000
.. Germany	7,000	—	- 7,000
.. United States	20,000	30,000	+ 10,000
.. Australia	4,000	2,000	- 2,000
.. Other countries	3,000	9,000*	+ 6,000
Total	102,000	108,000	+ 6,000
* Sweden £14,000			
Motors, electric			
From United Kingdom	10,000	8,000	- 2,000
.. Other countries	2,000*	1,000	- 1,000
Total	12,000	9,000	- 3,000
* Germany £2,000.			
Lamps, electrical:—			
From United Kingdom	21,000	23,000	+ 2,000
.. Germany	5,000	—	- 5,000
.. United States	7,000	7,000	—
.. Other countries	4,000*	11,000	+ 7,000
Total	37,000	41,000	+ 4,000
* Holland £2,000.			
Steam engines			
From United Kingdom	15,000	13,000	- 2,000
Gas and oil engines (except for motor-cars).			
From United Kingdom	70,000	43,000	- 27,000
.. United States	18,000	14,000	- 4,000
.. Other countries	1,000	1,000	—
Total	89,000	58,000	- 31,000
Boilers:—			
From United Kingdom	9,000	13,000	+ 4,000
.. United States	—	2,000	+ 2,000
Total	9,000	15,000	+ 6,000
Insulated cable and wires			
From United Kingdom	117,000	102,000	- 15,000
.. Germany	16,000	—	- 16,000
.. United States	8,000	—	- 8,000
.. Belgium	6,000	—	- 6,000
.. Other countries	—	2,000	+ 2,000
Total	147,000	104,000	- 43,000
Mining machinery.—			
From United Kingdom	21,000	15,000	- 6,000
.. Australia	2,000	2,000	—
.. Germany	—	—	—
.. United States	4,000	15,000	+ 11,000
.. Other countries	2,000	13,000	+ 11,000
Total	30,000	45,000	+ 15,000
Electric and magnetic plants			
From United Kingdom	14,000	—	- 14,000
.. Australia	—	4,000	+ 4,000
.. Other countries	3,000*	1,000	- 2,000
Total	17,000	5,000	- 12,000
* United States £3,000.			

WAR ITEMS.

At Dawlish (Devon), exemption was claimed for Mr. C. C. Hodges, manager of the Electric Light Co. For the directors, Dr. C. N. Lovely said that Mr. Hodges was previously exempted in September 1916. Since the last appeal the directors had advertised in the London technical Press, and eight replies were received. Of this number two were considered to be suitable, but on writing for the necessary particulars they heard no more of them. Mr. Leonard Lees, J.P. for the military, opposed exemption, on the ground that Mr. Hodges could be spared. Dr. Lovely replied that if Mr.

Dry Cell with Gelatinous Electrolyte.—A rather ingenious solution for obviating the drying-out trouble of the electrolyte in dry cells, and the deterioration of the electrode even when open circuit, is made the subject of a patent by Edward McCall and M. D. Malcolm of Orange, N. J. It has been discovered that by using colloidal gelatinous electrolyte, the usual swell and shrink, the ordinary defects of dry cells are largely done away with, and that when, for example, zinc and oxide of copper are employed the efficiency of such cell is greatly increased, being in fact, greater than that of a wet primary battery employing similar electrodes and an alkaline electrolyte. This is due, in part, to the starch grains or other particles of organic material in the colloidal solution apparently increasing the ionisation of the electrolyte whereby the capacity and conductance are increased.

Electrical World

THE A.E.G. AND FUTURE EXPORT TRADE

ONE of the most remarkable facts brought to light in recent years relates to the grip which the leading electrical engineering groups in Germany have, or had, obtained in different parts of the world. Apart from the footing gained in British Overseas Dominions, which has probably now been largely removed, these groups have developed their sphere of activity in China, Japan, Mexico, and in practically all the Republics in South America. The direct export trade from Germany to overseas countries has been greatly facilitated by the formation of transmarine supply and tramway companies, which first expand into installation contractors, and then develop into general contractors, whether the machinery, plant and accessories are procured from Germany or elsewhere, or partly made on the spot. With these introductory remarks attention may now be directed to the future aims of the A.E.G., as disclosed by Dr. Walther Rathenau at the recent annual meeting, and although the observations specifically refer to this company, it is reasonable to apply them also to the Siemens-Schuckert Co. and the associated Siemens & Halske Co. in connection with their transmarine ramifications.

The principal subject discussed at the recent annual meeting of the A.E.G. in Berlin, as in certain former years, referred to the rate of dividend which was recommended for adoption. Several shareholders suggested that the accounts would permit of the payment, instead of the 12 per cent. then proposed, of a rate of 14 per cent., as paid in years of peace. In opposing this contention, Dr. Walther Rathenau is reported to have stated that without the possession of the undisclosed reserves, the undertaking would probably have suffered very severely in war time. The dividend rate was carefully examined by the directors, whose fees were fixed according to the rate, and who, therefore, had a great interest in the percentage. If, nevertheless, they exercised reserve in calculating it, that was not due to an ill-intentioned policy, or one of accumulating reserves, but it was based upon the construction of the undertaking. Those who were shareholders must know that they were interested in an undertaking which was certainly well established, but which entertained no chances for speculative development, and also had not the advantage of offering a surprise in dividends. As to the renewed wish for a higher dividend, the speaker proceeded to emphasise the dark side of the problem. He said that above £20,000,000 was invested in the undertaking, but a considerable portion of that was employed abroad in the form of branches, investments and credit both in neutral and hostile countries. The directors did not know at all how to value that capital. The business was international, and over 40 per cent. of the work was exported in times of peace. If the export trade after the war should be lacking, the buildings which served that purpose would be without employment. In order, however, to maintain the business, a large expenditure of work, energy, and, above all, of money, would be necessary. The reserve fund was provided for difficult times. Could it not, even once, happen that the company might not earn any profits? Then efforts would be made not to remain without any dividend.

Dr. Rathenau proceeded to state:—"We are a peace undertaking; that is characterised by a great ramification over all European and ex-European districts. The company is interested abroad through branch establishments, branch undertakings, credit and contracts; the transmarine, the international business in general, claims a considerable amount of our annual turnover. If we decided at the beginning of the war to undertake a very fundamental transformation of working, we did not conceal from ourselves the danger assumed by us that the question concerned the subjection of a portion of our property to great depreciation, and the exclusion of a considerable part of our regular business. We, nevertheless, resigned ourselves to this new form of business with enthusiasm, under the consideration that it is our duty, as a factor in German economy, to serve the country's defence, and place our workshops, machinery, and men unreservedly at disposal for the great common purpose. In this connection we have been led by the idea that this war is not a war of months, but extends over years. On reaching our decision considerable services were rendered by the fact that the reserves—just the reserves—made it possible for us to raise buildings and plant out of the earth, without the danger of touching our assets. The liquidity of funds, which is a costly luxury and which represents over £5,000,000 without employment, has contributed in this direction. The efficacy which the company developed is great. The question concerns over 250,000 sq. metres of superficial area which we built over: 30 hectares (74 acres) are roofed in, and the war contracts already run into nine figures.

Dr. Rathenau continued:—"Also, if one does not mistake the political and military situation, the feeling cannot be excluded that now, for the first time, after a long while, a light appears in the distance—a peace light—but this situation also cannot relieve us from our duties. We have also to continue to strengthen our equipment, even to create buildings and large new works, since it is known that the Hindenburg programme claims the whole force of the country—that through this mighty strain of labour Germany has become an arsenal." In conclusion, the speaker stated that "the auxiliary service law makes every one of us a soldier, and in this the A.E.G. has to play its part."

SOME NOTES ON WARRANTIES.

[FROM OUR LEGAL CONTRIBUTOR.]

MANY manufacturers in different parts of the country are at the present time engaged in manufacturing and selling goods which are rather outside their own line. Consequently, it is the more important that they shall pay attention to the terms of the contracts which they undertake to fulfil. For instance, a man accustomed to manufacture and sell a particular kind of lamp will not concern himself about warranties of any kind; but when he commences some new manufacture, those whom he has to supply will probably bind him to the fulfilment of very strict conditions.

A large number of cases which reach the courts in relation to the sale and purchase of goods depend to some extent upon the question of warranty. Was a warranty given? Was there a breach of that warranty? These are questions of great importance to dealers in goods of all descriptions.

It is of the utmost importance that if a warranty is given, it is carefully carried out. A breach may lead to consequences the scope of which it is impossible to foresee.

At the same time, the machine, or whatever it is, can only be expected to do what is required of it if it is properly erected. If an accident happens owing to improper erection by the purchaser, the seller is not to blame.

In a case recently heard at Birmingham, a firm of engineers and founders in Coventry sued another firm of engineers in Birmingham to recover damages for alleged breach of warranty. The defendants had supplied a crane, to be placed on a cupola platform, to lift about 15 cwt. Soon after the crane was erected in its place, it fell over when carrying a weight less than it was warranted to carry, with the result that one unfortunate workman in the employ of the plaintiffs was killed, and the accident cost the plaintiffs over £200, paid under the Workmen's Compensation Act. To recover this sum the plaintiffs sued the defendants. It was alleged by the defendants that the crane was perfect in its construction, and that it fell owing to careless erection by the plaintiffs, and an undue strain upon a particular arm of the crane which was not placed on a level foundation. In this case there was an amicable settlement, but as to the question of breach of warranty, judgment was entered for the defendants.

A warranty need not necessarily be expressly given. If it appears by the contract that the buyer relies on the vendor's skill or judgment, and the goods sold are in the way of his business, the vendor is bound to supply goods reasonably fit for the purpose, and there is an implied warranty that they are so. For example, a shipbroker gave an order to the salesman of a coal merchant for bunker coal for a steamship, and said they had been using "B" coal, and the salesman said he could supply "S" coal, which ought to suit if "B" coal suited. Whereupon the broker gave the order for the "S" coal, which proved to be worthless for bunkering. It was held that the salesman's statement was tantamount to a warranty, and that the warranty had been broken (Crichton and Stevenson v. Love (1908), S.C., 81).

There is all the difference in the world between the kind of representation which is generally made to induce a sale and that which is a warranty in the strict sense of the term. Every seller extols his own merchandise. A.B. tells you his metallic filament lamps are the finest in the world. Go into C.D.'s shop next door, and his man behind the counter will tell you that C.D.'s lamps are the finest in the universe.

What a man says by way of commending his own goods cannot be twisted into a warranty. Nor is a mere expression of opinion a warranty so as to be part of the contract.

In a leading case the vendor put up a horse for sale by auction, and the plaintiff bought the horse for £280, relying on the positive assurance made to him privately the day before the auction that the horse was sound. It turned out wrong, and the purchaser sold it for a reduced price and sued the vendor for breach of warranty. It was finally held on appeal that what was said about the horse was representation only, and not a warranty, and that the vendor could not be held responsible for a misrepresentation, unless made fraudulently. An expression of opinion is not a warranty, and is not, therefore, a part of the contract. A buyer who proves a breach of warranty is not entitled to avoid the contract and refuse the goods unless there is an express stipulation to that effect in the contract.

It must be acknowledged that the distinction between a warranty and a mere representation is in some cases rather fine. It has been generally held that where a representation is shown by the evidence to have been intended to influence the buyer, and, in fact, was intended as a warranty which would be an essential part of the contract, it will be taken as a warranty, and where it was not reduced to writing the warranty, as a part of the contract, will be tested by the evidence showing whether or not the representation was made pending the sale, and subsequently accepted as a *bona-fide* warranty. An interesting illustration of the extent to which a guarantee and description contained in a trade catalogue will be presumed to be a warranty is found in the case of *Williamson v. Rover Cycle Co.* (1 W.R. 615). The plaintiff bought a machine from the defendants' agent which answered the description in their catalogue—which he read before buying—and there was in the catalogue an express guarantee that

The plaintiff, who was a journeyman electrician, was employed by the defendant, who was a contractor, to repair a broken tube. The plaintiff, after the accident, replaced the broken parts and threw them away. The plaintiff, relying on the fact that the tube was broken, and that the defendant was liable for the accident, and the appearance of the broken tube were no evidence of defective material or workmanship. The defendants having replaced them and thrown them away, the burden of proof was thrown upon the plaintiff.

BUSINESS NOTES.

Book Notices. The December issue of the *British Westinghouse* is a *Brighton* number, published for Western home men with H.M. Forces. It contains a number of amusing, sketchy and often that will be very interesting to others besides those for whom they are written. Nothing in the issue is more timely than the picture of a sturdy British Westinghouse workman who is going to "Strike Hard in the Coming Year" at home with his fighting comrades do likewise just across the channel.

Calendars. MESSRS. SIMPLEX CONDUITS, LTD., of Garrison Lane, Birmingham, have sent us another of their pocket diaries which we have found so useful in past years. Just the thing with handy tables and other technical information, and a desk blotter handsomely designed and finished in bronze, which cannot possibly conceal itself under a pile of papers, as does that elusive sheet of blotting paper, which is never there when it is wanted.

MESSRS. DOWNS & DAVIES of Stanley Street, Liverpool, have issued a calendar for 1917. It is a charming study of "Elaine," with the firm's name and a neat little set of monthly slips both unobtrusively placed.

MESSRS. GRINDLAY, ROSS & CO., LTD., of 47, Waterloo Street, Glasgow, have issued a wall calendar for 1917 with monthly date slips.

From the HART ACCUMULATOR CO., LTD., of Marshgate Lane, Stratford, E., we have received a desk blotting pad for 1917, with the calendar for the year neatly placed on each sheet.

France. La Compagnie Generale de Constructions et d'Applications Electromagnetiques is the name of a new company which has lately been formed at Pantin near Paris, with a capital of £250,000.

Holidays. The works of the HOFFMANN MANUFACTURING CO., LTD., Chelmsford, are closed until January 1st for holidays and stock-taking.

Bankruptcy Proceedings.—L. A. THOMSON (trading as Saville & Walton, 39, Victoria Street, S.W., electrical engineers and contractors)—Trustee (Mr. E. S. Gray) released December 18th, 1916.

Trade Announcement.—MR. T. A. NEWBOK, of 4, Carr Street, Blackfriars, Manchester, has been appointed agent for Lancashire and Yorkshire by the Midland Electric Manufacturing Co., Ltd., of Birmingham, and will represent the firm from January 1st. This is in addition to the other agencies at present held by him.

LIGHTING AND POWER NOTES.

Aylesbury.—The responsible Ministry has informed the U.D.C. that it is unable to recommend the L.G.B. to agree to an application for sanction to a loan to give an additional supply to a local firm. The Council has decided to meet the case by laying a larger main at an estimated cost of £150, one-third of which is to be paid by the firm, together with not less than 25 per cent. of the total outlay for the next two years by current use; the price per unit is to be 1½d. with a special fuel clause. Lloyd's Bank, Ltd., has been asked to increase the electricity loans to £21,600.

Baildon (Yorks.).—E.L. PROPOSAL.—The District Council has asked the Baildon Council if it will undertake to supply an electric light to the Baildon area for the coming year. The Baildon Council has expressed its willingness to supply Baildon if terms can be arranged, and has instructed the electrical engineer to prepare an estimate as to probable consumption, and report to the next meeting.

Bolton.—PUBLIC LIGHTING.—With a view to minimising the increasing number of accidents, a conference of representatives of the Electricity, Gas, Tramways, and Watch Committees has decided to install electric lighting at points to be selected by the Chief Constable.

Bedford.—PROPOSED EXTENSIONS.—The T.C. has adjourned a recommendation by the electrical engineer to carry out certain extensions costing £34,076, including new turbine plant, mains, transformers, &c., with a view to supplying a large consumer outside the borough. A minimum revenue of £2,890 per year for five years was guaranteed, while the consumer had agreed to pay towards the cost some £5,119. The engineer pointed out that the existing turbine had saved 20 per cent. in coal, while the proposed 1,500-kw. set would save about £2,000 a year additional, and obviate the present need of falling back on older and less efficient plant to meet increasing demands.

Bradford.—WAGES.—Many of the employees of the Bradford Corporation electricity department, through the National Union of General Workers, are demanding an increase of 10s. per week on pre-war rates of pay. The respective departmental Committees will first consider the demands, and make recommendations to the Special War Bonus Committee of the Corporation.

Brighton.—The Lighting Committee of the T.C. has decided to dispose of a 440-kw. Willans-E.C.C. set for £1,250. The set was purchased in 1897 for £1,788.

Burnham (Somerset).—PRICE INCREASE.—The Electricity Co. has informed the U.D.C. that the price of current has been increased from 5d. to 6d. per unit.

Chile.—Permission has been granted to Senores Francisco Undurraga and Ismael Jerez Diaz Valdes to utilise the waters in the Department of La Victoria for the production of electric power for lighting and industrial purposes. *Board of Trade Journal.*

Colwyn Bay.—YEAR'S WORKING.—The working of the Council's electricity department, for the year ended March 31st last, has resulted in a surplus of £1,216.

Continental. SPAIN.—La Sociedad Electrica Rotena is the name of a company which has lately been formed in the Province of Cadiz, to establish a small central electric lighting station in the town.

East Ham.—The question of reconsidering the present scale of charges for electricity supply has been referred to the E.L. Committee.

Hires of arc lamps whose contracts are in abeyance have been permitted to use them during the Christmas season at specified hourly charges.

Epsom-Ewell.—E.L. PROPOSALS.—The Epsom R.D.C. has decided to waive the receipt of the necessary July notice by the Wimbledon T.C. and the South Metropolitan Electric Tramways and Lighting Co. in their application for prov. orders for E.L. at Cuddington and Cuddington and Ewell respectively. The view taken is that it would be a great help to Ewell to have a supply of current from a large central station like the County of London station.

The Epsom U.D.C. has decided to apply to the B. of T. and the R.D.C. with a view to obtaining protection in respect of the order of 1912, under which the Council is authorised to supply premises in Ewell with electricity.

The Ewell P.C., after considering the matter, has decided to submit the following resolution to the B. of T. and to ask for a deputation to be received on the subject:—"That the Ewell Parish Council is strongly in favour of a cheap and efficient supply of electricity being installed at the earliest possible moment. It is, furthermore, of opinion that one of the greatest needs of rural parishes in the South of England is cheap and reliable power. This would do more than anything to keep the village industries alive."

London.—ST. PANCRAS.—The Electricity Committee, in view of the restriction of materials, has decided that until such time as the King's Road new plant is in operation, no application for current other than for national purposes will be entertained, other than where tenants take over premises already equipped.

KENSINGTON.—The General Purposes Committee has consented to an application by the Kensington and Knightsbridge E.L. Co. for the raising of the charge for electricity for lighting 5d. 5d. per unit. Similar applications by the Notting Hill Co. were granted in 1915 and 1916, and it was therefore agreed to raise no objection to this company increasing the price to 5½d. per unit after the December quarter, and until June 30th, 1917.

Londonderry.—PROPOSED LOAN.—The T.C. has authorised an application for sanction to a loan of £1,700 in connection with the electric light and water extension schemes, the estimate having been exceeded owing to the increased cost of machinery.

Manchester.—The Corporation electricity department set up a record one day last week, over 800,000 units being consumed during the 24 hours.

Southampton.—The Borough Electrical Engineer has drawn the attention of the Council to the flooding of the mains on the Western shore; also to the difficulty of getting spare machinery parts—a particular case being steel spindles for the coal conveyor which are subject to excessive wear. A satisfactory increase in

load on the station has occurred, this now approximating that of the winter before the war.

Further boiler plant will be required before or when the lighting restrictions are removed, and consent is to be asked for this new plant.

The T.C. is to place an order with the Chain Belt Co. for an elevator to be installed for a new coal bunker. The price is approximately £76.

Southend-on-Sea.—**PROPOSED PLANT EXTENSION.**—The electrical engineer reported that the capacity of the existing plant at the generating station and in the battery room at Chalkwell Park was 3,220 kW., and that in his opinion the demand upon the plant would at the termination of the war, and when the lighting restrictions had been removed, amount to approximately 3,800 kW., in addition to which a margin of 500 kW. would be necessary as a stand-by, and that consequently it would be necessary to take into consideration at an early date the desirability of acquiring two 750-kW. steam generators which could be installed in the existing floor space available, thus avoiding the expense of carrying out extensions to the engine room. The Electric Lighting Committee has referred the matter to a sub-committee for consideration and report. A recommendation by the Highways and Works Committee that notice be given to the Southend Gas Co. to determine the existing agreement for public street lighting was rejected by the Council.

TRAMWAY and RAILWAY NOTES.

Birmingham.—**TRAMWAY STOPPAGE.**—On Friday last, owing to the bursting of a steam pipe at the Nchells temporary power station, the whole of this plant was shut down temporarily, and as a result the tramway service was again suspended during two short periods of the morning.

Bradford.—**WAGES.**—In connection with the negotiations already proceeding in the tramway department for advances in the wages and revision of conditions of work of certain classes of workers, the Tramways Committee met again last week on the matter, and resolved that drivers who have not received an advance since the commencement of the war be granted 1d. per hour advance, and that all other male employees of the traffic staff (including drivers and conductors) be granted 1d. per hour increase, irrespective of scale advances, as a special war wage, on account of the increase in the cost of living. Overtime is to be paid for at the rate of time and a half, either on the seventh day or over the normal time on other days. The men's demand was for 1d. advance.

Continental.—**SPAIN.**—The Sarria-Las Planas section of the new electric railway of the Compania de Ferrocarriles de Cataluna, to connect Barcelona with Tarrasa, has lately been completed and opened for traffic.

A concession has been granted to Messrs. Chavarri Petremont and Co. for the construction and working of an electric tramway for goods traffic, from the station of Miravalles (on the Castillon-Bilbao Railway) into the town.—*Board of Trade Journal.*

Chile.—A decree has been published granting to Don Eduardo Heyraud permission to construct and work an electric street railway between Santiago and Renca; the line will be of metre gauge, and approximately 8 km. in length.—*Board of Trade Journal.*

Rochdale.—The Tramways Committee attributes the recent fatal accidents on its system to the dark condition of the streets, and the manager is to approach the Chief Constable with a view to some improvement, either in the lighting of the cars or of the streets on the main car routes.

Shipley.—The abstract of accounts for the year ended March 31st last, issued last week, shows that all the trading undertakings have made profits—even the gas department having converted a former loss into a profit, owing to advanced prices. The only contributories to relief of the rates, however, were the tramway department, £574, and the water department, £729.

Southampton.—**EFFICIENCY (?) OF FEMALE LABOUR.**—As a result of the ticket stock-taking for the year ended March 31st, 1916, it was found that tickets of the face value of £408 were unaccounted for. It was thought at first that a mistake had been made on the previous stock-taking, but after full investigation the tramway manager states that he is bound to arrive at the conclusion that the discrepancy is accounted for by the transition from male to female employees. They first adopted the system of women conductors in August, 1915, and practically at the same time the entire ticket-office staff was replaced by girls. Owing to the work being intricate, and in many cases far beyond the understanding of the women conductors taken on at that time, mistakes in booking were extremely frequent, and were not always detected by the new and inexperienced ticket-room staff. In his (the manager's) report of February 1916, regarding the control of the office staff, he made special reference to the state of chaos which existed in the ticket room up to that time. Girls were much more careless about losing tickets than the men were, although this fault has been greatly remedied of late by adopting stern methods. A ticket error book has now been adopted, which automatically

prevents error through this cause. Another point is that a great number of tickets were used in the women's training room, and at one time a large number of these were taken from stock and not booked up. Before the ticket error book was inaugurated, conductors undoubtedly accidentally kept packs of tickets out instead of paying them over at night. This may have resulted in many packs being missing during the stock-taking, and possibly next year when stock is taken a large number of the tickets short may be found. The manager is absolutely satisfied that there has been no monetary loss in this connection, and that the shortage is purely a paper one.

Southend-on-Sea.—Application is to be made to the B. of T. for permission to use double-decked tramcars upon the light railways in the borough. In view of the difficulty of securing the necessary material required for maintaining the tramways, the electrical engineer has been authorised to purchase parcels of any material required, subject to the sanction of the chairman.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—**SYDNEY.**—January 22nd. Electrical plant (converters, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.*

February 19th. Municipal Council. Meters, maximum demand indicators, feeder regulators. Specification from E.L. Department, Town Hall.

PERTH.—January 10th. P.M.G.'s Department. Telephone instruments and parts. See "Official Notices" December 15th.

MELBOURNE.—January 31st. Department of the Navy. Dynamos, switchboard, motors, balancers, and control gear, for Flinders Naval Base. Specifications from the Director of Naval Contracts, Melbourne.

March 5th. Corporation. One 7,500-k.V.A. turbo-alternator. Specification (21s.) from the Town Clerk.

Bootle.—Corporation. Tramway rails. See "Official Notices" to-day.

Leith.—January 3rd. Electricity Department. 6,000 tons of washed singles during six months from January 15th, and (alternatively) 12,000 tons of washed singles during 12 months from January 15th. Burgh Electrical Engineer, Great Junction Street.

New Zealand.—**DUNEDIN.**—January 24th. Motor-generator, accessories and spares. City Electrical Engineer, Market Street, Dunedin.*

TAURANGA.—February 12th. Borough Council. Supply of six three-phase transformers, 11,000-400 volts. Messrs. H. W. Clime and Sons, Consulting Engineers, Rautahi. *N.Z. Shipping and Commerce.*

Spain.—The municipal authorities of Astorga (Province of Leon) have recently invited tenders for the concession for the electric lighting of the town during a period of 15 years. Tenders have also been invited by the municipal authorities of Pedroguer (Province of Alicante) for the electric lighting of the town for two years.

West Ham.—January 11th. Corporation. One water-tube boiler, one 3,000-KW. turbo-alternator. See "Official Notices" to-day.

Wigan.—January 8th. Tramways Committee. 30-H.P. motor tower-wagon. Mr. Frank Buckley, General Manager, Market Place.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Department in London.

CLOSED.

Australia.—P.M.G.'s Department, N.S.W. :—

Additional automatic telephone apparatus, £1,101.—Automatic Telephone, (Aust.), Ltd.

30,000 jointing sleeves, £295.—Western Electric Co. (Aust.), Ltd.

N.S.W. Public Works Department

The tender of Harvey & Phillips originally accepted for the supply of 16 D.C. motors and equipment (see *Elek. Rev.*, December 15th), has been annulled, and the contract awarded to Widdowson, Frank, Ltd. (Electric Construction Co.), £3,948.

Department of Defence :—

Installation of 18 intercommunication telephones at Victoria Barracks Melbourne, £189.—T. Draper & Co.

Victorian Railways Department :—

Signal lighting transformers for portable signals.—Aust. Gen. Electric Co.

Half-watt lamps, lanterns and globes.—Aust. Gen. Electric Co.

Government Contracts.—In the list of War Office contracts announced in our last issue, for the name *Bristol Ebonite Co. Ltd.*, read *British Ebonite Co., Ltd.*

Hford, U.D.C. Cost for the Electricity Department
 1. The motor cost 18s. 6d. per h.p. and 10s. per h.p. per mile.
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 10. The motor cost 18s. 6d. per h.p. and 10s. per h.p. per mile.

London, St. Pancras. Owing to a fire at the New-
 gate Battery the R.C. has had to buy other classes of coal.

Rawtenstall, Corporation. Additional switch-panels
 at the electricity works, Harncliffe, Britton Westinghouse Co.

VARIABLE-SPEED GEARS FOR MOTOR ROAD-VEHICLES.

BY ROBERT E. PHILLIPS

The following is an extract from a paper read before the Institution of Mechanical Engineers, on the above-named subject.

Electric Transmission.—Electric systems, or, as they are more properly designated, petrol-electric systems, owing to the prime movers employed being of the internal combustion type, may be conveniently divided into four groups:—

1. In which the surplus power of the engine is stored in the form of electric energy in a battery of accumulators and is given out when required to augment the power of the engine, of which the Pieper or Auto-Mixte may be taken as an example.

2. In which the entire power of the engine is converted into electrical energy, which is absorbed continuously by an electric motor driving the road wheels of the vehicle, of which the Stevens may be taken as an example.

3. In which electric energy is employed to start and accelerate the vehicle, after which the drive from the engine to the road wheels is transmitted through a magnetic clutch, of which the German may be taken as an example.

4. In which the electric energy is wholly or partially employed to start and accelerate the vehicle, after which the electric drive is cut out and the power is transmitted to the road wheels mechanically, of which the Thomas may be taken as an example.

Although it may well be argued that each is best adapted for a particular class of work, there is no gainsaying the fact that the second system is the only one which has been used on a commercial scale for any considerable length of time. Dealing, however, with these systems in their numerical order, the points in favour of the first system are that the surplus power of the engine is being continuously stored in the form of electric energy which is available for use when the power of the engine requires to be augmented, and that the engine and dynamo run at a constant speed, which enables the former to be run to the best advantage and enables the latter to produce a current of suitable voltage to charge the accumulators at the proper rate.

The points in favour of the second system are, first, its simplicity, in the sense that the power of the engine is converted into electrical energy, which is transmitted direct to the motor driving the road wheels; secondly, the small number of its parts and, thirdly, the speed of the engine is independent of that of the vehicle it can be run at the speed at which it gives its maximum power and efficiency. It is claimed for the Stevens transmission that the over-all commercial efficiency running in normal omnibus service is 79 per cent., and that this efficiency arises chiefly from the great economy both in petrol consumption and in general upkeep. The factors which make for economy in petrol consumption are the slow speed of the engine as compared with the speed of the transmission shaft, and the ability of the vehicle to free-wheel, i.e., run without propulsion, for a considerable part of its running time; while the factors which make for economy in upkeep are: (1) The simplicity of the transmission, in which no gear-wheels, no clutches, and no battery are employed; (2) the absence of transmission stresses due to the elasticity of the electrical drive; (3) the absence of clutching and de-clutching as obtains in mechanical gearing; and (4) the non-breaking of any electrical circuits during driving. These advantages have been realized in the Tilling-Stevens omnibuses and other public service vehicles for several years. In the London service alone these omnibuses have run over 6,000,000 miles at an estimated cost of 7.132d. per mile; while in the running of over 3,000,000 miles on solid rubber tires in the London service of omnibuses an average of 20,148 miles per tire has been obtained.

The advantages claimed for the third system as compared with the first or second systems are, first, that when the load is within the capability of the engine the drive between the engine and the road wheels is practically, though not absolutely, mechanical, at which time the electrical losses are reduced to a minimum; and, secondly, that the mechanism can be used for braking purposes. Against these, however,

is the serious drawback that mechanical means has to be employed for the reverse, in addition to which the double commutator adds to the complication of the control. It is also claimed for this system that as the electrical equipment is used solely, or mainly, for starting and accelerating, the equipment can be made comparatively smaller, lighter, and cheaper; but this would seem to be a fallacy, as the output of the electrical equipment cannot be confined to starting and accelerating duties only, for the simple reason that occasions must arise when more power than can be obtained on the direct drive will be called for, thus making it necessary to use the electric transmission. As this is the most severe duty that the electrical equipment can be called upon to perform, it must be of such proportions as will propel the vehicle during the whole working period without overheating it trouble is to be avoided.

As regards the fourth system, this is considered more economical than a direct electrical transmission, but against this must be set off the complications which arise from the introduction of the planetary gear and the clutches. The Thomas transmission has undergone two trials under the auspices of the Royal Automobile Club. The first trial was with a 36-h.p. Leyland lorry over a distance of 2,008 miles, the running being continuous day and night. The weight of the lorry unladen was 4,502 tons, and the weight of the load, including passengers, 3,181 tons, making a total of 7,683 tons. The running speed was not to exceed 12 miles per hour, and averaged (running time only) 10.47 miles per hour; the fuel consumption worked out at 7.555 miles per gallon, giving 58.046 ton-miles per gallon calculated on the gross weight and 24.030 miles per gallon calculated on the net load. During the trial no work was done upon the transmission with the exception of lubrication, for which 5½ oz. of oil were used, and at the end of the trial the whole of the transmission, with the exception that the teeth of the double helical planetary wheels were somewhat worn, and two brushes, four sparking tips, and one brush contact point were sufficiently burnt to require renewing, was in good condition. The second trial was with a 12-16-h.p. Delahaye car from London to Edinburgh and back, in which test the fuel consumption was approximately 35 miles to the gallon, giving 67.9 ton miles per gallon. An omnibus fitted with this transmission and running in a regular service in London has given from 10½ to 11 miles per gallon of fuel. It would therefore seem that the claim that this system is more economical than the direct electrical system is well founded.

Petrol-electric systems are without doubt handicapped as compared with the sliding type of change-speed gears—at all events, for use in pleasure and light commercial vehicles—first on account of excessive weight, and secondly on account of lack of power of rapid acceleration. As regards weight, it does not appear possible to make this compare favourably with the mechanical types of variable gearing without seriously risking its efficiency, and even breakdown under severe duty. With respect to acceleration, it must be borne in mind that sudden acceleration of the engine—which in a purely mechanical transmission is at once transmitted to the road wheels—only results, in a petrol-electric system, in an increased generation of electricity in the dynamo, which is followed later by increased speed of the electric motor as the magnetic flux is built up in the generator, and therefore an appreciable time elapses before the current has had time to make its influence felt at the road wheels. For heavy commercial work neither the increased weight nor the sluggishness in acceleration is a matter of much serious moment, and the latter defect may even be a blessing in disguise, as it allows a means of cushioning any shocks that may be set up in the transmission system by unskilful or careless driving. As petrol-electric systems allow of maximum acceleration without subjecting any part of the vehicle to undue strain, they have, as compared with mechanical gears, the great advantage that it places the most incompetent driver on a par with the most experienced and careful driver using a mechanical gear, and it is questionable whether—at all events for commercial work—the inability to accelerate rapidly is not more than compensated for by the saving in wear and tear arising from absence of shocks and undue strain.

Comparing petrol-electric transmission with hydraulic transmission, there does not seem to be much between them on the score of being noiseless, of not being affected by the distortion of the frame of the vehicle, and of giving a smooth acceleration and retardation. Theoretically, each seems to be an ideal transmission for motor road-vehicles.

French National Laboratory of Physics and Mechanics.

L'Académie des sciences has resolved to establish a National Physical and Mechanical Laboratory, for the purpose of scientific research directed towards industrial uses. The Laboratory will be controlled by a Council, of which half the members will be nominated by the Academy, one-fourth by State Departments, and the remainder by the chief industrial associations. The executive control will be in the hands of a small technical Committee. Existing laboratories engaged on similar work will be affiliated to the National Laboratory, and will work in close relationship with the latter. Substantial funds will have to be provided for the working expenses of the Laboratory, and for the assistance of the affiliated institutions.—*Génie Civil*.

NOTES.

Electric Lighting Provisional Orders.—The following is the official list of applications for Provisional Orders deposited with the Board of Trade on or before December 21st, 1916, under the provisions of the Electric Lighting Acts, 1882 to 1909:

Title of Order and description of area.	Name of promoters.	Agents.
Clayton and Queensbury	Electrical Distribution of Yorkshire, Ltd.	Torr, Durnford and Co., 2, Millbank House, Westminster, S.W.
Epsom Rural District (Extension). The Parishes of Cuddington and Ewell in the Rural District of Epsom.	South Metropolitan Electric Tramways and Lighting Co., Ltd.	Rees & Frenes, 5, Victoria Street, S.W.
Featherstone, Garforth, Horbury, Luddenden Foot, Otley, Penistone, Rawdon and Yeadon, and Wortley.	Electrical Distribution of Yorkshire, Ltd.	Torr, Durnford and Co. (as above).
Wimbledon Electric Lighting (Extension) Order. The parish of Cuddington in the Rural District of Epsom.	Corporation of Wimbledon.	Lees & Co., Palace Chambers, Bridge Street, Westminster, S.W.

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Orders for the week by Lieut.-Col. C. B. Clay, V.D. Commanding.

Monday, January 1st.—Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10. Signalling Class. Recruits Drill, 6.25. Lecture on "Telephones," 7.30.

Tuesday, January 2nd. School of Arms, 6.7. Lecture, 7.15. "Street Fighting," by Company Commander Hynam.

Wednesday, January 3rd. Instructional Class, 6.15. Platoon Drill, No. 1 Platoon.

Thursday, January 4th. Platoon Drill, No. 7 Platoon. Ambulance Class, 6.30.

Friday, January 5th. Technical for Platoon No. 10, at Regency Street. Squad and Platoon Drill for Platoon No. 9. Signalling Class. Recruits Drill, 6.25. Lecture on "Telephones," 7.30.

Saturday, January 6th. Commanding Officers' Parade, 2.45 (uniform), for drill in Battersea Park.

Sunday, January 7th. Entrenching at Otford. Parade, Victoria (S.E. & C.R. Booking Office), 8.45 a.m.

(By order) MACLEOD YEARSLEY, Adjutant.

Institution and Lecture Notes.—**Diesel Engine Users' Association.**—At the December meeting of the Association, Mr. Geoffrey Porter, borough electrical engineer to the Corporation of Worthing, was re-elected president for a second year. Messrs. R. W. Lyle (Messrs. Hoffmann Manufacturing Co., Chemsford) and W. Fennell (St. Albans) were elected members of the General Committee, and Mr. Percy Still (Chelsea) was re-elected as honorary secretary.

The total membership of the Association to date is 79, being an increase of 31 Diesel engine users during the year. The total horse-power represented by the Association has doubled during the year, being now 46,108 H.P.

A considerable amount of attention has been given during the year to the subject of the use of tar oils as fuel in Diesel engines. Several members of the Association have already commenced to use tar oils in their Diesel engines, either with a pilot ignition apparatus fitted to the engine, or without, and a considerable amount of useful experience has been obtained in the use of this class of fuel. Further trials are still being made, and certain difficulties have to be met, but there appears to be no doubt that if such fuel can be supplied to a suitable specification in various parts of the country at a reasonable price, Diesel engine users will soon make the necessary arrangements for its use, either wholly or partially, in place of the imported product.

The Committee's report on "Air-Compressor Explosions and Troubles" has been issued in pamphlet form, copies of which can be obtained from the honorary secretary.

Mr. Elliott A. Evans will, at the meeting next January, read a paper on "Chemistry and Examination of Lubricating Oils."

Information and particulars concerning the Association can be obtained from the honorary secretary, Mr. Percy Still, 19, Cadogan Gardens, London, S.W.

Physical Society of London.—At the meeting held on November 24th, a paper "On the Measurement of the Thomson Effect in Wires," was read by Mr. H. R. Nettleton. The paper describes how absolute measurements of the Thomson effect may be made in wires. The theory is fully worked out, and the sources of error likely to arise—especially owing to the smallness of the area of cross-section—are considered. The method is sensitive, consistent, and very rapid; its ultimate object is to determine the Thomson effect at different temperatures in a number of metals, both rare and base, at the same time, and with the same specimens, finding their thermo-electric powers. The preliminary experiments of this paper, testing the method, are with constantan wires of different lengths, with manganin, and with German silver,

A paper "On the Thermo-Electric Properties of Fused Metals," by C. R. Darling and A. W. Grace, was read by the former. One of the authors has for some time been investigating the possibility of using base metal thermocouples at temperatures above the melting point of one of the constituents. For this purpose it was necessary to determine whether any peculiarities in the thermo-electric behaviour of metals occur at fusion. In the case of lead, tin, zinc and cadmium there is no perceptible break in the continuity of the curves obtained. In couples containing bismuth, however, several cases were noted in which the E.M.F. remained constant for a wide range of temperature after the fusion of the bismuth. This occurs with silver, aluminium, iron, or nichrome as the other element. Useful applications of this property are discussed.

Appointments Vacant.—Assistant electrical engineer (£360) for the Government Electric Light Department, Federated Malay States. For particulars see our advertisement pages to-day.

Metropolitan Water Board Employees.—The *Times* states that the Board has adopted increased scales of pay for workmen employed in the Engineers' Department, fitters and electricians being among those affected.

Moscow and Co-operative Electricity.—Recently, in connection with fuel supply difficulties of industries in the central district of Russia, including Moscow, an interesting project has been proposed for constituting a large central electrical station to supply the factories and works with motive power on a co-operative basis. A report on the question, drawn up by the Association of Manufacturers and Works of the Moscow industrial region, states that the Moscow industry has to regard dearth of fuel, not as a passing phenomenon connected with the war situation, but rather as a permanent factor, even after the war. Certainly cheap petroleum cannot be expected, and almost as little may one expect cheap coal. The only sort of really cheap fuel that would be constant in price is peat. With centralised production of electrical energy, the current would be delivered at distant points as required. The question is only one of choosing a site for the central station and the selection of fuel. The choice lies between Donetz coal and peat. With Donetz coal the station might be constructed close to Moscow. With peat, on the other hand, it would be more profitable to construct the station on the marsh, as a good extensive peat marsh is to be found at a distance from Moscow of 120 to 140 versts. The cost of peat fuel will be one-half that of Donetz coal, even under the most favourable conditions for the latter.

Just recently, as a result of an agitation amongst some Moscow industrialists, energetically supported by the Association of Works and Factories, the question of establishing a central electrical station on a co-operative basis has made considerable progress; and not long ago, at a preparatory meeting, representatives of industrial concerns were invited to take part in the formation of an association called "Electro-Co-operative." This meeting took place on the premises of the Manufacturers and Works Association of the Moscow District, with N. I. Gutchhoff presiding. M. U. P. Jozhom acquainted the meeting with the history of the question. The idea arose two years ago, when the question of liquidating the 1886 Electric Light Co. was debated. The Association of Manufacturers and Works of the Moscow Industrial Region addressed in the year 1914 a report to the Ministry of Trade and Industry, in which was shown the importance to the Government of facilitating the supply of electrical energy to local industry, and the analogy of electric power to steam power for the railways.

The proposals in the report met with the complete sympathy of the Ministry, and there the working out of a corresponding project of law was warmly taken up; it is now completed, and has been placed before the Council of Ministers, and in the shortest possible time legal effect will be given to it. It is proposed to publish a supplementary regulation which will provide for a compensation per verst for the right of alienating land and using the ground, where cables are to be laid and posts erected.

The proposed Electro-Co-operative should of itself bring about a mutual alliance of the industrial concerns requiring electrical power. Trading in electricity for the purpose of extracting profit is not included in the objects of the promoters. Therefore only a surplus above the Co-operative's requirements can be delivered to manufacturers who may not be included in the Co-operative Association. Calculations show that the capacity of the plant should be 30,000 H.P.

Linking-up Electricity Stations.—A meeting, convened by Mr. W. J. Bache, borough electrical engineer of Cheltenham, was held at Bristol on December 18th to consider the question of linking-up electricity works in the West of England area. It was decided to form a general committee, with Mr. F. H. Corson, of Gloucester, as chairman, and Mr. Bache as vice-chairman and secretary, and a working sub-committee was also constituted.

Fatalities.—LONDON.—On December 20th, at the City Coroner's Court, Mr. Walter Schroder held an adjourned inquest on Emily Booth, aged 19, lift attendant at 5, Newgate Street, City, who was fatally crushed in an electric lift there. She had been employed for about a month by Messrs. Vickers & Poinson, art needlework manufacturers. On the day in question she had brought a junior clerk down from the fourth to the third floor, where she was to have waited. The lad had scarcely left the lift, however, when the cage suddenly ascended, and Miss Booth, in attempting to jump out, was pinned between the floor of the lift and the ceiling above. Engineers and carpenters had to be called in, and nearly an hour elapsed before the girl could be extricated,

See page 720. At the first hearing, Mr. John Tomlinson Corbin (P.N. & B. 200) a 47-year-old, of 52 Queen Victoria Street, was called and he had been charged with the lift for 10 years. It was worked on the lift, controlled by a lever in the cage. Witness thought the only explanation to be given for the accident was that the deceased had been near the switch and unconsciously moved the handle.

When the case was resumed, Mr. Thomas William Corbin an electrician, member of the same firm, stated that on Tuesday, last week, he visited the premises and found the lift exactly as it had been left after the accident. In conjunction with a representative of Waygood-Otis, he examined the lift, and found a leakage of electric current to earth, the result of the leakage being that the lift would move without the handle being operated, and while the door was open. His opinion was that the lift would move at once, and that the leakage occurred just at the time of the accident. That was not a thing that could be guarded against, and the person having control and knowledge of the working of the lift would not recognise it until the accident happened. If the deceased had remained standing in the centre of the lift she would have been quite safe.

By Mr. Verney (H.M. Inspector): He located the leakage close to the control handle, and stripped off the metal tubing in which the wires were fitted, and there discovered the leakage. It occurred at a point where the tube went round a sharp corner. In that bend one of the wires had become bare, and was touching the tubing, and so was earthed. The wires did not move in the ordinary sense of the term, but he imagined there was a little vibration every time the lift moved. He saw no reason why they should move, and, in his opinion, the break was not there when the lift was originally fitted up. A long-continued, but slight, vibration would account for the break. He thought the abrasion of the outer covering had probably been going on gradually for years. He did not think it should have been manifest in the working of the lift, and it was probably made manifest for the first time when the accident occurred. He thought the wiring was properly arranged. As an expert, he did not think the controlling handle came into the question of the accident at all. The deceased's body got in the position in which it was seen because the gate was open.

Harold Gates, chief engineer to the previous witness, said he had never heard of a similar accident to a lift. Quite recently this lift had stopped owing to a dirty contact, which was remedied in a few minutes.

Mr. John T. Corbin, recalled, said that Messrs. Vicars had always given him full instructions to do anything necessary at any time. There was nothing to suggest any defect in the insulation. Witness was present at the inspection on the Tuesday, and he agreed with his brother's evidence.

Mr. Charles H. J. Day, a director and engineer of Waygood-Otis, Ltd., said the lift was put in by his firm 14 years ago, but they had had nothing to do with it for 10 years. He had seen what had been discovered, but he did not think there was a means of detecting the defect by ordinary observation, the wires being in a steel tube, and beyond the range of vision. He did not know how such a thing could be provided against. He did not think an insulation test would be infallible, although it might show it. He agreed that if the girl had remained standing in the cage she would have been safe, as the lift would have stopped almost level with the top floor, and quite clear of the buffers. If an insulation test were made, a fault might occur an hour or two afterwards. The test might reveal a weak spot.

By Mr. Verney: He did not agree with the witness as to vibration, which would be absolutely infinitesimal. He thought the defect had been suddenly produced. He hardly thought the wiring was defective when it was put in, because it had stood for 14 years. There was certainly no indication to show that the lift was out of order.

The jury returned a verdict of "Accidental death."

DEUBLIN.—At an inquest on the body of Patrick Davis, 28, electrician, employed by the Great Northern Railway Co. of Ireland, at the Amiens Street terminus, Dublin, the evidence showed that he had been found fatally injured lying between the rails at the station after the departure of a train for Howth. Mr. Bannerman, station-master, said it was not customary for an electrician to go under a train before it started, and he did not know what deceased could have been doing there. The engine driver of the Howth train, Patrick Rice, said if anyone was working under the train, he should have got notice of the fact, and a red flag should have been hoisted. He received no notice, and saw no flag. John Stanley, electrician, said he told Davis about a defective light in one of the Howth carriages, but he did not know that he had gone to work under the train. John McWilliam, foreman of the train-lighting department, deposed to the precautionary measures taken when electricians were at work on trains. A red flag should be used, and in the event of an engine being attached to a train the man should warn the engine driver and have a look-out man. There were 10 electricians employed, but there were no persons specially employed as look-out men. In 21 years' experience, witness had never known of an accident of this kind until now. Mr. A. W. Whieldon, engineer, working under the locomotive engineer, said a man working under a train must take precautions to see that he was protected. It was not sufficient merely to tell the foreman or charge hand. The foreman could not supervise every case. Witness had made a quarter of a million inspections, and that was the first accident in 21 years. The Coroner (Mr. Fiery) said he considered the company had been guilty of negligence in not seeing that the regulations were carried out. The jury returned a verdict that death resulted from shock and hemorrhage, and added a rider that "there was want of supervision on such dangerous work."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—The General Purposes Committee of St. Pancras B.C. has adopted a recommendation of the Electricity Committee that the salary of Mr. T. W. MERRY, superintendent at the King's Road electricity station, be increased from £208 per annum to £233 per annum, and further increased a year hence to £250 per annum. In October last Mr. Merry submitted an application to the chief electrical engineer asking for permission to apply elsewhere for a post of electrical engineer which was vacant, and, after consultation with his chairman, the chief electrical engineer replied that he was unable to release him, but promised to recommend an increase of salary. Mr. Merry has been in the service for over 16 years, and has been in receipt of his present salary of £208 per annum since March, 1910. Since that date the output from the generating station under his direct supervision has increased from seven million units to this year's output of about 12 million units. The chief electrical engineer states that Mr. Merry has put in a considerable amount of time at the works on Sundays and after normal hours, particularly since the war, as the plant under his control is much overworked and requires constant skilled supervision at all hours for its repair and maintenance; that he has proved himself a very capable assistant, and, under his supervision, the plant has been maintained in a high state of efficiency. The following salaries paid by other boroughs for a similar position were submitted, namely:—Hammersmith £300, Woolwich £280, plus house, coal, and light, Leyton £250, Stepney £240, plus house, coal, and light, and East Ham £240.

Mr. CLAUDE R. MARSHALL, chief assistant engineer at the North Metropolitan Electric Power Supply Co.'s St. Albans undertaking, has been granted leave of absence, and permission to accept a commission in the Inland Water Transport, Shipping Section, of the Royal Engineers.

The Rochdale Electricity Committee have granted a further month's leave of absence to Mr. C. C. ARCHISON, the borough electrical engineer, who is still away owing to a breakdown in health.

The Southampton Tramways Committee has increased the salary of the manager, Mr. W. T. ROBSON, from £400 to £500 per annum.

The salary of Mr. H. W. MILES, assistant accountant, Southampton electricity department, is to be increased from £210 (which includes £10 war bonus) to £225 by increments of £10 and £5. The salary of Mr. B. HORNE is to be increased from £99 to £115 (which includes war bonus). In the event of war bonuses being stopped at any time, the maximum salaries in these cases will be £225 and £100 respectively.

Doncaster Tramways Committee has appointed Inspector FULLER as chief inspector, vice Mr. BAKER, appointed to succeed Mr. Strachan as traffic superintendent.

General.—Mr. A. H. NORWAY will resume his duties in the General Post Office, London, on January 1st, on the expiration of his period of appointment as Secretary to the Post Office in Ireland. The Postmaster-General has appointed Mr. J. MACMAHON to succeed him in Dublin.

Roll of Honour.—The Meritorious Service Medal has been awarded to Lance-Corporal J. G. L. GREEN, R.E., for services rendered in France. Mr. Green was with Messrs. Page and Miles, Ltd., electrical engineers, Brighton.

Private ERNEST MASON, North Staffs. Regiment, who was in the electrical department of the North Staffordshire Railway, is reported missing.

Private J. NEWSTEAD, London Regiment, who has fallen in action, was an employé of the Telegraph Construction and Maintenance Co.

Lance-Corporal H. MAYES, Oxford and Bucks Light Infantry, of the B.T.H. Co., Ltd., of Rugby, has died of wounds. Mr. C. LINFORD, formerly employed in the St. Pancras electricity department, has died of wounds received in action.

Private J. PRINCE, of the Lancs. Fusiliers, killed in action, was employed by Messrs. I. Frankenburg & Co., Salford.

Private A. JACKSON, Cheshire Regiment, attached to the Machine Gun Corps, has been killed in action. He was employed by the British Westinghouse Co., Trafford Park.

Private G. LEWIS, Lancashire Fusiliers, killed in action, was employed at the Salford Corporation electricity works.

Lance-Corporal E. LATHAM, of the Loyal North Lancashire Regiment, of Preston, who has been recommended for the Military Medal, and is in hospital suffering from wounds, was employed by Messrs. Dick, Kerr & Co.

Private B. PARR, North Staffs. Regiment, who enlisted whilst with Messrs. Taylor, Tunnicliffe & Co., Ltd., electrical fittings manufacturers, Hanley, is reported missing.

Obituary.—MR. ARTHUR JAMES IRELAND.—After a brief illness, Mr. A. J. Ireland, of the British Thomson-Houston Co., Ltd., Rugby, died on the 22nd inst., aged 57. Mr. Ireland had a very wide circle of friends in the electrical industries.

MR. HARRY L. DAVIS.—The death took place on December 26th of Mr. Harry L. Davis, of Brockley, S.E., who was for 42 years with the Telegraph Construction & Maintenance Co., Ltd. He was in his 59th year.

MRS. JANE DAVIDSON CALLENDER.—We regret to note that Mrs. Jane Davidson Callender, widow of William Ormiston Callender, founder of the well known business now known as Callender's Cable & Construction Co., Ltd., passed away at Bournemouth, on December 22nd, in her 90th year.

CITY NOTES.

India-rubber, Gutta-percha, and Telegraph Works Co., Ltd. The annual meeting was held on December 20th, at 109, Cannon Street, E.C. Major LEONARD DARWIN, the chairman, first referred to the loss of their cable-ship *Dacia*. Although an old ship—she was built in 1867, and acquired in

1872 from Sir Charles Bright, the pioneer of Atlantic telegraphy—she was still a valuable vessel for her work, the cable machinery being as good as, if not better than, that of any cable-ship afloat. In her time she had laid cables in the West Indies, on the coasts of Chile and Peru—in that voyage she anchored alongside Lord Brassey's original *Sunbeam* in one of the land-locked bays in Smith's Channel; she had seen service in the Persian Gulf, the Mediterranean, the West Coast of Africa, and North Atlantic Ocean. Fortunately, in this her last voyage, she had performed the principal work for which she had been chartered, and when she met her fate on the 3rd of this month in Funchal Roads from the torpedo of an enemy submarine, only a few comparatively unimportant tasks still lay before her. But the chief matter for congratulation lay in the fact that the whole of the crew were landed safely, without personal injury to a single one of them. With regard to the *Silvertown*, as there was little chance during the war of their obtaining a contract for the laying of a cable sufficiently long to make a remunerative cargo for her, the directors decided to accept an offer for her as an oil ship. She was built in 1873, and her tanks exceeded in size those of the *Great Eastern*, which was supposed at that time to be specially fitted for cable work on account of her large carrying capacity. The *Silvertown* had laid cables in all parts of the world, from Senegal to Mossamedes on the West Coast of Africa, from New York to Havana, San Francisco to Honolulu, Sydney to Auckland, and Manila to Shanghai. They hoped she would still do useful work during the war as an oil-tank steamer. The question of acquiring another cable-ship with all modern requirements was engaging the attention of the directors. The board had put £50,000 to the reserve fund, which now stood at the same figure as it did immediately before the war. Persian and the foreign branches did very well during the year under review. It must be remembered, however, that the French works were liable to the French war tax, and that this would, of course, reduce the company's available profits. What that tax or the English war taxes would amount to they did not know. The re-issue of their debentures in March last entailed a considerable cash expenditure, together with a liability for additional interest in the future, the present value of which amounted to about £30,000. It was hoped that this large additional financial burden, which was entirely due to the war, would be taken into consideration in making the assessment for the excess profits duty and the munitions levy. Their special activities had made it necessary to limit their output in other directions. This had entailed a loss of trade in the only markets which would be open to us after the war. Considerable difficulties were likely to be experienced in re-occupying this lost ground, and this was a matter which also ought to be held in view by the authorities when imposing war taxation. They felt confident, however, that they would be justly treated by the Government, and they had no apprehensions whatever on the subject. To relieve the congestion of work at Silvertown and to meet the increased demands for war material, the directors had acquired treble-holm land at Burton-on-Trent, and a shop had already been erected there. The land, about 50 acres in extent, was nearly level, and was flanked by a railway and a canal. It was hoped that after the war they would be able to devote the works at Burton to a great extent to the production of those articles of which, before the war, Germany had obtained a practical monopoly.

Mr. C. H. GRAY seconded the motion.

Mr. DRYSDALE congratulated the director upon the satisfactory state of the company's affairs, and inquired whether provision had been made for meeting their liability under the war tax. With regard to the new works at Burton, he hoped that the forecast of the chairman as to their being able to capture German trade would turn out to be correct. As far as his experience went, the Germans had always been keen on selling a cheap article, whereas too often the English manufacturer would only sell the article which he thought was best. He knew, for instance, that their Silvertown products were of the very highest quality, but the question was whether they could produce a cheap article which would meet

the requirements of the merchant and pay the company equally well. Mr. Drysdale said he took it that the French war tax would be considered as part of the expenses of the French works, and that only the net amount coming to this country would be subjected to our own war tax.

The CHAIRMAN, in reply, said the directors had no apprehension as to being able to meet the war tax. They had a large carry-forward of about £10,000, and there was £50,000 placed to the reserve fund, which latter they hoped they would not have to touch. As to the French tax, the double taxation ought not to fall upon them, and he did not believe it would. Justice would seem to point to their not having to pay war taxes to both the French and the English Governments.

Mr. C. H. GRAY, replying to Mr. Drysdale, said that in regard to capturing German business, the general policy which the board was going on at present was that they would not attempt to make anything or take anything from the Germans which they could not actually produce and sell at the pre-war prices of the Germans. They had already made sufficient experiments, and they had sufficient knowledge, to assure them that there were many lines which they could actually manufacture at Burton which would fulfil those conditions.

The report was adopted.

Melbourne Electric Supply Co., Ltd.

The annual meeting was held on December 21st, at Finsbury Pavement House, E.C. Mr. J. B. BRAITHWAITE, who presided, said that 122 of the company's employes were now serving with the Forces (23 per cent. of the total staff). Dealing first with the Melbourne undertaking, with regard to the profit and loss account the figures were in every respect satisfactory, and the result reflected the greatest credit on their managing director and staff in Australia. At Melbourne their revenue from private supply had risen from £94,791 to £109,257; that from power had increased from £44,393 to £57,966; the receipts from the tramways supply had grown from £21,443 to £31,389, and the revenue from the bulk supply had risen from £2,529 to £1,860. Thus every item of the revenue showed a considerable increase, the total receipts being £223,153 against £179,752. There had, of course, been an increase in expenditure, the increased cost of coal rendering that inevitable, apart from the very large number of additional units sold. The cost of generation had risen from £35,012 to £47,004; the cost of distribution was slightly reduced; repairs and renewals were £12,396, as against £11,142; and general charges had increased from £19,013 to £24,342. The sum carried to the profit and loss account was £131,673, as against £107,514 in the previous year. It might interest them to know how the increased units sold had been distributed. They had sold practically 24 million units during the year, as compared with 17,486,300 in the previous twelve months, an increase of over 6,000,000 units, which he thought was a very satisfactory increase indeed. It was more significant, however, if they analysed the figures, and saw where the increases had taken place. In private lighting there had been an increase of 18 per cent., and the public lighting had increased by about 17 per cent. Power showed an increase of 40 per cent. The power connections had increased during the year by 2,687 H.P., bringing the total figure up to the very substantial one of between 17,000 and 18,000 H.P., exclusive of the tramway supply. They had sold 6,165,226 units to the tramways, an increase of 39 per cent. over last year. An equally important and satisfactory item in their supply, although it did not bulk very largely at present in their output, was the bulk supply to outlying municipalities. During the year they had agreed to supply two additional districts, which made a total of 15 local authorities they were now supplying. Their bulk supply had increased 90 per cent., which was proof that the supply was appreciated by municipalities, who greatly appreciated being able to get their power supply from their very cheaply instead of having to put down small power-houses of their own. Last year he told them that they were doing a small domestic business, such as supplying toasters, shaving water heaters, heaters for curling irons, &c. The sale of units for those purposes during the past year had increased 80 per cent.—a very healthy development. One of the most gratifying features of that increase was that it showed they were pleasing the ladies. They were so pleased with those little domestic uses for electricity that they were not content unless they had their houses lit by the electric light, and it was almost impossible now to let or sell a house in the district of their supply unless it was wired for electricity. With regard to the street lighting, they were now supplying current in nearly 600 miles of streets. Last year he told them they were supplying as far as from London to Aberdeen. During the year they had added another 40 miles and connected 4,500 additional consumers, so they would see that the company continued to make splendid progress, in spite of the drawbacks to which they were subjected owing to the war. Those drawbacks were especially marked with regard to the supply of plant and machinery. They now had to go through all sorts of formalities to get leave to get additional plant. They had to go to the Ministry of Munitions to get certificates, and when the plant was manufactured they had to get special licences to allow it to be shipped for Australia. Fortunately, before the war they had always adopted a policy of keeping their plant just ahead of their demands, and although the 6,000-kw. machine that ought to have been shipped two years ago was

not only to be out until next May or June, the provision they had made for the year would be hoped enable them to carry on, unless, of course, they had a serious breakdown. So far they had managed to pull through without having to cut down on their supply, and he hoped they would be able to do so. There was room for considerable further expansion at their power house at Mchicourt, and they were making provision for putting in additional plant and boilers. A time would come, however, when they would have to consider where they were going to get any additional power they might require, and that matter was engaging the serious consideration of the directors. They were not losing sight of the future, but were endeavouring to make preparations well ahead, so that the company might continue its uninterrupted course of progress and prosperity. With regard to Geelong, that was a shipping port, and the restriction on shipping had naturally affected it. Even there they had made an increase in every item. The profit had risen from £10,162 to £11,641, and the units sold were about 300,000 up. It would be seen on referring to the appropriation account that they were adopting a very conservative attitude.

Mr. R. P. SELLOX seconded the motion, and the report was adopted.

Subsequently, extraordinary resolutions were agreed to increasing the capital by £750,000, divided into 50,000 preference shares of £5 each and 500,000 ordinary shares of £1 each, and increasing the borrowing powers of the directors by £250,000.

W. & T. Avery, Ltd.—Dividend £5 per cent. per annum on 1st per share, less income-tax, on ordinary shares for the half-year.

Chile Telephone Co., Ltd.—Interim dividend, 5 per cent. per annum 13s. per share, free of income-tax, on ordinary shares for half-year.

STOCKS AND SHARES.

WEDNESDAY MORNING.

The Stock Exchange year draws to its conclusion with noticeable confidence in the markets, and, at the same time, noticeable uncertainty with regard to what is going to be done in the way of distributing man-power. The House is naturally discussing a good deal the question as to how far it conducts an essential or non-essential industry, but the answer lies in the hands of the powers that be; and, whatever happens, Stock Exchange men are not likely to raise any particular grumble if they see that they are really wanted for something of more vital urgency to the national interest.

Prices are well maintained. The American Peace Note, which had the effect of producing a violent break in prices in Wall Street, added weight to the growing volume of conviction that Germany's power is broken, and that Austria, especially, will be likely to grasp at any opportunity for bringing the war to a conclusion; although the negotiations to this end may cause the war to drag on for many a long month yet.

There has been comparatively little doing this week, and, in the circumstances, a few comparisons of present prices with those ruling a twelvemonth ago are appropriate. Starting with the electricity supply list, here are some of the principal shares:—

Share.	Price, Dec. 31, 1915.	Pre-sent price.	Rise.	Share.	Price, Dec. 31, 1915.	Pre-sent price.	Rise.
Brompton	72	68	2	London Elec.	12	12	—
Charing Cross	30	32	2	Metropolitan	22	24	2
Chelsea	4	3	1	St. James'	63	64	1
City of London	124	11	1	South London	24	25	1
County of London	10	10	—	8th Met. Pref.	1	1	—
Kensington	6	52	46	Westminster	64	52	12

Business in electric lighting shares has been very quiet throughout the year, in consequence of the lighting restrictions, the Daylight Saving Bill, and the difficulties as regards coal, labour, and material. Only County ordinary and South Metropolitan preference have managed to secure a rise on balance.

More activity has developed in the telegraph market, where prices have on the whole improved, as the following list shows:—

Share.	Price, Dec. 31, 1915.	Pre-sent price.	Rise.	Share.	Price, Dec. 31, 1915.	Pre-sent price.	Rise.
Anglo-Am. Tel.	100	53	47	Gt. Northern	33	37	4
Brit. Insulated	224	23	201	Indo-European	47	49	2
E. Extension	121	11	110	Marcon	11	12	1
E. Telegraph	128	110	18	W. Ind. & Pan.	12	1	11
Globe Ord.	102	12	90	Western	124	134	10

Marconis proved a lively market during certain parts of the twelve months, and, after rising above 3, are still £1 higher on the year.

Railway stocks came into pronounced favour during the last few weeks; and a feature has been the steady rise in Underground Electric Incomes for months past, for reasons which have been indicated frequently in these columns from week to week, the bonds having been recommended here, as

a speculative investment, from 75 upwards. We set out a few comparisons:—

Share.	Price, Dec. 31, 1915.	Pre-sent price.	Rise.
Metropolitan	24	24	—
District	157	163	6
Underground Ordinary	15	24	9
" Income	77	92	15

In the foreign list, the slump in Mexican stocks has continued almost without interruption, but British Columbia stocks are irregular on balance. Brazil Tractions have been as high as 65 during the year, and they close, as will be seen, at 49:—

Share.	Price, Dec. 31, 1915.	Pre-sent price.	Rise.	Share.	Price, Dec. 31, 1915.	Pre-sent price.	Rise.
Braz. Tractions	51	49	2	Mex. Trams	42	24	17
B.C. Elec. Pref.	60	62	2	Mexico Tramway	3	3	—
Indo. Debt	40	33	7	per-cent. Bonds	49	32	17
Anglo-Arc. Trams	10	13	3	Mex. Light Com.	10	7	3
1st Pref.	44	3	41	Ditto 1st Bonds	47	27	20

Substantial rises have taken place in many of the shares of the manufacturing companies, as the following list shows:—

Share.	Price, Dec. 31, 1915.	Pre-sent price.	Rise.	Share.	Price, Dec. 31, 1915.	Pre-sent price.	Rise.
Brit. Aluminium	14	11	3	India fully-paid	1	18	17
Brit. Insulated	101	11	90	Ind. Con.	14	1	13
British Westing.	10	11	1	Henley	10	13	3
house Prof.	1	2	1	India-Rubber	9	13	4
Callenders	10	13	3	Tele. Con.	31	38	7
Caster	3	3	—				

Investment business has not been bad, taking the year through. Having regard to the absence of speculation, on the Treasury prohibition, the volume of Stock Exchange trade has been reasonably active, and the above price lists exhibit clearly how investors have taken stock at rising figures.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend	Price	Rise or fall	Yield
	1914, 1915.	Dec. 27, 1916.	this week.	p.c.
Brompton Ordinary	10	10	68	47 11 0
Charing Cross Ordinary	5	5	59	7 8 2
Chelsea do. do. 44 Pref.	44	44	8 5	6 11 0
City of London	9	8	112	6 18 4
do. do. 6 per cent. Pref.	6	6	10	7 0 8
County of London	7	7	104	6 18 8
do. do. 6 per cent. Pref.	6	6	6	6 1 6
Kensington Ordinary	9	7	68	6 4 6
London Electric	4	4	13	6 10 5
do. do. 6 per cent. Pref.	6	6	41	6 15 4
Metropolitan	24	24	94	6 18 4
do. do. 44 per cent. Pref.	44	44	94	7 4 0
St. James' and Pall Mall	10	8	6	6 19 4
South London	24	25	23	7 5 6
South Metropolitan	7	7	104	6 7 8
Westminster Ordinary	9	7	68	6 4 5

TELEGRAPHS AND TELEPHONES.

	Price	Rise or fall	Yield
	Dec. 27, 1916.	this week.	p.c.
Anglo-Am. Tel. Pref.	6	6	6 5 8
do. Def.	80	83 5	7 10 0
Chile Telephone	8	8	6 12 8
Cuba Sub. Ord.	5	5	6 8 6
Eastern Extension	7	8	6 14 4
Eastern Tel. Ord.	7	8	6 14 0
Globe Tel. and T. Ord.	6	7	124 x d
do. Pref.	6	6	10 x d
Great Northern Tel.	22	22	6 18 6
Indo-European	13	13	49
Marcon	10	10	22
New York Tel. 43	43	43	4 9 0
Oriental Telephone Ord.	10	10	2 5
United R. Plate Tel.	8	8	6 12
West India and Pan.	1	1	6 d.
Western Telegraph	7	8	185 x d

HOME RAILWAYS.

	Price	Rise or fall	Yield
	Dec. 27, 1916.	this week.	p.c.
Central London, Ord. Assented	4	4	6 2 2
Metropolitan	12	1	4 0 0
do. District	Nil	Nil	Nil
Underground Electric Ordinary	Nil	Nil	Nil
do. do. "A"	Nil	Nil	6 6
do. do. Income	6	6	46 9 10

FOREIGN TRAMS, &c.

	Price	Rise or fall	Yield
	Dec. 27, 1916.	this week.	p.c.
Adelaide Sup. 6 per cent. Pref.	6	6	4 15
Anglo-Arc. Trams, First Pref.	54	54	85 x d
do. 2nd Pref.	54	54	27
do. 5 Dec.	5	5	62 x d
Braz. Tractions	4	4	4 + 24
Bombay Electric Pref.	6	6	10
British Columbia Elec. Ry. Pref.	5	5	63 x
do. do. Preferred	Nil	Nil	40
do. do. Deferred	Nil	Nil	35
do. do. Deb.	41	41	62
Mexico Trams 5 per cent. Bonds	Nil	Nil	32
do. 6 per cent. Bonds	Nil	Nil	27
Mexican Light Common	Nil	Nil	16
do. Pref.	Nil	Nil	16
do. 1st Bonds	Nil	Nil	27

MANUFACTURING COMPANIES.

	Price	Rise or fall	Yield
	Dec. 27, 1916.	this week.	p.c.
Babcock & Wilcox	14	15	21
British Aluminium Ord.	6	7	80
British Insulated Ord.	15	17	113
British Westinghouse Pref.	75	75	28
Callenders	15	20	13
do. 5 Pref.	5	5	44
Edison & Swan, 23 paid	20	22	85 x d
do. do. fully paid	Nil	Nil	16
do. do. 4 per cent. Deb.	6	6	62
Electric Construction	6	7	12
Gen. Elec. Pref.	10	10	182
do. Ord.	20	25	16
Henley	43	44	4
do. 43 Pref.	10	10	13
India-Rubber	90	90	88
Telegraph Con.	90	90	88

* Dividends paid free of income-tax.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING NOVEMBER, 1916.

THE November returns of electrical export business show a falling-off in value as compared with previous months, the total amounting to £438,830, as compared with £501,822 in October and £573,314 in September. The electrical imports into this country, on the other hand, reached a somewhat higher value, amounting to £198,192 worth, as against £187,261 worth in October.

The re-exports at £18,367 were also higher, being some £7,000 in advance of the previous month's figures.

The decline in export values is apparent in nearly every section of the table, excepting the lamp and miscellaneous sections, the

former of which shows a considerable advance on the last month. Electrical machinery exports amounted to, approximately, £150,000 in value, while cable exports reached, roughly, £80,000 in value. In the imports section, the electrical machinery business was on an increased scale, while lamp and cable imports fell off in value considerably.

During the month France was our best customer: India, our Australian Colonies, China, and Japan were also prominent in the list, while of the importers into this country, the U.S.A.—the foremost—did a somewhat greater business than in October, though in other directions not much movement was shown.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Sweden, Norway and Denmark ...	6,253	2,375	116	3,686	5,117	1,191	5,298	2,351	439	978	121	5,768	33,693
Netherlands, Java and Dutch Indies ...	480	10,432	1,297	55	111	20	901	140	216	512	184	2,473	16,821
Belgian Congo ...	65	...	...	...	...	...	...	...	...	...	...	...	65
France ...	3,820	219	774	452	275	73	21,314	4,977	644	25	20,428	3,223	56,284
Portugal ...	77	241	69	861	389	...	93	...	37	304	4,680	6,777	...
Spain, Canary Isles and Spanish N. Africa ...	1,014	52	149	...	...	454	3,784	77	36	...	41	349	5,959
Switzerland, Italy and Austria-Hungary ...	1,719	200	193	...	...	745	9,875	...	10	55	682	3,765	17,276
Greece, Rumania, Turkey and Bulgaria ...	...	...	...	...	...	...	60	...	...	...	...	116	176
Channel Isles, Gibraltar, Malta and Cyprus ...	314	39	53	37	...	19	89	...	...	...	...	12,569	13,122
U.S.A., Philippines and Cuba ...	1,737	...	170	243	...	...	236	...	...	21	624	253	3,284
Canada and Newfoundland ...	331	...	379	95	...	994	1,621	4	11	...	183	64	3,682
British West Indies and British Guiana ...	49	...	80	24	...	119	257	...	21	...	12	16	578
Mexico and Central America ...	18	...	...	...	...	...	...	...	...	...	...	...	18
Peru and Uruguay ...	...	...	101	42	...	...	...	...	...	...	...	194	337
Chile ...	378	1,008	402	66	...	623	1,386	...	39	104	16	469	4,482
Brazil ...	590	622	139	382	...	...	772	1,180	264	1	407	69	4,336
Argentina ...	881	52	458	357	19	1,944	590	154	1,106	42	1,698	806	8,107
Colombia, Venezuela, Ecuador and Bolivia ...	35	67	13	...	...	...	214	...	61	...	...	...	390
Egypt, Tunis and Morocco ...	240	...	82	414	...	...	211	15	100	19	...	976	2,057
British West Africa ...	107	6,632	19	222	...	12	2,128	349	29	20	272	459	10,249
Rhodesia, O.R.C. and Transvaal ...	1,573	4,544	3,608	3,202	235	180	4,072	1,602	523	138	4,225	1,023	24,925
Cape of Good Hope ...	1,066	1,241	618	1,269	...	60	1,155	1,504	2,137	13	394	922	13,382
Natal ...	876	9,385	1,202	439	...	156	5,721	1,127	1,303	68	46	765	21,088
Zanzibar, Brit. E. Africa, Mauritius & Aden ...	297	302	620	770	...	144	1,288	49	123	...	322	107	4,022
Azores, Madeira and Portuguese Africa ...	154	23	18	133	...	34	714	...	33	...	9	143	1,261
French African Colonies and Madagascar ...	48	92	217	4	...	...	...	60	...	...	...	...	421
Persia ...	46	211	6	56	...	23	60	99	80	...	82	110	773
China and Siam ...	1,676	8,354	794	558	13	1,889	2,973	390	935	72	275	311	18,240
Japan and Korea ...	316	...	51	79	1,615	1,441	781	8,763	773	20	...	...	13,839
India ...	4,381	3,670	4,100	1,268	35	910	19,354	3,568	2,964	135	413	983	44,781
Ceylon ...	4	121	572	50	...	18	270	...	37	...	362	408	1,842
Straits Settlements, Fed. Malay States and Sarawak ...	328	317	352	274	...	19	444	324	231	42	592	349	3,272
Hong Kong ...	367	1,043	162	314	174	888	595	74	...	76	18	888	4,599
West Australia ...	93	923	665	202	...	204	418	...	244	...	3,207	...	5,956
South Australia ...	107	871	1,001	316	...	188	556	93	24	34	1,821	72	5,083
Victoria ...	1,631	7,817	3,029	1,764	...	1,163	4,919	152	875	32	2,243	770	24,395
New South Wales ...	1,545	9,500	3,697	1,405	96	1,441	14,947	3,176	1,733	135	3,013	395	41,083
Queensland ...	198	347	297	62	...	...	829	...	...	17	2,187	...	3,907
Tasmania ...	313	1,739	8	125	...	...	39	...	...	...	...	23	2,247
New Zealand and Fiji Islands ...	911	4,603	1,448	1,652	...	929	2,963	730	723	6	1,669	387	16,021
Total, £	33,978	80,078	26,963	23,908	8,079	15,881	110,927	30,958	15,728	2,602	45,823	13,905	438,830

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	...	...	...	2,540	...	6,102	...	1,506	...	...	...	10,118
Netherlands ...	144	...	...	13,531	7,702	...	300	260	1,290	...	...	23,227
France ...	241	152	12	268	54	880	140	...	7,307	1,312	45	10,411
Switzerland ...	1,252	...	60	83	...	1,467	438	148	820	821	...	5,089
Italy ...	...	2,786	...	...	...	1,398	415	...	...	...	...	4,599
Japan ...	398	...	3,318	7,434	695	...	...	...	113	...	67	12,325
United States ...	8,923	9,174	1,471	3,283	862	3,729	5,593	50,068	12,704	13,659	20,992	130,458
Total, £	10,958	12,112	4,861	24,599	11,853	6,076	13,971	50,871	24,040	15,792	21,104	196,257

Additional imports.—Spain, carbons, £606. Canada, wires and cables, £30; batteries, £1,296; glow lamps, £140; fittings, £10; electrical machinery, £56; electrical goods, £97.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	2,386	2,518	...	4,267	105	3,363	2,818	...	309	123	2,478	18,367
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TOTAL EXPORTS: £438,830

TOTAL RE-EXPORTS: £18,367

TOTAL IMPORTS: £198,192

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned which is not necessarily the country of origin.

CONTROL SYSTEMS FOR TRACTION MOTORS.

A recent issue of one of our American contemporary the *Electric Railway Journal* contained an interesting review of the various types of electric railway and tramway construction, more especially dealing with the trend of American practice.

Of particular interest is the summary of developments in control systems, of which the following is an abstract.

Control systems for modern electric railway cars may be classified as direct and indirect, this division being based on the method used in performing the switching. Both use the series-parallel method of adjusting the voltage, wherein the motors, or groups of motors, are arranged first in series and then in parallel, the "non-rheostat" system for four-motor equipments giving an intermediate step with the motors in two groups.

In order to effect the rearrangement of motors or the change from the series to the parallel connections three schemes are in use, namely, the shunting-out, the bridge, and the open-circuit transition. The shunting-out method short-circuits one motor, or group of motors, while the controller handle is being moved from the last series position to the first parallel position on the controller. The decrease in tractive effort which occurs when this is done tends to produce an unpleasant jerk during acceleration, particularly if the cars are heavy. At present this method is largely confined to control equipments, both direct and indirect, for small and medium size motors. The bridge system is now widely used with in

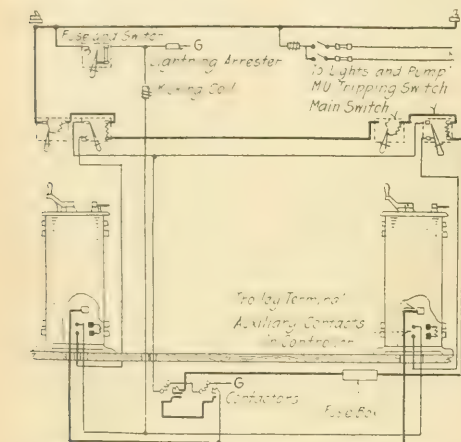


FIG. 1.—CONNECTIONS OF MODIFIED DIRECT CONTROL.

direct control systems for large motors. Direct controllers equipped with the bridge transition have not proved very satisfactory because of the time element involved in making the various circuit connections. The connections in this system are such that all motors are working during the transition period, with the result that a fairly uniform tractive effort is maintained throughout the notching-up portion of the accelerating period. The open-circuit transition at one time was quite widely used in connection with direct control for large motors, but the development of the bridge transition and the indirect systems of control has rendered it practically obsolete for the heavier classes of service. It is still used, however, with some of the modified forms of direct control.

Direct Control Systems.—Of the direct control systems, the most familiar is that in which the Type K controller is used. Within recent years the most important developments in connection with this controller have been its adaptation for use with field-control motors and the many improvements in structural details. For the more recent designs, 600 volts, 750 volts, and 1,200 volts are the standard voltage ratings. Those rated at 1,200 volts were designed for use on interurban roads having a trolley voltage of 1,200, but they have not proved very popular in interurban and all high-voltage services, the tendency being toward the use of indirect control.

Direct control was used five years ago on practically all city and suburban cars, and on many of the lighter interurban and rapid transit cars. However, in the heavier services this type of equipment was rendered objectionable because of the large size of controller necessary. Its use to-day is largely confined to city car equipments where the motors are of less than 50 H.P.

A modification of direct control has recently come into rather wide use; it combines a number of the advantages of both direct and indirect control. In this system remote-controlled circuit-breaking or contactor switches are mounted underneath the car to break the main power circuit. These switches are used in connection with a regular cylindrical controller, and they relieve the controller fingers of the heavy

arcing and burning incident to the rupture of circuits carrying heavy currents. The controller is provided with an auxiliary contact device on the main cylinder, which consists of two contact fingers operated by a pivoted arm that in turn is actuated by a cam on the controller drum. The action is such that when the drum is turned in the "on" direction the main circuit drum fingers close first and then the controller fingers. The power circuit is thus closed by the contactor switches instead of by the main drum fingers. Provision may be made for a tripping mechanism which, in case of overload, operates the tripping switch and thus permits the contactors to open.

This type of control is not only more reliable than the standard direct control, but the use of remote-control switches in the main power circuit makes possible the interlocking of the control system with door opening and closing and other safety devices. In fact, the latter advantage has been very largely the cause of its popularity.

Indirect control was developed primarily to permit the operation of several cars as a unit from the master controller

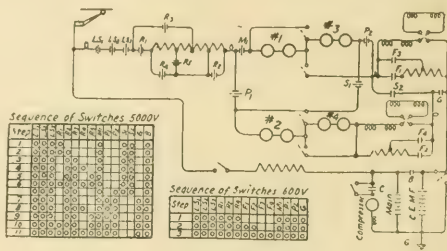


FIG. 2.—CONTROL DIAGRAM, 5,000-VOLT, D.C. EQUIPMENT.

of the leading car, and up to a few years ago its application was largely confined to rapid transit cars, suburban cars on electrified steam lines, and electric locomotives.

Indirect-Control Systems.—Indirect control is now used altogether for rapid transit and other heavy services and quite widely in interurban service. In the latter case it is almost universal where the contact line carries more than 600 volts. In city service it is being used to a limited extent, largely without the multiple unit feature, however, particularly in connection with some of the low-floor types of car, because of the ease with which the various control features may be segregated and mounted in limited spaces and the readiness with which safety features may be incorporated.

By the addition of a current limiting relay, which opens a control circuit when the motor current exceeds a predeter-

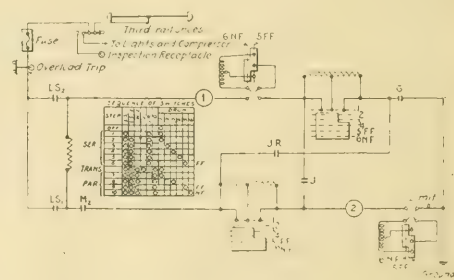


FIG. 3.—DIAGRAM FOR TYPE 214 CONTROL.

mined value, and suitable interlocking devices, either electrical or mechanical, automatic acceleration can be secured with any indirect-control system. Automatic acceleration ensures against abuse of the motors by the motorman, and tends to provide a fairly uniform rate of acceleration. It has long been used on elevated roads and in other rapid transit service, and in connection with some of the new light-weight, indirect-control designs it seems to be gaining in popularity for city service.

The earlier indirect-control systems were too heavy, and besides, automatic acceleration was quite often a feature of these equipments. This was of importance where operating conditions were more or less uniform, but did not have so many advantages when applied to interurban service. There were the objections, also, of high cost and complexity; for these reasons simplified types of hand-operated indirect-control systems were developed, and during the last five years they have found wide application.

Of these systems, the Westinghouse H.L. and the General Electric M.K. are the best known. In both these systems the arrangement of control handles is similar to that of the Type K controller, and the energy for the auxiliary control circuit is taken through a resistance from the contact line.

The main parts of these systems are the main or motor controller and a master controller which operates in proper order the switches of the motor controller. These switches are closed against springs by electrically-controlled compressed air cylinders or powerful solenoids.

The unit switches are equipped with arc chutes and magnetic blow-outs. An overload relay is used which either opens the control circuit and trips out all the contactors or a remote-controlled line switch.

The H.L. system has been further simplified, and is being applied to light-weight cars. The M.K. system is being superseded to a certain extent by a later P.C. type of control.

Indirect control systems for use in connection with high-voltage, direct-current motors are essentially the same as those used with lower voltages. Complications are sometimes necessary because the motors are required to operate at low voltage within cities. In the latter case, to ensure the opening of the power circuit, two switches connected in series are generally used to make the interruption.

In connection with the control of alternating motors the only development of special interest is the control for the doubly-fed motor adopted by the Pennsylvania Railroad. This control is an adaptation of the unit-switch system, and it is arranged for automatic acceleration. The motors, which are connected in series, are started and operated up to approximately 15 m.p.h., as repulsion motors, with the auxiliary or compensating field, the armature and the main field in series. With these series connections the armature is also paralleled

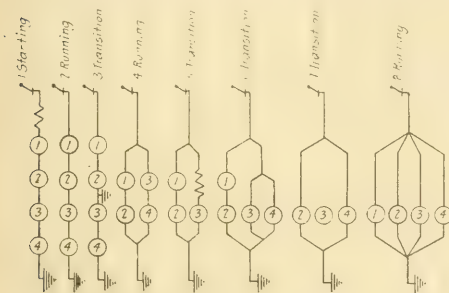


FIG. 4.—MOTOR GROUPING FOR "NON-RHEOSTATIC" CONTROL.

by a resistance. Resistance is inserted with the motors on the first step and is cut out on the second. The third step changes the connections so as to energise the auxiliary field from one portion of the transformer, and the armature and main field, connected in series from another portion, thus affording the doubly-fed connection. The armature short-circuit is removed when the motors are operating with the double feed. Subsequent steps in the control are obtained by increasing the motor voltages.

New Control Systems.—The control system devised originally for the steepest centre-entrance cars of the New York railways, known as the Westinghouse P.K. control, consists of a drum motor controller equipped with a power-operated notching mechanism. This notching mechanism consists of a pair of opposed air cylinders whose common piston rod carries a rack that engages with a pinion on the shaft of the motor-controller drum. Electrically controlled valves admit or discharge air from the cylinders in accordance with the manipulation of a master controller located on the car platform. The motor controller may be located on the platform underneath the car or in some other convenient place.

In appearance the master controller is a miniature platform controller. Manual acceleration is possible, although a current limiting relay is provided on most equipments, and the circuits are so arranged that automatic acceleration will occur in case the controller is moved more than one notch at a time. The latest form of power-operated head can be readily applied to any Type K controller. Energy for the control circuits may be obtained either from the contact line or a storage battery carried on the car.

A later control system brought out under the trade designation of Type 214 control is a combination of the principles involved in the P.K. and the older A.B.F. system. As designed for the field-control motors of the New York Municipal Railway rapid transit cars, the motor controller box includes the following parts: Two unit switches acting as circuit breakers, four unit switches for series paralleling the motors, one drum-type reverser, one drum-type commutating switch, one current-limiting relay, one overload relay, one main circuit terminal board, and one control circuit terminal board. Electro-pneumatically operated unit switches, interlocked to secure proper sequence, are used for making main-circuit changes while a commutating switch of the drum type, operated by a P.K. notching mechanism, is used to cut out resistance. A line relay cut-out permits feeding up of the control when power is off the line and the bucking of the motors for emergency braking in case of failure of the air brakes.

The automatic acceleration feature of this control is particularly interesting as the action of the current-limiting relay is

modified by the current passing through an auxiliary winding of the relay, in such a way as to provide for the same rate of acceleration for all loads. The amount of current passing through this auxiliary winding is controlled by a switch operated in connection with the variable-load brake mechanism. The adjustment of this mechanism corresponds directly to the deflection of the bolster springs under load. Energy for the control circuit is obtained from a 34-volt storage battery, which also furnishes energy for emergency car light, signal lights, door interlocks, and other special circuits. This control is designed for use with the larger motors, those on the New York municipal cars being rated at 160 h.p. on 600 volts.

In the P.C. control equipment, recently placed on the market by the General Electric Co., the motor controller consists of a group of switches or contactor units (used for effecting the series and parallel groupings of the motors and in cutting out resistance, together with a reverser, a circuit-breaker and overload, potential and current-limiting relays, all of these being assembled in a single case. The contactors are closed mechanically by means of cams mounted on a shaft which is revolved by a rack and pinion. The rack is operated by two air cylinders, whose valves are electrically controlled by the master controller. All of the contactor arc-chutes are grouped in one unit similar in construction to that used in the ordinary drum controller. The circuit-breaker switches are also operated pneumatically and controlled electrically. The overload relay operates to de-energise the control circuit of these switches in case of excess current. When opened by an overload, a reset switch must be thrown to close them again. The switches are of the unit type, and are readily removed. The reverser is very similar to the drum reverser used in a Type K controller, except that it is power operated by means of compressed air cylinders with electrically-controlled valves.

The master controller is similar in general construction to that used with the Type M control systems built by the same company. It is provided with a slip-ring attachment which closes the control power circuit when the handle is moved from the "off" to the first position, and maintains the circuit for any forward motion, but opens it if the handle is moved back.

This type of control may be arranged either for automatic or hand acceleration, and may receive the power for the control circuit either from the contact line or storage batteries carried on the car. As with most modern systems of indirect control, the power circuit is opened in case the motorman removes his hand from the control handle, and provision may be made also for setting the brakes.

Non-rheostatic Control.—From the standpoint of economy and flexibility in speed regulation, the non-rheostatic control for the four-motor cars of the Pittsburgh railways is of interest. In this system resistance is used on only two transition points, the first and fifth, and as there are three running notches the transition points are used only for very short intervals, so that there are practically no rheostatic losses.

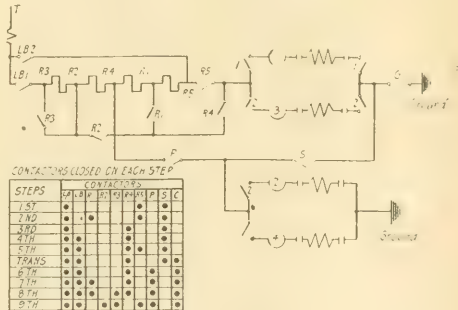


FIG. 5.—CONTACTOR SEQUENCE FOR P.C. CONTROL.

Frequent use is made of the first running notch with all motors in series, and as low speed can be secured on this first point, excessive controller operation is avoided, and savings in the maintenance costs of control equipment, wheels, and brakes are effected. Tests over an extended interval of time indicate that the energy consumption is from 8 per cent. to 15 per cent. less than with a standard series-parallel control when used on cars of the same weight operating in a similar service.

The contactor switches are arranged in two switch group cases under the low floor of the car. The combinations and connections provide for interlocks on the contactors to establish holding circuits whereby the motors are maintained in parallel groups while the control handle is being thrown to the "off" position, thus affording a closed path of low resistance for the discharge of the energy stored in the magnetic fields of the motors. The use of field control with this system would, of course, add some complication, but would result in a speed flexibility practically equal to that of the steam locomotive.

Wiring.—Electrically-controlled brakes, speed-control devices, car signal and door interlocking circuits result in the use of the New York Municipal Railway in the use of 18 train wires, of which only seven are used directly for control purposes, and the wires are of extra large cross-section to permit the multiple unit operation of a large number of cars.

With indirect systems, a knife-blade switch of the quick-break variety connected between the trolley base and main fuse, is used to disconnect the main circuit so that the motor circuit can be operated for test or inspection purposes. The use of a main base box of the magnetic blow-out type is becoming almost universal, the accepted form of fuse consisting of a thin copper ribbon held at the ends between heavy clamps.

Later practice in car wiring tends toward the use of light steel conduit that is enamelled, galvanised, sherardised, or treated in some other way to make it rust-resisting, the conduit for some of the later cars having walls only 1/32 in. thick. In cars designed for very light weight there is an increasing tendency to use some of the fireproof non-metallic conduits now on the market. Of these one that has been extensively used is made of natural warp cotton yarns woven

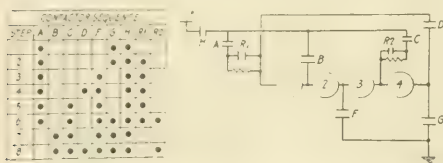


FIG. 6.—SWITCH SEQUENCE FOR "NON-RHEOSTATIC" CONTROL.

very tightly to give it strength, and saturated with a waterproof and fireproof compound. It is more economical than metallic conduit, not only because the price is much less, but also because no fittings are required, since the non-metallic conduit can be bent into any desired position. The weight of 1 in. conduit in this material approximates 0.13 lb. per ft., while metal even 1/32 in. thick should weigh 0.25 lb., including the fittings.

The arrangement of control details in a few groups has greatly simplified the control wiring necessary, and there is a tendency to use multi-conductor cables for the motor and other current-carrying leads instead of single wires.

With regard to lightning arresters, the magnetic blow-out types are still very popular for car service, and a form of condenser arrester seems to be meeting with some favour.

The aluminium-cell type of lightning arrester has not met, as yet, with great favour among operating men; several companies have installed it on their latest types of cars. There is a tendency to use larger choke coils than were used formerly. The favoured location of the arrester seems generally to be on the roof of the car.

Control Circuit and Door Interlocking.—In an effort to promote safety and accelerate traffic, several methods of interlocking the car doors and the control system have been devised. Generally speaking, any of these schemes is applicable, as far as principle is concerned, to any system of indirect control as well as to the system of modified direct control. The door apparatus consists of a wooden rod attached to the door and upon which is a brass ferrule. When the door is closed this ferrule engages with a pair of contactors which form a part of the circuit energising the contactor, or line switch in the motor control. In any position of the door, except tightly closed, these contactors engage with the wooden surface of the rod and not with the brass ferrule. Consequently, the contactor control circuit is open and the contactor itself cannot be closed, but when the door is shut the control circuit is complete, and the motors are under the control of the motorman. This enables a motorman to set his controller handle on the starting position immediately after a door is opened at a stop. Then, when the door closes, the car starts ahead at once without any signal from the conductor. Frequently switches are provided that operate in connection with the conductors' emergency brake valve. The operation of this valve, therefore, shuts off the power as well as sets the brakes, and eliminates the current surge that would result if the motors pulled against the brakes until the overload relay tripped.

Such interlocking devices, by permitting a quick start after passengers are loaded, have a very marked effect in speeding up traffic. They eliminate to a large extent the need of a signal system for the conductor, and by requiring the door to be shut before the car can be started, reduce the number of door and step accidents.

Australian Commonwealth Offices.—On December 27th the offices of the High Commissioner for the Commonwealth of Australia were moved from Victoria Street to Australia House, Strand, London, W.C.

REVIEWS.

Large Electric Power Stations. By Dr. G. KLINGENBERG. English translation from the German. London: Crosby Lockwood. Price 25s. net.

The publisher's note to this book states that the translation supplied by the author was in type some months prior to the war, and that the proofs have been subjected to careful revision by an English engineer, and in view of the importance of the subject it has been decided not to delay publication further.

The increase in the public importance of electricity supply is bringing about a change in opinion as to the basis on which electricity should be produced and distributed.

The fundamental question is whether the generating station should be a private one, one controlled by a municipal body, or one managed by a company. Nowadays, unless in a very isolated area, a private power station would prove uneconomical. It also seems impossible for a municipality to manage its electricity supply undertaking on any but what may be called political lines. The engineer-in-charge will be asked for his opinions on engineering or economic problems, but the electricity committee's decisions are necessarily governed by the policy of the party to which the majority of its members happen to belong. On the other hand, the management of a supply company presents an entirely different picture. The policy of the company will be controlled by experts in engineering, in business, and in finance. They possess entire control, their decisions are influenced by the interests of the concern only, they can organise and renew their staff according to the ability of the individual, and are necessarily in close touch with industrial and engineering developments. Under municipal control there is not the same incentive to attain the highest possible economy as with a dividend-paying company. These are facts that no one can seriously dispute, and the public is confronted with the question whether it is preferable to allow limited liability companies to take control of the electricity supply business—of course, under proper Parliamentary supervision—or to allow existing municipal supplies to develop or co-operate with private concerns. The future only can say what will happen in this country. The author's views on these and on like matters are set forth in a lengthy and very readable introductory chapter.

Chapter I is one of 78 pages. It deals broadly with the general principles involved in the design of large electric power stations. The use of the various governing factors, e.g., the diversity factor, is first illustrated with the aid of diagrams from various German power stations. This section of the chapter is decidedly clear and valuable. The engine room is then discussed. A quantity of information is given, but the question as to choice of different types of turbines is not entered into at all. The treatment of the selection of generators and auxiliary machinery is fairly good. Some genuinely valuable advice is next given on the design of boiler houses and their contents, together with some data that the reviewer has not seen published before. One of the author's figures appears a little heroic—a steam velocity in the pipes feeding the turbines of 262 ft. per sec. The reviewer would be inclined to think that there would be an appreciable drop in pressure unless the pipes were very short, and further, he would expect some vibration in the pipes on sudden changes in the load. Storage and transport of coal, ash removal, and switchgear are then discussed in a satisfactory, though somewhat brief, manner. For example, five lines only are devoted to protection against lightning in the switchgear section. The chapter concludes with some very sensible advice on the choice of the position of a power station, and on its architecture. As the author rightly says, many power stations resemble theatres more than anything else, and the beauty of a power station building—as of machinery—should be in the simplicity of the design and in its proper proportions. The fact must not be lost sight of that a power station is merely a factory for producing electricity. At the same time, of course, it should be adapted to the appearance of the locality as far as is practicable.

Chapters II and III deal respectively with comparisons of costs of electrical transmission of energy and of the transport of coal, and with economy and generating costs in relation to capacity and utility factor. The value or otherwise of this sort of thing depends, of course, entirely on the initial assumptions made. Some of the costs appear to be distinctly on the low side to the reviewer, but the author's methods appear to be sound, and will serve as a model for similar calculations with different initial costs.

The first constructional example of the principles set forth in the preceding part of the book is that of the Markische electricity works in Germany. The installation is most thoroughly described, and illustrated with plates and photographs. The leading dimensions of essential parts of the plant are given, and also the name of the maker—of course, in every case a German firm. An analysis of the working results is given at the end of the chapter. These are not at all remarkable, but it is to be remembered that the station is five or six years old.

The second and last example is that of the Victoria Falls and Transvaal Power Co., Ltd., in South Africa. The initiation of this enormous power supply scheme and the different

power stations involved is most thoroughly described, and also the possibilities of future extensions. The author states, and probably correctly, that the A.E.G., Berlin, undertook the engineering of the scheme and the installation of the entire plant.

The book consists of 260 pages and a large number of plates. It bears distinct evidence of most careful thought. The translator has also done his work very satisfactorily, the large majority of the units, both money and dimensions, being given in English measure. The work will undoubtedly be of distinct use to engineers engaged in power station design. However, in spite of its merits, 25s. net is a large sum of money to pay for the book. Possibly the large number of plates is partly responsible for the price.—H. G. S.

The Mechanical Handling and Storing of Material. By GEORGE FREDERICK ZIMMER. London: Crosby Lockwood and Son. Price £2 2s. net.

Probably one of the most neglected branches of engineering is that relating to the mechanical handling and storing of material, and we believe "The Mechanical Handling of Material" first published by the author was the first work of any real importance on this subject. The present treatise is a new edition of this work, in which the mechanical handling of material has been brought up to date, and to which the various methods of storing material has been added. The author had an immense field before him, and we must give him credit for making the most of his opportunities; though the work consists mainly of data and particulars of plant gathered from all corners of the globe, it is not the less valuable on this account. In fact, it is not too much to say that the engineering profession should be very greatly indebted to Mr. Zimmer for placing before it a work involving considerable labour in collecting and arranging information dealing with so important a subject as the economy of labour by applying mechanical means to the handling of material in works and factories appertaining to practically every industry.

In an excellent introductory article, the reader is told the necessity for the introduction of labour-saving machinery, and the benefit derived not only by the capitalist, but by the labourer himself is pointed out; as this question may possibly become an acute one after the war, it is necessary that Labour should be educated to recognise this fact, and we can fully endorse the author's statement that "In round figures, it may be taken that the saving of one man's wages warrants the investment of £1,000 in machinery." As an example, the author cites a modern flour mill in which the wheat may be unloaded from an ocean-going steamer, stored, cleaned, graded, ground, dressed, packed, weighed, registered, and loaded into a railway truck for dispatch to the consumer without any manual labour whatever. The view, however, of the Labour leader is that were it not for this machinery men would be employed and wages paid, but he forgets that whilst, no doubt, 20 or 30 workmen are released for other labour, hundreds of their fellow workmen are benefiting by the lower cost of flour. Are the greater number willing to suffer, to benefit—which is doubtful—the few? Moreover, as the author truly points out, the multiplication of labour-saving appliances is not in the least detrimental to the interests of Labour, but, on the contrary, "experience has shown that his daily life is thereby made easier, his intelligence improved, and his wage-earning capacity increased," and in no industry has this been proved to such an extent as in that of mining.

The work consists practically of six parts, viz.: The continuous handling of material; continuous handling of material by pneumatic and hydraulic means; intermittent handling of material; unloading and loading appliances; miscellaneous installations; and the automatic weighing of material.

The first part claims 18 chapters, and deals with elevators and conveyors for every imaginable purpose; naturally, among so many designs there is room for very considerable improvement in some, but to examine critically each design would take several volumes as large as the present to deal with them. There is, however, plenty to choose from as a basis for the design of any particular piece of handling or conveying machinery. It would seem as though in many cases the designer or builder of conveying machinery did not consider it necessary to study the effect of friction as a power consumer, or thought that the economy effected by the use of the conveyor was such that there was a big margin for inefficiency—anything would do for a conveyor so long as it worked. Some that we know of didn't work; not that the idea of the conveyor was bad, but sufficient study had not been given to its construction by the designers to suit the particular conditions. It is mainly so with all conveyors; a little thought and study would greatly improve their efficiency.

The next three chapters deal with the handling of material such as grain, coal, and ashes by pneumatic or hydraulic means. Amongst the latter is mentioned the hydraulic plant at the Hammersmith Borough Council's electric light installation, which was estimated to cost £15,600 and to save £1,577 per annum, or practically 10 per cent. on the capital outlay. As a means of removing ashes from boiler houses the hydraulic system would appear to have many advantages. Some of the pneumatic systems described for conveying grain are both interesting and ingenious, and naturally much more care and workmanship has to be expended on this type of plant.

The intermittent handling of material includes endless-rope and chain haulage, not, of course, as installed in mines, but as applied to moving tubs or small wagons for short distances. It includes all kinds of aerial ropeways, methods of coaling vessels at sea, rails and telfers, and the handling of material in connection with blast furnaces, and coke from coke ovens; some of these are good, but many are indifferent, and others might have been left out altogether. Especially does this apply to some of the German methods for dealing with hot coke from coke ovens.

The last two portions deal with such subjects as the coaling of railway engines, boiler-house handling plants, storage of coal, grain, and other materials, and the automatic weighing of material, and conclude with a table giving the weights of materials.

As we have said, the subject is a huge one, and we are afraid one that has not been sufficiently studied in this country, partly because of prejudice, but mainly, we think, because of our—we hope now obsolete—conservatism. With the ever-increasing cost of labour in production, it becomes more than ever necessary to reduce the producing cost of the finished article, and to release the labourer, otherwise engaged in the handling of material, for more useful employment, where his services will be more productive, both for himself, his employer, and the public generally.

If Mr. Zimmer's book, by showing what has already been done in this direction, and by giving details of examples of conveying and other labour-saving machinery, will help the development of this branch of engineering in this country it will have served a useful purpose.

If we have any fault to find, it is in the bulkiness of the volume, which we think would have been handier had it been published in, say, two volumes instead of one. Otherwise, it is well printed and bound, the illustrations are good, many being folding plates, and the work does credit to author and publisher.

Dynamo and Motor Attendants and their Machines. By FRANK BROADBENT, M.I.E.E. London: S. Rentell & Co., Ltd. Price 2s. 6d. net.

This is the eighth edition of a work which has long held a high reputation, and has established its position as one of those books for which there is always a demand. The text has been extensively revised, over 50 pages have been added, and 40 drawings, a new chapter on accumulators has been inserted, and generally the matter has been brought up to date. The chapter on "General Principles" has also been entirely rewritten. There are a good many misprints, but these are generally obvious, and the author reasonably claims indulgence in view of the revision having been done in strenuous times. The remarkable scope of the book, the conciseness and lucidity of the treatment, and the essentially practical nature of the contents, render it the most useful guide for the class of readers addressed that we know of, and its continued popularity indicates that they concur with us in regarding it as excellent value for the small price at which it is published.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

CHILE.—For convenience of reference, the following particulars of the rates of import duty, now payable on the under-mentioned goods on importation into Chile, are taken from the recently-published Parliamentary Return, giving a translation of the new Customs Tariff Law—see the Review of November 3rd:—

India-rubber:—		Pesos.	Cts.
Resilient: Raw	... .. kilog. gross	0	04
In sheets	... .. kilog. gross	0	20
With cloth or metal for packing machinery, &c.	... .. kilog. gross	0	36
Vulcanised, in sheets	... .. kilog. gross	1	20
Rubber waste	... .. kilog. gross	0	12
Rubber solution	... .. kilog. legal	0	60
Manufactured articles of rubber, not specially mentioned	... .. kilog. legal	2	50
Boots and shoes, &c., of rubber, or with rubber soles	... .. kilog. net	2	00
Buttons (pushes) for electric bells	... .. kilog. legal	1	80
Iron and steel:—			
Wire in all shapes (including barbed)	100 kilogs. gross	0	50
Lamps for electric lighting	... .. kilog. legal	0	70
Cable or rope of wire	... .. kilog. gross	0	04
Meters for electric current, and parts	... .. kilog. gross	0	20
Copper and its alloys:—			
Sheets, bars, or ingots	... ..		Free.
Bars or cylindrical rods for cutting into bolts	... .. kilog. gross	0	10
Pure, for assaying	... .. kilog. net	1	80
Filings (borings); solder	... ..		Free.
Pipes or tubes not specially mentioned, and accessories kilog. gross	0	20

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